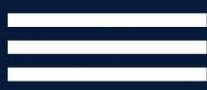


III TWR CONFERENCE

TRANSDISCIPLINARY WORKPLACE RESEARCH

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Chiara Tagliaro, Alessandra Migliore and Rossella Silvestri (eds.)

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Department of Management, Economics and Industrial Engineering

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Chiara Tagliaro, Alessandra Migliore and Rossella Silvestri (eds.)

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PREFACE

In the wake of the COVID-19 pandemic, radical changes in the ways of working have rapidly put the workplace at the centre of a profound debate over its function and *raison d'être*. More than ever, employers, consultants, and researchers have acknowledged the necessity for a transdisciplinary approach to advance knowledge and practice in this area and foresee a reasonable evolution of the workplace.

These Proceedings address such pressing issues by collecting the most recent knowledge advancements in this field that were presented at the III Transdisciplinary Workplace Research (TWR) Conference, held in Milan, Italy, from September 7th to 10th 2022.

The Conference brought together work environment experts in a wide range of disciplines, from both academia and practice, in line with the spirit of the Transdisciplinary Workplace Research (TWR) Network (www.twrnetwork.org), whose aim since 2017 has been to encourage the convergence of the various aspects of the workplace that are usually studied in isolated academic and professional fields. The idea of the Network is that design and operations of healthy and productive working environments not only take individual economic, personnel, design, or technical-communicative aspects into account; integrative approaches beyond disciplinary paths are also necessary. Moreover, practical experience must underpin a sound evidence-based approach to research, in order to overcome the traditional theory-practice dichotomy. The TWR Network has an international board which contributes to expanding the types, methods, and reach of workplace studies, finding common paths across countries, and enhancing the differences among them.

With this aim, the TWR Network organizes a biannual conference that is brought every year in different parts of the world. After the first TWR Conference (2018) in Tampere, Finland, and the second one (2020) in hybrid form between Frankfurt and online, this year's conference took place in Milan, Italy, hosted by Politecnico di Milano.

The III TWR conference included a multiplicity of topics, regarding the physical work environment (such as architecture and design, building physics, material science), social work environment (such as human resources management, behavioural sciences, organisational science, business, health and safety, neuroscience, environmental psychology, philosophy), digital work environment (such as information communication technology, virtual reality, sensor engineering, data analytics), and management of the built environment (such as asset, facility and property management, economics, corporate real estate management, decision science). Presented research focused on an individual, team, organisational or urban level of analysis.

The tangible outcome of this initiative is this publication: the Proceedings of TWR 2022 gather all the 80 contributions that were included in the Conference program after a thorough selection of 120 submitted abstracts.

A special thank goes to all authors and reviewers for their diligent participation in the double-blind peer review process. On the one hand, all the authors presented original investigations described concisely and effectively. On the other hand, all the reviewers provided constructive feedback that the authors carefully considered to improve their work. Most of the authors gave their consensus to publish their short papers in this volume. For those who preferred to submit

their paper elsewhere, we included only the abstract. This is a remarkable collection of insights that keep adding value following up on the precedent TWR 2018 and 2020.

The III TWR Conference was for many of the attendees the first in-person large gathering after the COVID-19 pandemic. The enthusiasm about engaging in physical exchanges across borders and disciplines was clear in the large participation that the event obtained, demonstrated by the following numbers:

172 authors

26 countries

100 in-person presenters

8 virtual attendees (non-presenters)

71 papers

5 posters

4 book presentations

21 parallel sessions spanning from Corporate Real Estate to new working spaces, from salutogenic approaches to hybrid working, from communities to academic campuses

3 workshops with the industry about *diversity and inclusion* in the workplace

4 networking events

1 keynote speech proposing a philosophical perspective on spatial relations and mutual respect in the workplace

3 days and a half of workplace formal and informal chats among enthusiast people on state-of-the-art of transdisciplinary workplace research.

We would like to thank the TWR Network for all the support over the past (nearly) 2 years. In particular, the leading force, Rianne Appel-Meulenbroek, for her contagious passion for the TWR mission and values, as well as Mascha Will-Zocholl and Annette Kaempf-Dern, organizers of TWR 2020, for being always available to pass on their experience and share their guidelines.

Finally, this TWR 2022 would not have been possible without a common purpose that we achieved with Politecnico di Milano and Fondazione Politecnico di Milano, and with our sponsors - CBRE, Lendlease, Unispace, and StudioWé. In particular, we are grateful to our mentors Andrea Ciaramella, Ilaria Mariotti, and Cristina Rossi-Lamastra who put themselves on the frontline whenever necessary to endorse the initiative.

Enjoy the read!

Milan, September 2022

Chiara Tagliaro

Alessandra Migliore

Rossella Silvestri

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TWR2022 CONFERENCE PROGRAM

WEDNESDAY SEPTEMBER 7TH

- 9:00 - 11:00 **TWR Board Meeting**
Event open only to TWR Board members
Room 16B.2.1
- 11:00 - 11:30 **Welcome Coffee**
Room 16B.0.1
- 11:00 - 11:30 **Conference Registration**
Room 16B.0.1
- 11:30 - 13:00 **Politecnico di Milano Campus Tour**
Room 16B.1.1
- 13:00 - 14:30 **Lunch Break**
Room 16B.0.1
- 14:30 - 16:30 **Parallel workshop sessions with industry sponsors,
facilitated by Studio Wé**
- | Session W1 | Session W2 | Session W3 |
|-------------------|--------------------|-------------------|
| Unispace Workshop | Lendlease Workshop | CBRE Workshop |
| Room 16B.1.1 | Room 16B.2.1 | Room 16B.3.1 |
- 18:00 - 21:00 **Welcome Aperitivo**
@ Polimi Campus Leonardo - Room 16B.0.1

THURSDAY SEPTEMBER 8TH

8:30 - 9:00	Conference Registration Room 16B.0.1		
9:00 - 9:30	Welcoming Session: Institutional Greetings from TWR Board and Politecnico di Milano Room 16B.1.1		
9:30 - 10:30	Opening Keynote by Roberto Mordacci "Space relations and mutual respect" Room 16B.1.1		
10:30 - 11:00	Coffee Break "TWR anniversary celebration" Room 16B.0.1		
11:00 - 12:30	Session 1A Campus and Academic Work Room 16B.1.1	Session 1B Geography of New Working Spaces Room 16B.2.1	Session 1C Sustainable Workspaces Room 16B.3.1
12:30 - 14:00	Lunch Break Room 16B.0.1		
14:00 - 15:30	Session 2A Hybrid Campus Room 16B.1.1	Session 2B New Working Spaces and Communities Room 16B.2.1	Session 2C Corporate Real Estate Room 16B.3.1
15:30 - 16:00	Coffee Break Room 16B.0.1		
16:00 - 17:30	Session 3A Critical Thinking and Working Environments Room 16B.1.1	Session 3B New Working Spaces and Strategies Room 16B.2.1	Session 3C Salutogenic Approaches Room 16B.3.1
20:00 - 23:30	Social Dinner @ Museo della Scienza e della Tecnica Leonardo da Vinci, Sala delle Colonne		

FRIDAY SEPTEMBER 9TH

8:30 - 9:00	Conference Registration Room 16B.0.1		
09:00 - 10:30	Session 4A Covid-19 and the Future of Workspaces Room 16B.1.1	Session 4B Co-Working Spaces, Health and Wellbeing Room 16B.2.1	Session 4C Work Environments Between Virtual and Physical Activities Room 16B.3.1
10:30 - 11:00	Coffee Break Room 16B.0.1		
11:00 - 12:30	Session 5A Covid-19 and Work Outcomes Room 16B.1.1	Session 5B Offices, Health and Wellbeing Room 16B.2.1	Session 5C Book Presentations Room 16B.3.1
12:30 - 14:00	Lunch Break Room 16B.0.1	Poster Session Room 16B.0.1	
14:00 - 15:30	Session 6A Practices of Hybrid Working Room 16B.1.1	Session 6B Workspaces, Inclusion and Corporate Social Responsibility Room 16B.2.1	Session 6C Workspaces, Culture and Experiences Room 16B.3.1
15:30 - 16:00	Coffee Break Room 16B.0.1		
16:00 - 17:30	Session 7A Theories of Hybrid Working Room 16B.1.1	Session 7B Working Environments: Interdisciplinarity Between Research and Education Room 16B.2.1	Session 7C Activity-Based Working: Theory and Practice Room 16B.3.1
20:00 - 23:30	Farewell Party - Conference Closing @ Balera dell'Ortica		

SATURDAY SEPTEMBER 10TH

10:00 - 12:00	Post-conference Event - Discover Milano @ Monumental Cemetery of Milan
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SESSION 1A: CAMPUS AND ACADEMIC WORK

Academic Work – Something else?

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ABSTRACT

Academics can be defined as knowledge workers, but not all knowledge workers are academics. The academic workplace has for a long time been associated with individual cellular offices. There is now a change in space demand, which is a result of new ways of working, technology, more collaborative activities etc. There is not much research specifically on what academic workers actually do, and how they do their work. This paper looks at academic work and academic practice to map the different activities taking place in the academic workplace. It investigates if academic work is something completely different from what literature defines as knowledge work and identifies similarities and distinctive features between the two, to help understand the academics' needs when planning academic workplaces for academics in the future. The data collection for this paper is done through a literature study investigating knowledge work and academic work. The findings from the literature on academic work are supplemented with findings from ten semi-structured interviews with academic staff from different academic disciplines at the Norwegian University of Science and Technology. The findings show that there are both expected similarities, but also variations between knowledge workers and academics. Concentration work is an important part of both knowledge work and academic work. One prominent difference between knowledge work and academic work is identified as the constant alternation between supervising students, deep concentration work, and the need to access sources such as books and archives, as well as academics' close link to practice through e.g., fieldwork or laboratory experiments. The findings in this paper offer practical possibilities in the studies of workplace management, facilities management, real estate development, campus development and other studies of the built environment.

Keywords

Academic work, Academics, Academic practice, Knowledge work, Workplace.

1 INTRODUCTION

Traditionally, at least in Western countries, academics have had a long tradition of defining individual cellular offices as their workspace. This has been related to a perception that academic work consists of lonely individuals sitting concentrated and immersed surrounded by their books and other artefacts in their offices. This tradition of individual offices and the predominance of working in solitude is now being challenged in multiple ways (Wilhoit et al., 2016). Technology has significantly influenced how we work. It has made employees more mobile, and new ways of teaching, both digital and hybrid, have emerged from the use of

technology (Weijts-Perrée et al., 2018). Further, collaborative, and interdisciplinary research activities have increased in academia to be able to adequately address problems that cannot be solved by one discipline alone (Reich & Reich, 2006). In addition, an increasing focus on sustainability has resulted in a greater awareness of the use of areas and resources, and we now realise that buildings need to be utilised more efficiently. Academics can be defined as knowledge workers, but not all knowledge workers are academics. Although there is a growing body of literature on the academic workplace, much of the research on workplace design has been focused on more traditional fields of office workplaces, especially in the private sector, and not on public academic institutions. De Been et al., (2016) stated that even though there is quite a lot of research on how the built environment influences labour and productivity in organisations, there is still a need for more research on “The differentiation in understanding individual needs and preferences of different groups [...]” (De Been et al., 2016, p. 151). There might be large variations among employees in one single company (van der Berg, et al., 2020). Design of office workplaces has to a large degree been based on standardisation of solutions to achieve flexibility and mobility from an understanding that the work activities and processes, simply put, pretty much are the same for everyone. The findings in this paper show a large variety of activities and processes within one organisation. In the Norwegian University of Science and Technology (NTNU) campus development project, today’s practice and understanding of knowledge work in academia are being challenged. The discussion amongst the university staff regarding the academic workplace has mostly been related to the individual office and a fear of being deprived of this. The discussion has quickly become one-sided and unvarnished where the stakeholders refer to different studies that defend one point of view or the other. This paper focuses on academic work and academic practice to map and understand the different activities taking place in the academic workplace and within different academic disciplines. It investigates if academic work is something completely different from what literature defines as knowledge work and identifies similarities and distinctive features between the two to better understand the academics’ needs when planning academic workplaces in the future.

2 THEORETICAL FRAMEWORK

This section will look at knowledge work and academic work to form a base for the discussion.

2.1 Knowledge work

Since the late 1990s knowledge in organisations has been viewed as an important corporate asset and a competitive advantage (Davenport & Prusak, 1998). Davenport et al. (1998) described knowledge as information combined with experience, context, interpretation, and reflection. The term “knowledge work” refers to work that occurs primarily from mental processes rather than physical labour (Kelloway & Barling, 2000; Heerwagen et al., 2007). According to Reinhardt et al., (2011, p. 150), what characterises knowledge work “[...] is the perennial processing of non-routine problems which require non-linear and creative thinking”. This characterisation and the fact that knowledge workers primarily rely on their brains in their work often causes knowledge work to be less structured, as well as harder to structure, than administrative or production work (Davenport, 2005). Knowledge work activities focus on thinking, problem-solving, collaborating and networking (van der Berg et al., 2020). It is perceived as high-level cognitive work and involves concentration activities such as reading, research and reflection on ideas from their memory, but also mundane tasks such as making calls or answering emails. Collaboration, interaction, and networking with colleagues to develop ideas are important parts of knowledge work (Heerwagen et al., 2007). De Been et al. (2016), found that support for concentration and communication is what people considered most significant for their productivity in the office.

2.2 Academic work

In this paper academic work refers to work conducted by scientific staff in a university or higher education, and whose primary activities are to generate, preserve and disseminate systematic knowledge. Academic work consists of a large variety of activities, and depending on their job description their day often includes activities such as teaching, research, supervision, administrative tasks, committee work etc. (Macfarlane, 2010). An assumption about academic work is that it consists of workers sitting in their offices doing research, and sometimes leaving their offices to give lectures or attend meetings. Academic work is more complex than this, and knowledge creation rarely happens in solitude in an office, but rather in many different interfaces. These interfaces might be with colleagues, students, during fieldwork, laboratory work etc. (Macfarlane, 2010; Teichler et al., 2013). In a study by Huhtelin and Nenonen (2019) on researchers in different disciplines, they found that the majority of the respondents required both concentration and interaction in their research activities. Studies have shown that academics usually find themselves in their offices only about 30-40% of the workday. This is not because they are not working, but simply because they are conducting their work in other places. They might be away giving lectures, attending meetings, supervising students, travelling, presenting at conferences etc. (NTNU, 2018; Häne et al., 2020). Also, different academic disciplines work in various ways and while some mainly do research in their offices, others do research in e.g., laboratories, studios, fieldwork, or different kinds of workshops.

3 METHODOLOGICAL APPROACH

This paper aims to investigate academic work and practice, and whether academic work is something completely different from what literature defines as knowledge work. To identify similarities and differences between knowledge work and academic work a literature search was performed investigating the terms knowledge work/workers and academic work/workers. The initial search consisted of wide terms; “knowledge”, “knowledge work*”, “academic work*”, “academic practice*”, “knowledge work characteristics” and “academic work characteristics”. The truncation symbol * was used to broaden the search results. This resulted in many hits and a variety of journal articles and books. To limit the search 3-5 articles per search term were scanned. For some of the search terms, the same authors and/or definitions appeared, and the search continued by reading through the references of the selected papers to find relevant literature, preferably published after the year 2000. The findings in this paper are mainly based on ten in-depth interviews with academic staff from different professional disciplines at NTNU. The selection of informants was based on NTNU’s campus development project, where eight academic clusters have been defined. These clusters consist of disciplines that are perceived to have some common characteristics and are expected to have great opportunities for collaboration and interdisciplinarity, both for students and employees. The achieved selection for this paper represents six of these clusters and is shown in Table 1. The two clusters that are not represented in this paper are Teacher Education and Health and Social Sciences. The cluster KAMD consists of disciplines within art, architecture, music and design, and the cluster HumSam consists of disciplines within Humanities and Social Sciences. Here three interviews were conducted to get an understanding of the width within these clusters.

Table 1. Overview of informants with abbreviations and which cluster they belong to.

Informant	Cluster
KAMD1	KAMD (Art, Architecture, Music, and Design)
KAMD2	KAMD

KAMD3	KAMD
HS1	HumSam (Humanities and Social Sciences)
HS2	HumSam
HS3	HumSam
E	Engineering
NS	Natural Sciences
EI	Economy and Innovation
IET	Information Technology and Electric Engineering

Due to the lock-down caused by COVID-19 five of the interviews were held digitally. The other five took place in the informants' offices. The themes in the interviews were the informants' workday, their feelings towards their office, interdisciplinarity and innovation, and their thoughts about the campus development project at NTNU. The interviews were recorded and transcribed word by word. The analysis of the interviews was done by using the data analysis software NVivo.

4 FINDINGS FROM INTERVIEWS

All informants for this paper hold positions that include 45% teaching, 45% research and 10% administrative work. Dissemination of research is one of the university's core activities, and therefore the findings are presented in the categories "Teaching", "Research", "Dissemination" and "Administration". The informants are referred to with their abbreviations in capital letters, and the explanation can be found in Table 1.

4.1 Teaching

All informants explained that teaching includes activities such as preparing and giving lectures, supervision, and grading. All informants except KAMD1 have classrooms or auditoriums as their main location for lectures, while KAMD1 uses design studios for most of the lectures. Informants HS1-HS3, E and EI primarily have a theoretical approach to teaching, while KAMD1-KAMD3, NS and IET have a practice-based approach. All informants except HS1, HS2 and EI need rooms with special functions in their teaching, such as laboratories, workshops, studios etc. NS is the only informant that needs a traditional scientific laboratory, while the other laboratories that are mentioned are rooms intended for a certain type of use. Informants KAMD1, KAMD3, HS3, E, NS and IET have fieldwork as a part of their teaching, and the extent of the fieldwork varies from big projects to observation studies, to sample collection. KAMD1 explained that their teaching to a high degree is project-based, and both individual and group supervision is a central part of the students' education. Informant HS1-HS3 explained that they focus on being innovative in teaching rather than in research, and this is related to their field's research traditions. They describe innovation in teaching as engaging students in the learning process on a larger scale than before. They mention flipped classrooms where they produce videos or podcasts for the students so they can prepare in advance and have more discussions or student presentations in class rather than just listening to the professor. They also mention using digital tools such as Mentimeter to quiz the students and map their knowledge level to better adapt the lectures to the students' needs. They work on moving away from traditional written exams, and rather have deliveries of smaller assignments throughout the semester as a basis for the final grade. All informants explain that they primarily carry out supervision in their offices, or meeting rooms if they are available. The informants were asked if they believed COVID-19 would change today's teaching practice. They all agreed that it was practical to have digital supervision, but they still prefer physical lectures over hybrid and fully digital lectures. They experienced that the students did not speak up as much in these lectures

as they would in the classroom, and the lecturer thereby felt they held monologues rather than interactive lectures.

4.2 Research

The informants explain that research includes activities such as data collection, reading, writing, reflection, analysis, and collaboration with others. They define reading, reflection and writing as concentration work, which usually is carried out in their offices with the door shut, or in their home office to ensure silence which is described as a necessity for effective concentration work. The most prominent differences between the informants' research activities are where and how they perform their data collection. Informants KAMD1-3 and E explain that their data collection takes place in different kinds of workshops, in laboratories or during fieldwork, and that their research is close to practice. Informants HS1 and HS2 mostly use written materials and work with this data from their offices, in archives, or the library, and their research has a theoretical approach. Informant HS3 has some commonalities with informant HS1 and HS2, but in addition, they do fieldwork and use computer software to develop and analyse their data. Informant EI describes the research at the department as fragmented and ranges from research on organisations, strategy, finance etc. Informant NS and IET traditionally carry out their research in laboratories or workshops, whereas informant NS needs a traditional scientific laboratory, and IET needs dedicated spaces to conduct experiments with technical inventions. KAMD1-3, E and EI view innovation as the creation of something new in research, and not as commercial innovation. Informants NS and IET explain that their disciplines have an extreme focus on innovation and see this as one of the core activities in their research, and they also focus on commercial innovation and patenting. All informants see the value and importance of interdisciplinary research, but for some disciplines, such work comes more naturally than for other disciplines. For instance, informant NS and IET focus a lot on interdisciplinarity in research, and together with informant HS3, they see interdisciplinarity as a characteristic of their academic practice. These interdisciplinary projects are in collaboration with other departments at NTNU, industry or universities in other countries. Informants KAMD1-3 inform that they do some interdisciplinary research, but they have the potential to expand in this field. Informant E often collaborate with both public and private industry, while informants HS1 and HS2's research activities are mono-disciplinary by nature.

4.3 Dissemination

Dissemination of research is described as a very important part of academic work by all the informants. They publish in journals, books, or newspapers, and present at conferences, podcasts, or arrange different exhibitions. Informant HS1 and HS2 deviate from the rest of the informants; within their disciplines monographs and individual projects are most common. Their research is more often published in books rather than journals, and both informants explain that they write chronicles for the local newspaper if they feel they can contribute to the public debate. Informant IET explains that a characteristic of their academic practice is that in their discipline researchers publish "extremely much", and their footprint online and internationally is more important than having a big corner office in the university. Their research is almost always interdisciplinary, and the co-authors are often outside national borders. Informant NS works in a discipline where publications often are interdisciplinary, and have many authors, both nationally and internationally. Informants KAMD1 and KAMD2 often produce models, physical works, or audio, but also journal articles and conference papers. Informants KAMD3, HS3, E and EI mostly publish in journals and present at conferences, often in collaboration with colleagues.

4.4 Administration

Administrative tasks involve committee work, writing reports, evaluation of subjects, writing job advertisements and hiring new colleagues, revising education plans or curricula, as well as mundane tasks such as internal meetings, answering emails or making calls. The informants view these tasks as something they just have to do, it does not need a high degree of concentration and can be performed “everywhere”. All informants see the importance of administrative work as a form of quality assurance for both teaching and research. Administration in teaching is mostly related to the evaluation of students’ works, and evaluation of subjects in reference groups which should be uploaded into different systems. The informants say that this is a good way to secure the quality of the education, but they experience that it takes more time than scheduled and that this is valuable time that could be used to do research or develop lectures. Only informant HS3 said that the administrative work did not take more time than what is expected and could not see why many colleagues experienced administrative tasks as so time-consuming.

5 DISCUSSION

The findings show both similarities and differences between knowledge work and academic work. The literature presents knowledge work as work that occurs primarily from mental processes rather than physical labour, and that such workers have high degrees of expertise, education, and/or experience, and the primary purpose of their work involves creation, distribution and/or application of knowledge (Davenport, 2005; Heerwagen et al., 2007). This also applies to academic work (Macfarlane, 2010), which in the findings is presented as teaching, research, dissemination, and administration. Concentration is an important part of both knowledge work and academic work (De Been et al. 2016; Huhtelin & Nenonen, 2019). From the interviews, it was found that the informants consider reading, reflection and writing as activities that demand concentration and therefore silence, which is similar to knowledge work (Heerwagen et al., 2007). The informants explained that they found themselves in multiple locations during the workday. The office or home office is their preferred space for concentration work, but when doing data collection or teaching they often find themselves in other places than their offices, which might explain the low utilisation rate in offices documented in different studies (e.g., Häne et al., 2020). The literature search showed that knowledge work and academic work both consist of a large variety of activities with frequent shifts between them (Heerwagen et al., 2007). From the interviews, it can seem that these shifts are more frequent in academic work regarding where the tasks are conducted, with whom, and the content of the activities. Supervision of students’ work is a large part of the academic teaching duties (Macfarlane, 2010). Academic work consists not only of switching between concentrative research activities and administrative tasks but also teaching and supervision activities, which differs from traditional knowledge work. Some academic work is closely linked to practice in the form of fieldwork, laboratory experiments and artistic or architectural practice, which differ from the traditional definition of knowledge work. A common feature between knowledge work and academic work is the need for interaction. Knowledge workers have a large degree of interaction in their work to exchange and develop ideas (Heerwagen et al., 2007; Huhtelin & Nenonen, 2019). Contrary to belief, academic work does not only take place as an individual activity in their respective offices but happens in many different interfaces, e.g., while meeting students or colleagues for discussions or in different research projects. The findings from interviews illustrate that there is variation in the degree of interaction within the different disciplines, where some are always interacting with colleagues in their research (informant NS and IET), while others work more monodisciplinary (informant HS1 and HS2), which the informants see as natural depending on their discipline’s traditions.

NTNU is a university with a large width ranging from technology and natural sciences to the humanities and social sciences, and the interviews uncovered similarities and differences within the academic clusters as well. The largest differences are found in teaching and research activities, while dissemination and administrative activities are quite similar across the clusters. As a result, there are variations in needs and research methods between the different academic disciplines. The findings showed a variation in approach to teaching and research ranging from theoretical to practice-based, and the needs for specialised areas ranged from none to laboratories with heavy technical infrastructure. What all the academic clusters do have in common is that they all perform the four core activities of teaching, research, dissemination, and administration in their job, but how this is expressed varies and depends on the different disciplines' traditions and practices.

6 CONCLUSION

For this paper, only a small selection of the university's academic workforce was interviewed. The findings show that academic work represents a large variety of activities and practices related to teaching, research, dissemination, and administration both within each discipline and across the disciplines. Further, that academic work is not completely different from knowledge work. There are differences, but also several similarities. But what does this mean for workplace design in academia? Until now, most of the discussions related to the campus development, at least from the academics' point of view, have been related to their individual need for cellular offices, especially for concentration work and student supervision. Consequently, the other aspects of academic work have ended up in the background. In addition, existing practice is now being challenged by e.g., technology and new ways of working. The findings both from the literature and the interviews underline the importance and need of working more interdisciplinary, closer to industry, and across countries to solve complex challenges. To design workplaces for academic staff one really needs to understand what kind of activities take place in such a workplace. After seeing the large variety in the findings from the interviews, it has become clear that there are many different needs within the organisation, and that standardisation is not the best solution when designing academic workplaces. Academic work is not something completely different from knowledge work, but to base workplace design for academic staff only on experiences from traditional knowledge workplaces might be a too easy resort. This paper was limited to knowledge workers' and academics' work activities to be able to better understand their work activities and needs and did not focus on their physical workplace. For future research, it will be interesting to translate these findings into the physical workplace and investigate what this means for academic workplace design.

REFERENCES

- Davenport, T. H., De Long, D. W., Beers, M. C. (1998), Successful Knowledge Management Projects, *MIT Sloan Management Review*, 39(2), 43-57.
- Davenport, T. H., Prusak, L. (1998), *Working Knowledge: How Organisations Manage What They Know*. Boston, US: Harvard Business School Press.
- Davenport, T.H. (2005), *Thinking for a Living: How to Get Better Performance and Results from Knowledge Workers*. Boston, US: Harvard Business School Press.
- De Been, I., van der Voordt, T., Haynes, B. (2016), Chapter 9: Productivity, in Jensen, P. A., and van der Voordt, T. (Eds.) *Facilities Management and Corporate Real Estate Management as Value Drivers: How to manage and measure adding value*. London: Routledge, 140-155.

- Häne, E., Flores, V.M., Lange, S. Gut, P.B., Weber, C., Windlinger, L. (2020), *Office workplaces in Universities and Hospitals: Literature review*. Available from: https://srv-clst-301-data66.zhaw.ch/bitstream/11475/20372/3/2020_Haene-et-al_Office-workplaces-in-universities-and-hospitals.pdf.
- Heerwagen, J.H., Kampschroer, K., Powell, K.M., Loftness, V. (2007), Collaborative knowledge work environments, *Building Research & Information*, 32(6), 510-528. doi: <http://doi.org/10.1080/09613210412331313025>.
- Huhtelin, M. T., Nenonen, S. (2019), The workplaces of researchers in different disciplines, *Journal of Corporate Real Estate*, 21(1), 36-54.
- Kelloway, E. K., Barling, J. (2000), Knowledge work as organizational behavior, *International journal of management reviews*, 2(3), 287-304. doi: <http://doi.org/10.1111/1468-2370.00042>.
- Macfarlane, B. (2010), The Morphing of Academic Practice: Unbundling and the Rise of the ara-academic, *Higher Education Quarterly*, 65(1), 59-73. doi: <http://doi.org/10.1111/j.1468-2273.2010.00467.x>.
- NTNU (2018), *Arealkonsept for Campus NTNU. NTNUs campusutvikling 2016-2025 fase 2*. Available from: <https://www.ntnu.no/campusutvikling/kartlegging/arealkonsept>.
- Reich, S. M., Reich, J. A (2006), Cultural Competence in Interdisciplinary Collaborations: A Method for Respecting Diversity in Research Partnerships, *American Journal of Community Psychology*, 38(1), 51-62. doi: [https://doi.org\(10.1007/s10464-006-9064-1](https://doi.org(10.1007/s10464-006-9064-1).
- Reinhardt, W., Schmidt, B., Sloep, P., Drachsler, H. (2011), Knowledge Worker Roles and Actions – Results of Two Empirical Studies, *Knowledge and Process Management*, 18(3), 150-174. doi: <http://doi.org/10.1002/kpm.378>.
- Teichler, U., Arimoto, A., Cummings, W. K. (2013), *The Changing Academic Profession: Major Findings of a Comparative Survey*. Berlin: Springer.
- van den Berg, J. Appel-Meulenbroek, R., Kemperman, A., Sotthewes, M. (2020), Knowledge workers' stated preferences for important characteristics of activity-based workspaces, *Building Research & Information*, 48(7), 703-718. doi: <http://doi.org/10.1080/09613218.2020.1726169>.
- Weijs-Perrée, M., van de Koevering, J., Appel-Meulenbroek, R., Arentze, T. (2018) Analysing user preferences for co-working space characteristics, *Building Research & Information*, 47(5), 534-548. doi: <http://doi.org/10.1080/09613218.2018.1463750>
- Wilhoit, E.D., Gettings, P., Malik, P., Hearit, L.B., Buzzanell, P.M., Ludwig, B. (2016), STEM faculty response to proposed workspace changes, *Journal of Organisational Change Management*, 29(5), 804-815. doi: <http://doi.org/10.1108/JOCM-04-2015-0064>

Autonomous vs collaborative workspaces for academic research: a design issue. The case of the new scientific university campus in the Milan Mind district

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ABSTRACT

As higher educational facilities face the challenge of digital transformation in teaching methodologies, and its impacts on spatial layouts, also contemporary trends in academic workplaces rethinking have undergone a significant push as the result of remote working, persisting also after the Covid 19 pandemic lockdown periods. The ongoing debate in workspaces design, arguing the advantages of open space against individual rooms, has shifted to a balance, acknowledging that a flexible mix of spaces for personal focus, informal communication, and collaboration provides a more effective and satisfying environment, responding to new physical and social requirements. Academia still strongly opposes the abandonment of the cellular office and the rethinking of research infrastructures in a perspective of openness and sharing, due to its hierarchical structures, even despite the functional obsolescence of existing facilities. However, further drives to renew research facilities design models arise from the issue of operational and maintenance costs, and the emerging trends in education. This paper presents the case study of the brief and meta-design definition for a new scientific university campus in Milan, introducing the issue of specialised high-tech laboratories and ancillary spaces as places for collaborative working within the quantitative and qualitative layout setting of the new facility. Accordingly, the meta-design methodology purposely implemented is reported as well as the definition of requirements, also following a thorough co-design process, finally allowing for the development of design guidelines for spatial flexibility and multidisciplinary research activities.

Keywords

Academic workplace, Collaborative space, Research laboratories.

1 INTRODUCTION

The spread of Information Technology has further stimulated research and experimentation on workspaces use and spatial distribution. In addition, the Human-centred design perspective has

recently gained particular attention, introducing new diverse behaviours and perceptions of the workplace (Kwon and Remøy, 2019). Indeed, the post pandemic ‘new normality’ put workers into a new condition where they can assess benefits and risks dealing with two modalities: individual working, in isolated and independent spaces and collaborative working, involving social interaction. Consequently, many studies are focusing on office layout and on the intermediate gradients generated by the two extremes. The literature highlights the need for collaboration and social interaction with peers (Cummings & Holdam, 1997) and their impact on the employee motivation, in learning about the performance of a task, recognizing a position and a sense of belonging in the community, with the positive effect of partially reducing the sources of stress (Toscano & Zappalà, 2020). In academic workplaces studies, the role of the ‘employee-user’ shifts to the ‘academic-user’, more directly involved in the space management than the commercial office stakeholder, due to a marked sense of hierarchy and territoriality (Ashkanasy et al., 2014) that impacts on the definition of workplace models. In addition, the complexity and variety of activities in an academic office also include integrated research, teaching, and laboratory research, which affect even more the balance between both high cognitive individual skills development and transdisciplinary cooperation, that is needed to foster the knowledge flow generating creativity and innovation (Dunbar, 1995). Accordingly, this paper presents the participatory design activity guided by a research team from Politecnico di Milano aimed at defining the design brief for the transfer of the scientific departments and faculties of the Università degli Studi of Milan, currently located in the Città Studi area of Milan, to a new Campus to be constructed in the MIND (Milan Innovation District) site in the former Expo 2015 area. This task required a rethinking and renovation of the spatial models currently in use in the existing facilities, to host research and didactic innovation and thus fostering a renewal of the individual and collaborative spatial patterns. Accordingly, a specific focus will be offered on academic workplaces for scientific research, characterised by different levels of specialised equipment.

2 BACKGROUND

The analysis and experimentation comparing the two above mentioned divergent directions, individual and collaborative patterns, through their impact onto the workplace spatial organisation are interlaced with the concept of ‘territoriality’ and ‘ownership’ of the individual workplace, with the notion of participatory design, and with the perception of space to evoke actions and behaviours. These studies, developed over the last decades, can be referred to the traditional office space literature before moving to the academic one, currently more lacking and fragmented than the former.

2.1 Spatial distribution models

Between the two extremes of *Open Plan Office* - OPO - and *Cellular Office*, a sequence of categories of office spatial patterns with different gradients of individual and collaborative modes can be identified. OPO, *per se*, originally refers to non-compartmentalized, open, and flexible spaces (Danielsson & Bodin, 2009) with assigned workplaces. It progressively evolves towards the affirmation of the no-fixed desk, with the spread of hot-desking and hotelling, applying the principle of ‘non-territoriality,’ to further reduce the standard area per person. The main weaknesses of these modalities are the lack of privacy, the disturbance caused by noise, the scarce control over the quality of the personal micro-environment by the user, and over the employees’ work, from the perspectives of the management (Kim & De Dear, 2013). Therefore, in recent years, the organisation of spaces has been more decisively oriented towards a business approach to increase revenue and reduce costs through an effective rationalisation. In particular, the *Activity-Based Workplace* - ABW - is grounded on the ability of employees to select the most suitable workstations, according to the kind of activity they are on, in a defined

period (Appel-Meulenbroek et al., 2011). This modality responds to different needs involving collaborative, individual, and routine work (Haapakangas et al., 2019), and guaranteeing user privacy. Based on the alternation of multiple shifts and, therefore, on the sharing of workstations, ABW allows employees to optimise the use of space. Then, ABW evolved towards an *Activity-based Flexible Office* (A-FO), a model that can easily respond to the ongoing demands with an adaptive attitude (Wohlers & Hertel, 2017). Nevertheless, this modality is related to issues typical of the non-territorial offices, such as the poor perception of the working space as one's own and the difficulty in finding colleagues; ABW also tends to eliminate status indications and the assignment of workstations to univocally and permanently defined groups (Elsbach, 2003), which is a relevant factor in the academic field. Overcoming this rigidity would allow to move forward in the direction of collaborative spaces.

2.2 The stakeholders' role in the workspace Process Design Project

The need for constantly transforming, adjusting, and responding to organisational learning led to the notion of *Agile Workplace* - AW - which allows for a dynamic relationship between work, the workplace, and tools of innovation (Joroff et al., 2003) also to guarantee an outstanding balance between collaborative and autonomous work. This approach aims to provide workspace diversity through a wide range of workspace typologies (The future academic workplace, 2020). Indeed, the academic workplace is characterised by certain activities and working methods that increasingly require a variety of environments and an 'agile re-arrangement'. In particular, the competitive research and the partnership with industry need a continuous updating of spaces' organisation and equipment to ensure innovation and nurture it (Backhouse et al., 2019). The turnover and the acquisition of younger researchers bring a renewal in working practices also employing digital technologies. Indeed, technology is an additional factor bringing the need to update spaces and devices, causing substantial repercussions on the interior features and on the relationship between the different work areas. The renewal and updating of the academic workplace requires a negotiation effort due to a certain autonomy of the academic workforce and sometimes to their resistance in transforming work practices (Van Marrewijk & Van den Ende, 2018), mainly when these entail the sharing of resources and spaces. Some studies have shown how a positive approach to change can be stimulated when the academic staff is called to contribute to the Project Design Process, specifically in the brief construction. In fact, by collecting qualitative and quantitative data and using those data to organise co-design sessions with the stakeholders it is possible to include the ultimate needs in work-related specific contexts, fostering a sustainable change over time (Markkanen et al., 2022).

2.3 Fostering the employees Interaction through Integrated models, beyond the users' Proximity

Thomas Allen, a MIT organisational psychology professor, demonstrated that 'functional centrality', getting employees close to the flows generated by entrances, horizontal and vertical connections, and services, is more effective to foster the encounter and conversation between users (Allen & Gerstberger, 1973) than bringing employees workstations closer to each other's. Developing the analysis in this direction, the importance of informal and 'incidental' interaction emerges with its different character from the institutional one, such as the one provided by meeting rooms. Indeed, in addition to the notion of *Proximity*, as one of the parameters that can favour spontaneous encounters and the exchange of information between employees, Fayard and Weeks (2011) indicate *Privacy* and *Permission* as factors that provide a certain degree of freedom and ease within informal communication. *Privacy* guarantees meetings and social relations out of the corporate hierarchy's control, while *Permission* is conceived as an interaction carried out in a context perceived as 'working', overcoming the

concept that 'real work' to be performed only at one's workstation or in meeting rooms. The word *Permission* refers to a cultural and conventional dimension that shapes our view of what makes others and ourselves perceive an appropriate behaviour in a particular environment. This perspective stems from the notion of *Social Affordance*, as the possibility that an environment can evoke actions and behaviours (Fayard & Weeks, 2007). Following the business office, also the academic workplace, particularly in laboratory planning and in the design of the relationship between laboratory and office, a model that allows to blur the boundaries between the two typologies has emerged, fostering the adoption of a more interdisciplinary character of space. This integrated approach (KlingStubbins, 2010) makes research labs more open, virtually, visually, and physically accessible, better connected with office spaces, and strategically positioned near formal and informal social interaction areas.

3 THE NEW SCIENTIFIC CAMPUS IN THE MILAN MIND DISTRICT

In 2017 Università degli Studi di Milano and Politecnico di Milano signed a scientific collaboration agreement to follow up the transfer of the scientific campus currently based in Città Studi neighbourhood of Milan in the new MIND Innovation District, to be built in the former Expo 2015 site. Thanks to a national and regional funding, new innovative research facilities can be in fact constructed in order to replace the existing scientific faculties and departments outdated buildings, constructed over different steps over the last century, scattered over a large urban area and in need of an overall renovation. Accordingly, among the different activities included in the agreement, a specific contribution of the Politecnico team focused on the definition of the new spatial layout and requirements for the academic workspaces, including both offices as well as several types of laboratories and mixed-use spaces.

3.1 Setting new requirements for new research facilities

It was clear from the beginning that a complete rethinking of the current model was necessary, not only because of the more compact extension of the new campus to be designed, but mainly based on a rationalisation of the spaces and on the ongoing continuous change in research methodologies to ensure competitiveness and innovation. In fact, the collaboration with the Property Management Office of Università degli Studi and a preliminary survey through a questionnaire distributed to the involved Departments to collect the size and types of the existing academic workplaces, revealed that, in addition to the age of the buildings and to the often-obsolete laboratories' equipment, other major interrelated issues emerged:

- The multiplication of laboratories and related ancillary spaces distributed in the many departments and facilities over the city, resulting in a completely non-efficient management and supplying.
- The oversized pro capita (per academic) standard area, also due to the doubling of circulation and servant spaces in the different separated buildings, also impacted on the economic sustainability of the institution.
- The status symbol concept associated with private space availability generates underused or crowded work areas and rooms occupied by pyramidal research groups thus conceiving the attribution of space according to hierarchy rather than use.
- The zoning of the spaces, rigidly organised by the fields of scientific knowledge, caused the consolidation of disciplinary silos, as well as hampering the optimization of logistics.

Thus, an initial literature review was carried out with the aim of mapping contemporary debate on a multidisciplinary basis; defining quantitative and qualitative standards for the new complex and acquire a considerable number of case studies of innovative scientific campuses and laboratories designed and built all over the world to be analysed and classified from a typological and technological point of view (Wilhoit et al., 2016; Di Berardinis et al., 2013; KlingStubbins, 2010; Perkins & Will, 2001). The descended results focusing on academic

workplaces interpreted and applied to the specific issues and to the initial expectations of the Università degli Studi gathered through a first round of interviews with the involved Departmental staff, highlighted the need for the introduction and the diverse translation of the concept of shared and collaborative spaces and for a possible transformation over the time:

- Co-working spaces for temporary uses (meetings, temporary research units for funded projects, Ph.D. candidates, researchers, meetings with students, etc.).
- Proximity spaces for informal communications in adequate circulation and coffee break/social spaces to foster encounters and exchanges among disciplines and hierarchies.
- Laboratories and ancillary spaces for ordinary activities and research practices shared among different Departments.
- High-tech, highly specialised and equipped cutting edge laboratories to be shared on a campus level for innovative experimental activities to boost competitiveness and contaminations with the industry in the new MIND scientific and technological park.
- Flexible loose fit spaces to accommodate not only changes in room sizes and partitioning but also the program transformation between offices and laboratories according to the rapid evolution of research projects, groups, and methodologies.

3.2 Constructing the methodological and design process

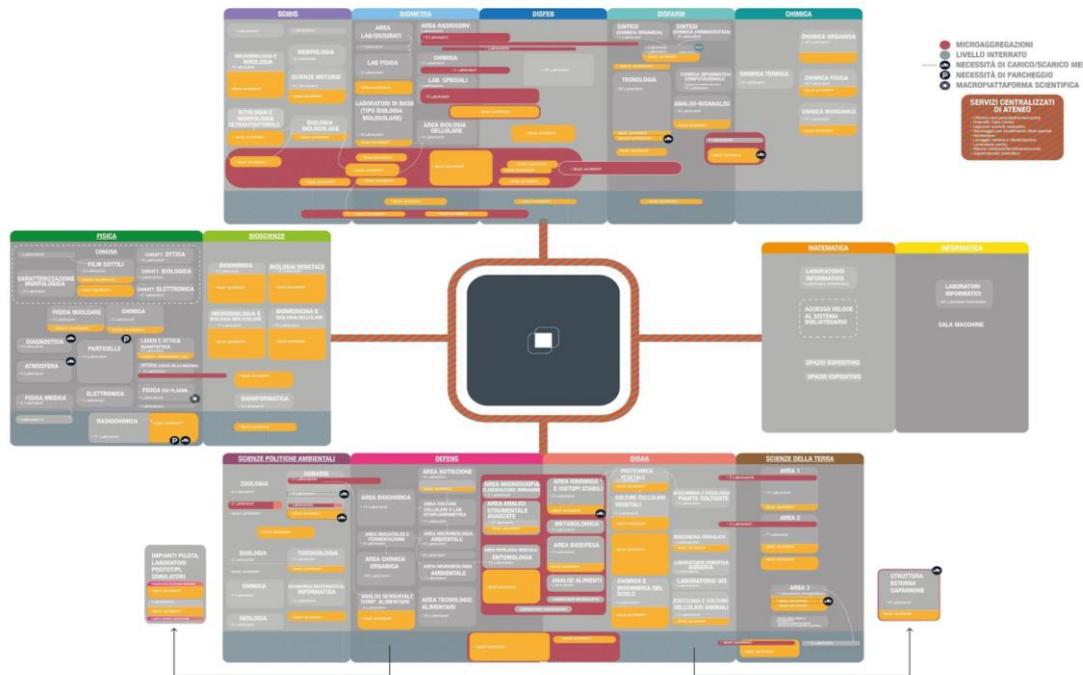
As "positive and sustainable change is possible when academic staff influence or initiate the briefing and design process" (Backhouse et al., 2019) in this case the need to support and stimulate the raise of awareness and engagement towards the definition of their own customised layout was fundamental; co-design activities were thus planned since the initial phases of the project development. A stress was posed on the definition of laboratories areas detaining a higher complexity in equipment and use modes, including both spaces for experimental activities with instruments as well as data processing workspaces, where some of the academics spend even more time than in conventional offices and studios. A first campaign of 4 workshops, aimed at the definition of the different concepts of sharing applied to laboratories, involved 13 scientific departments (13 chairs or delegates, 3 property managers, 2 technical staff,) grouped according to the existing or possible multidisciplinary collaborations (Kelsey & Labov, 2013) to work and reason on the characteristics of the facilities and of the ancillary related spaces and services. In addition to the workshops carried out with the departments' delegates, a survey activity was carried out with a group of 14 students aimed at learning about their behaviour in the use of university spaces and their requests with respect to the departments' relocation program.¹

¹ Further information about the process, objectives, methodology, and results of the co-design activity carried out by the Design Department of the Politecnico di Milano are reported in the following publications: Camocini B., Collina L., Daglio L., Mazzarello M. and Trapani P. (2018) Service design methods and tools as support to the participatory definition of the meta-design brief of a contemporary integrated campus. Servdes 2018 (Milan), Linköping University Electronic Press.

Trapani, P., Collina, L., Camocini, B., Daglio, L. and Mazzarello, M., (2018). The transition to a new university campus as an opportunity for the urban regeneration of the former Milan expo 2015 areas. HCII - Cross-Cultural Design Applications in Cultural Heritage, Creativity and Social Development (Las Vegas) - pp.391-408. Springer International Publishing.

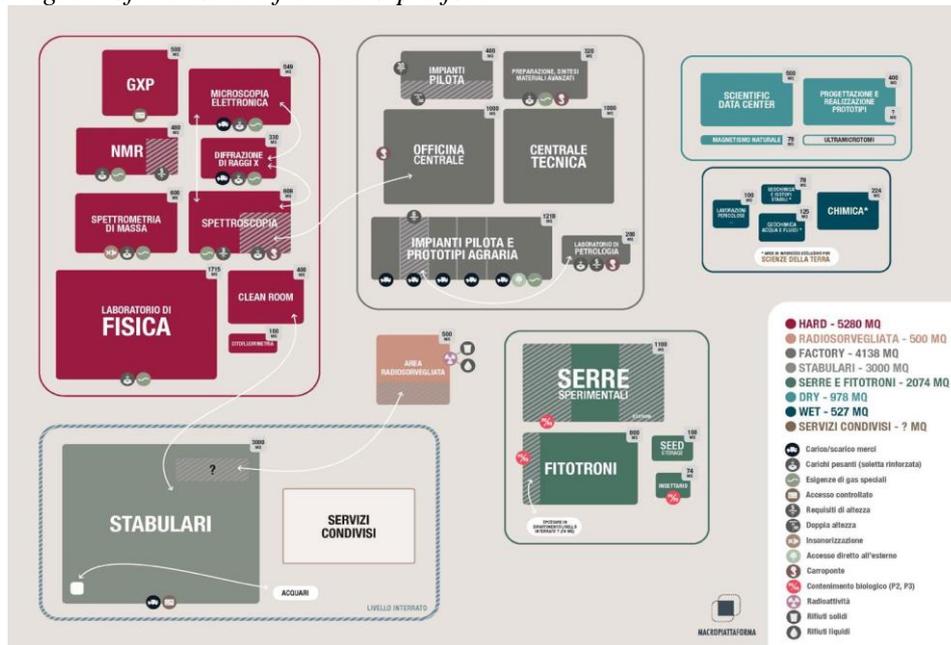
The following participated design sessions comprehended consecutive group discussions of the systems of shared spaces re-elaborated by the Politecnico Team in order to reach a final proposal, involving the Departments representatives, the Property Management Office staff and the Governance.

Figure 3. The relational diagram of the different levels of shared labs and ancillary spaces among Departments. The red and yellow areas highlight the newly shared facilities at the intra-departmental scale, suggesting proximities and spatial relations among the new Department buildings. The central black area represents the "scientific macro-platform", the common labs and facilities (cf. Fig.4) at the inter-departmental scale



A special focus through co-design sessions, involving selected participants from the various departments' staff, was dedicated to the definition and organisation of the new concept of shared "scientific macro-platform", the buildings dedicated to facilities and laboratories either available and used by all or most of the Departments or hosting highly specialised equipment in terms of contrivance, instruments, hardware, and specific building requirements (structure and building services).

Figure 4. Diagram of the "scientific macro-platform"



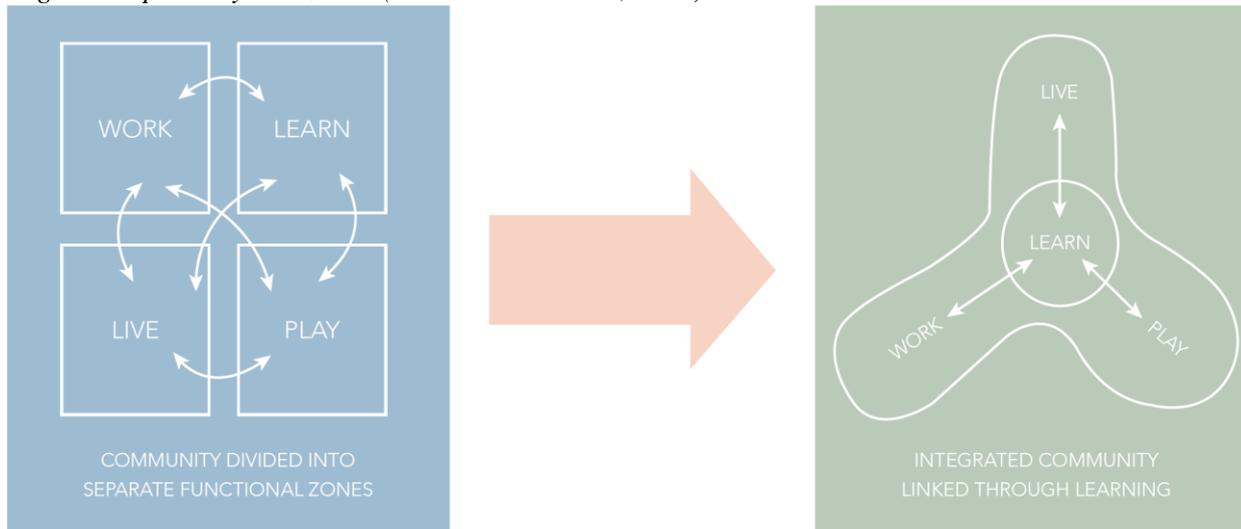
The participating process canvassed a new attitude towards collaboration in work and research activities, raising the awareness of the positive impact on creativity stemming from interaction with peers; the same attitude was then more easily transferred to the conventional office spaces, also thanks to the diverse degrees of flexibility offered.

3.3 The autonomous/collaborative mix developed

The meta-design proposal developed, gathering insights and data from the one-year long process of participated activities and discussions among the stakeholders at the different levels was finally based on the following concepts providing an open approach towards the characterisation of space:

- Flexibility of space (short, medium and long-term) to comply with ongoing innovation trends in teaching, research, and work organisation in general, resulting from the combination of intertwined different factors. First, the organisation of the spatial layout (both at building and complex level) according to distinct degrees of functional specialisation (offices, low-tech and high-tech labs) for a long-term conversion adaptability and of use (autonomous, collaborative, shared space) for a medium to short term adaptability, allowing for not a complete but a predicted set of transformations of the program. Accordingly, the selection of the structural/MEP services/spatial system considers the grid variations, the building shape and depth, the optimisation of the vertical and horizontal distribution of the building services. The choice of the construction systems favours inspectable, easily expandable and integrable solutions through advanced predispositions and scalable spaces. Mobile systems make space always reconfigurable to allow for quick adjustability at certain times of the day. Finally, the circulation and accessibility should allow the variation of spatial configurations.
- Hybridization of functions meets the needs of the constantly evolving styles of knowledge production and transfer in the digital age. Education facilities should allow for the new collaborative modes to include not only monofunctional research facilities but a wider set of public spaces to meet and study on the larger neighbourhood scale through a varied schedule of around-the-clock activities, which minimise the under-use of assets.

Figure 5. Spaces hybridization (Harrison & Hutton, 2013)



Therefore, the response to the dilemma of privacy vs. interaction in academic workplace was provided in terms of a varied “range of activity settings within the office environment, affording occupants access to both quiet, solitary workspaces and as well as to multi-occupancy, sociopetal spaces” (Parkin et al., 2011), to be adaptable over time.

4 CONCLUSION

The case study here presented highlights, beyond the tentative spatial balance between collaboration and privacy adopted for the new campus project, the importance of the process design entailing the involvement of the stakeholders since the brief definition. Not only the shared participation provision for the meta-design proposal was possible but a new attitude and posture to research and collaboration was created. In fact, the open discussion and rethinking of the research methods and practices led to the establishment of new partnerships and activities especially fostered by the new concept of scientific macro-platform, including informal social encounters and exchanges on a multidisciplinary level as well as highly specialised and equipped areas. Although it should be recommended that both participation and this new mindset were maintained during the project development, the construction phase, the relocation and final settlement in the new facility, the involvement of the Politecnico Team finished with the meta-design proposal delivery, setting thus the limits of the experimental experience. Moreover, also the consequences of the COVID-19 pandemic in terms of acceleration of ongoing changes, already triggered by the digital transition on learning and research models, could not be considered for a revision and enhancement of the proposal to enrich the typologies of spaces, equipment and fit-out generated by the new augmented modes of interaction and collaboration. Moreover, a systemic approach was implemented and applied, which includes on the one hand the multi-scalar approach of the design definition, combining the features and program of the workspaces with the functions, amenities and provision of spaces on the campus and district level. On the other hand, the multifunctional character of the space is comprehended, to reduce underuse, optimise operational and management costs according to sustainability goals, as well as to allow a collective, collaborative, creative, adaptable appropriation of the space by the users.

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REFERENCES

- Allen, T.J., Gerstberger, P.G. (1973), “A field experiment to improve communications in a product engineering department: The non territorial office”, *Human Factors*, 15, 487-498.
- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), “An End-user's Perspective on Activity-based Office Concepts”, *Journal of Corporate Real Estate*, 13(2), 122-135.
- Ashkanasy, N. M., Ayoko, O. B., Jehn, K. A. (2014), “Understanding the physical environment of work and employee behaviour: An affective events perspective”, *Journal of Organisational Behaviour*, 35(8), 1169-1184.
- Backhouse, S., Newton, C., Fisher, K., Cleveland, B., Naccarella, L. (2019), “Rethink: Interdisciplinary evaluation of academic workspaces”, in Avlokita, A. and Rajat, G. (Eds), *Revisiting the Role of Architecture for 'Surviving' Development. 53rd International Conference of the Architectural Science Association*, Architectural Science Association (ANZAScA), 87-96.
- Cummings, A., Oldham, G.R. (1997), “Enhancing creativity: managing work contexts for the high potential employee”, *California Management Review*, 40, 22-38.
- Danielsson, C. B., Bodin, L. (2009), “Difference in Satisfaction with Office Environment Among Employees in Different Office Types”, *Journal of Architectural and Planning Research*, 26(3), 241–257.
- Di Berardinis, et al. (2013), *Guidelines for Laboratory Design: Health, Safety, and Environmental Considerations*, 4th Ed., Hoboken, NJ, John Wiley and Sons.
- Dunbar, K. (1995), “How scientists really reason: scientific reasoning in real-world laboratories”, in Sternberg, R. J., Davidson, J. (Eds.), *Mechanisms of Insight*, MIT Press, Cambridge.
- Elsbach, K. D. (2003), “Relating physical environment to self-categorizations: Identity threat and affirmation in a non-territorial office space”, *Administrative Science Quarterly*, 48(4), 622–654.
- Fayard A.L., Weeks, J. (2007), “Photocopiers and Water-coolers: The Affordances of Informal Interaction”, *Organization Studies*, 28(5), 605-634.
- Fayard, A. L., Weeks, J. (2011), “Who moved my cube?”, *Harvard Business Review*, 89, 7-8.
- Haapakangas, A., Hallman, D. M., Mathiassen, S. E., Jahncke, H. (2019), “The effects of moving into an activity-based office on communication, social relations and work demands – a controlled intervention with repeated follow-up”, *Journal of Environmental Psychology*, 66.
- Hardy, B., Graham, R., Stansall, P., White, A., Harrison, A., Bell, A., Hutton, L. (2008), *Working beyond walls: The government workplace as an agent of change*, Office of Government Commerce.
- Harrison, A., Hutton, L. (2013), *Design for the Changing Educational Landscape: Space, Place and the Future of Learning*, Routledge, London and New York.
- IDEO (2003), “Methods Cards” available at: <https://www.ideo.com/post/method-cards> (accessed 22 March 2022).
- Joroff, M.L., Porter, W.L., Feinberg, B. Kukla, C. (2003), “The agile workplace”, *Journal of Corporate Real Estate*, 5(4), 293-311.
- Kelsey, S., Labov, A. (2013), “Interdisciplinary Research Facilities”, Neuman D. J (Ed.), *Building Type Basics for College and University Facilities*, (2nd edition,). John Wiley & Sons, Hoboken-New Jersey, 179.

- Kim, J., De Dear, R. (2013), “Workspace satisfaction: The privacy-communication trade-off in open-plan offices” *Journal of Environmental Psychology*, 36, 18-26.
- KlingStubbins (2010), *Sustainable Design of Research Laboratories: Planning, Design, and Operation*, 1st Ed., Hoboken, NJ, John Wiley and Sons.
- Kwon, M., Remøy, H. (2020), “Office employee satisfaction: the influence of design factors on psychological user satisfaction”, *Facilities*, 38 (1/2), 1-19.
- Parkin, J.K., Austin, S.A., Pinder, J.A., Baguley, T.S., Allenby, S.N. (2011), “Balancing collaboration and privacy in academic workspaces”, *Facilities*, 29 (1/2), 31-49.
- Watch, D.D., Kliment, S.A. (2002), *Building Types Basics for Research Laboratories*, Hoboken, NJ, John Wiley and Sons.
- The Future Academic Workplace. A literature Review* (2020), Hassell, Brisbane. Retrieved from [https://www.hassellstudio.com/docs/140221_academicworkplacelitreview-\(2\).pdf](https://www.hassellstudio.com/docs/140221_academicworkplacelitreview-(2).pdf)
- Sanders, E.B.N., Brandt, E., Binder, T. (2010) “A framework for organising the tools and techniques of participatory design”, In Proceedings of the 11th Biennial Participatory Design Conference (PDC ‘10). Association for Computing Machinery, New York, NY, USA, 195–198.
- Toscano, F., Zappalà, S. (2020), “Social Isolation and Stress as Predictors of Productivity Perception and Remote Work Satisfaction during the COVID-19 Pandemic: The Role of Concern about the Virus in a Moderated Double Mediation”, *Sustainability* Vol.12 No.23, 1-14.
- Van Marrewijk, A., Van den Ende, L. (2018), “Changing academic workplaces: the introduction of open-plan offices in universities”, *Journal of Organisational Change Management*, 31(5), 1119-1137.
- Wilhoit, E. D., Gettings, P., Malik, P., Hearit, L. B., Buzzanell, P. M., Ludwig, B. (2016), “STEM faculty response to proposed workspace changes”, *Journal of Organisational Change Management*, 29(5), 804-815.
- Wohlens, C., Hertel, G. (2017), “Choosing where to work at work – towards a theoretical model of benefits and risks of activity-based flexible offices”, *Ergonomics*, 60(4), 467-486.

Meaning Making through Artistic Interventions in University Spaces: An Aesthetic Approach

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ABSTRACT

This exploratory study analyses how meaning making can take place through aesthetic experience in university spaces. According to recent organizational studies, the aesthetic experience - being it generated by the intimate and personal experience of the space through the five senses - represents the basis for any other intellectual experience and knowledge development. Although these reflections have brought interesting results, they have not been applied to university contexts. With our study we aim to fill this gap, and ask the following research question: How do students construct meaning through the aesthetic experience of an artistic intervention in a university setting? We address this question by analysing how a group of students (19 in total) of a Master in arts management develop meanings through the aesthetic experience of an artistic production and the aesthetic interaction among them. Empirical data have been generated through observations and photos done by the researchers, written self-reflections and videos of shared experience in meaning making done by students. Through this study, we illustrate that the aesthetic experience connected with the artistic production leads group members to question and then to create new meaning to the concept of being a community of post-graduate classmates. In particular, from our analysis it emerges that the aesthetic experience helped the students to articulate both an emotional and a cognitive reaction. As a result, the students engaged in the attribution of a divergent meaning to their being a community, which we labelled as 'critical and emphatic meaning making'. Thus, we elaborate a model, supporting extant literature on the aesthetic valence of artistic interventions and its value to generate an unexpected sense-making process attribution, where both an emphatic and a more critical view of the educational community emerge.

Keywords

Organisational space, Aesthetic experience, Artistic interventions, Meaning making.

Workplace in Africa: the planning of administrative and didactic spaces for the Somali National University

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ABSTRACT

Planning workplaces for universities is a complex matter because it concerns the regulatory framework within which each university operates. For instance, the European Union provides specific guidelines on how to deal with safety, security, HVAC, the size of space, health and wellbeing of users, etc. Then, each State is responsible for implementing these guidelines, depending on the context and users' specific needs. In other contexts, such as the African one, there isn't a regulatory framework on the subject matter. Therefore, the process of sizing on-campus administrative spaces and workplaces (for example the offices for professors) becomes even more complex. The paper presents the experience of the authors while supporting the Somali National University of Mogadishu in developing their new campus. The methodology entailed a questionnaire that was administered to the Rector and the members of eight faculties to gather information on the number of people and type of activities that the campus should have hosted. The questionnaire results allowed a preliminary analysis of the quality and amount of space necessary for administrative, didactic, and research activities and helped solve the lack of African laws on the subject matter. In conclusion, the paper shows how Italian laws and European standards and regulations were used to estimate the need for on-campus spaces and define some benchmarks. This contribution reflects on the need for flexible enough regulations that allow decisions tailored to each specific case in order to better address different users' needs.

Keywords

Workplace planning, Regulatory framework, African universities, University campus design, Administrative and didactic activities.

1 INTRODUCTION

In recent years the scientific debate in the field of university campus design has focused on how universities are facing a season of renovation on the buildings through adaptability of spaces (den Heijer, 2008). Furthermore, how these renovations have an impact on the work of faculty and students and how spatial configurations are changing rapidly together with new needs (Kuntz et al., 2012). Also, since university and society are organically linked together (Huhtelin and Nenonen, 2015), the debate is investigating how universities play a key role in "building community" and "creating a sense of place" (den Heijer, 2008). This is the reason why physical campuses are becoming essential parts of cities and they need reinvestments, but also new understanding of academic office design (Huhtelin and Nenonen, 2019) with different requirements for workplaces of different disciplines. The literature review also showed that the pandemic has led the university campus to face an opportunity for bigger changes, by being more focused on economy, flexibility, space use, demographic aspects, and urban development

(Nenonen and Danivska, 2021). Moreover, the European third generation universities are increasingly distributed in multiple places within a city (Poutanen et al., 2021), with important consequences on mobility and on the academic work environment. These are the main trends affecting today's university planning. Thanks to these new opportunities, for some universities it is possible to optimise their role within the cities they are based in. However, there are universities that do not fit into the topics recently analysed by the scientific debate because they are facing completely different challenges in contexts very far from the European one. Starting from the literature review on European university campuses, the paper investigates how to plan the university campus design of an African country as a case study, in the absence of specific literature on the subject. The key intention is to understand users' needs and find an agreement between users' expectations and reality, to provide insight for the university campus design in a developing country.

2 AIM

Over the years the university campus has had different forms in the urban context: the campus as a separate city, the campus as a "gated community" in the city (with or without the actual gates), and the campus integrated within the city (den Heijer, 2008). While the first model is gradually disappearing because of the growth of cities enclosing the campuses, the other two models reflect the role of university among society and how this has changed in the last 20 years (Poutanen et al., 2021). It is common knowledge that university campuses nowadays combine the traditional functions (i.e. teaching and research) with the so-called "Third Mission" (Molas-Gallart and Castro-Martínez, 2007), which refers to all activities concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments (den Heijer, 2008). This is the reason why university campuses are more strategic than ever, with society at the centre of university's activities and an increasing demand for flexibility that involves adaptability of buildings from a technical point of view, a mix of owned, leased and rented space from a financial point of view, and a better use of the capacity from an organisational point of view (den Heijer, 2008). A campus that contains buildings for education, research, housing, hotels, related businesses, retail and leisure – and is accessible by car and public transport – is a city itself (den Heijer, 2008). The literature review brought up another trend among the so-called third generation universities, the network universities, which have premises located in multiple places within a city (den Heijer & Tzovlas, 2014). Therefore, the academic workplace can be seen as distributed and creates a challenge for the campus development because of the increasing number of university organisation mergers (Poutanen et al., 2021). However, in the literature the multi-campus seems to refer mainly to regional level situations (Zeeman & Benneworth, 2017) and in terms of in-city university mergers, the studies focus on policy and change management (Tienari, et al., 2015). A great number of external stakeholders play a role in the campus development nowadays (Poutanen et al., 2021) and are involved in delicate matters regarding the new ways of management. The debate focuses not only on the role of technology, but also on the challenge offered by the latest methods and tools to support the decision making process (Heijer, 2008). At the same time a large part of the existing campus is ageing and needs reinvestment or at least reconsideration (den Heijer, 2008). Literature reports several examples of consolidations operations reported as case studies focusing on the European context. Concerning what was just mentioned, the scientific debate on European universities focuses on realities that have been consolidated for centuries and recognized all over the world. This is not the case with African universities, which are born in a very different context from the European one. Historically younger and often privately owned, they are small businesses that have only been consolidating in recent years. The purpose of this paper is to share the insights

gained by a recent research and consultancy work performed by the authors while supporting the Italian Agency for Development Cooperation (AICS) in the process of Somali National University's (SNU) structural strengthening and expansion. Interdisciplinary collaboration between professors of Politecnico di Milano, with Rector Jimale's involvement, has been fundamental for gaining useful insights. The reconstruction of the SNU could provide the occasion for the university's rebirth on the European and Italian model in particular, but the paper aims to understand if the context allows it. In fact, not only in Africa there is a lack of useful laws to do this (the last ones date back to 1985, pre-civil war) but also references in the same context to look at as "good examples". The research can be considered one of the few contributions on African development to the field of universities. Moreover, it can give new indications about the evolution of design in the African context, where the spatial and functional needs are very different from those of European campuses. In fact, the faculties present in the SNU (i.e. Veterinary and Agriculture) are much more concrete than theoretical and this is the reason why spaces such as stables for animals and botanical gardens are necessary to support traditional classrooms.

3 METHODOLOGY

3.1 SNU history and new masterplan

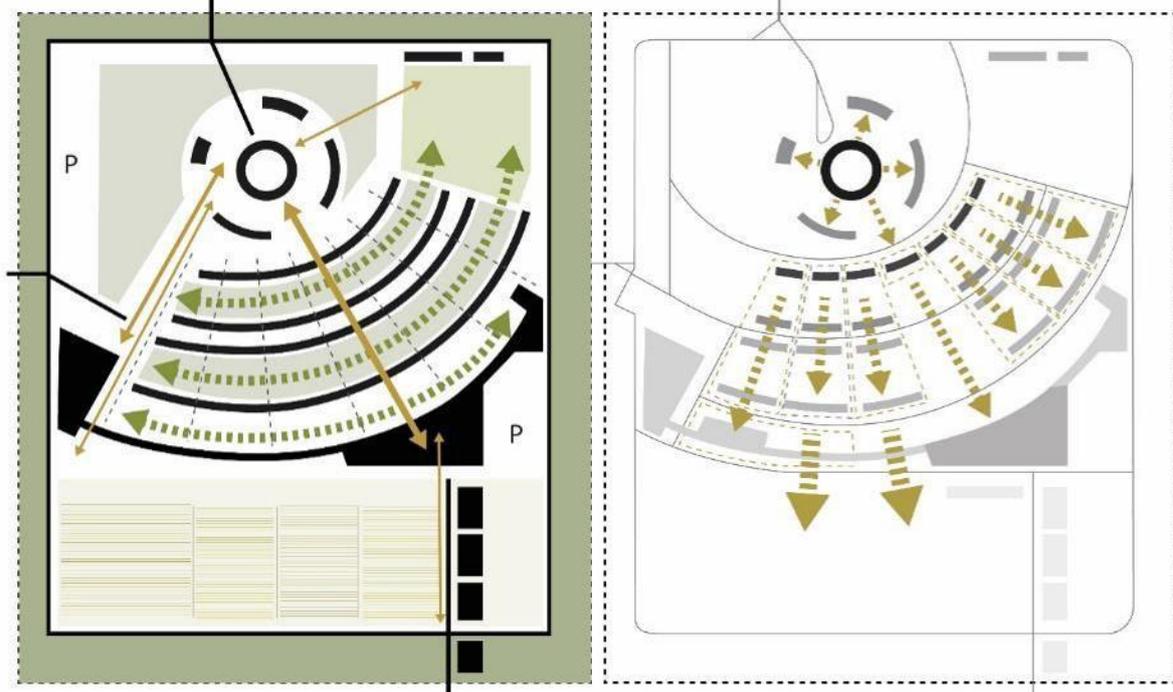
SNU was founded in Mogadishu with the support of Italian cooperation in the mid-1970's, and was open until the beginning of civil war in 1991. The Gahayr campus was realised with the help of the European Common Fund on a project made by two Italian architects, Ludovico Quaroni and Salvatore Dierna (Figure 1). Due to the civil war, SNU was abandoned for twenty-seven years and finally reopened in 2018, but the buildings still need to be completely renovated. SNU is 6 km away from Mogadishu's centre and 5 km away from the seaside. It is decentralised with respect to other universities on the territory (such as, The City University of Mogadishu, The Atlas University of Somalia, and The Capital University), but this may be an advantage thanks to a greater flexibility of the open space.

Figure 1. Aerial view of the campus designed by Quaroni and Dierna – Quaroni archive



The new masterplan, developed by a team led by professor Laura Montedoro, maintained the original structure centred on the rectorate, with an incremental strategy to be implemented in stages with the growth of the student population (Figure 2).

Figure 2. Masterplan developed by professor Montedoro – elaboration of Politecnico di Milano



3.2 Methodology applied

This study started with the collection of data through different methodologies, both qualitative and quantitative. The survey method aims at referring to the “design process approach”, as suggested by Costa (2014), which consists in involving all the stakeholders, merging several disciplines and applying different methodologies (questionnaire, interviews, and a collection of regulatory framework as reference) toward the full understanding of the actual situation.

First, a questionnaire - listed in Appendix A - was administered to the Rector Jimale, with the aim of systematically collecting some information about expectations and needs, but also on the current situation and on SNU’s history. Indeed, the questionnaire covered several aspects and was composed of nine different sections. Some of them in more detail regarded:

- General data (such as, student population);
- Educational and Researching activities (such as, Faculties, offices, and departments);
- General services (such as, libraries, sports centre, and canteen);
- Accommodations (such as, dormitory, residence, and guest house); and
- External area (such as, botanical gardens, stables, and recreational areas).

The questionnaire was written in two languages (Italian and English) to facilitate understanding and compilation.

Figure 3. Sample section of the questionnaire - elaboration of the authors

Servizi generali / General services							
Ambito	Area of interest	Tempo	Period	Domanda	Question	Chiarimento	Explanation
1	Rettorato	Presente	Present	Quanto è grande l'edificio del rettorato?	How big is the rectorate?	mq	square metres
				Che cosa comprende?	Which kind of spaces are there now?	Descrizione degli spazi principali che fanno parte dell'edificio. Ad esempio: sale riunioni, sale di rappresentanza, uffici, ...	Description of what are the main spaces that are part of the rectorate. For example: meeting rooms, representative rooms, offices, ...
		Futuro	Future	Che cosa comprenderà?	Which kind of spaces will be there?	Descrizione degli spazi principali che saranno parte dell'edificio. Ad esempio: sale riunioni, sale di rappresentanza, uffici, ...	Description of what are the main spaces that should be part of the rectorate. For example: meeting rooms, representative rooms, offices, ...
				Quanto sarà grande?	How big will it be?	mq	square metres
2	Amministrazione	Presente	Present	L'amministrazione è divisa in dipartimenti?	Is the administration composed of departments?	Descrizione dei vari dipartimenti	Description of departments
				In quali spazi si svolgono le attività amministrative?	Where is the administration located in the campus?		
		Futuro	Future	Verranno aumentati?	Will they be increased?		
3	Biblioteche	Presente	Present	Esistono biblioteche?	Are there any libraries?		
				Quante?	How many libraries are there in the campus?	Una unica per tutte le facoltà, una per facoltà, ...	One per all the faculties, one per faculty, ...
				Quanto sono grandi?	How big are they?	mq	square metres
		Futuro	Future	Includono postazioni per gli studenti?	Do they include spaces for students?		
Quante biblioteche ci saranno nel nuovo campus?	How many libraries will there be in the new campus?						
						Descrizione degli spazi principali che saranno	Description of what are the main spaces that

Second, semi-structured interviews were conducted with the goal to bring together impressions and willingness towards the project. The questionnaire proved to be useful to better organise the meetings, since they involved nine people (the Rector and the Deans of Faculties) and were all virtual. Supported by a detailed checklist, the team punctually registered the number of:

- Students;
- Professors;
- Administrative personnel;
- Faculties; and
- Degree courses.

Thanks to the questionnaire and the interviews, it was possible to cluster the spaces, following typological and functional criteria, to have some insight into how the space was used and to generate the hypothesis to verify afterward. Moreover, the numbers obtained from the questionnaire and the interviews were used to calculate periodic increases of the new campus (e.g., the construction of new buildings) in 20 years.

Third, the Italian regulatory framework as reference was collected to set the activity in the legislative context (Table 1) and to properly weigh and interpret information gained during the interviews through some quantitative investigations.

Table 1. Italian legislative framework – elaboration of the authors

Legislative framework	Contents
D.L. 18/12/1975	Updated technical standards relating to school buildings.
D.L. 81/2008	On the protection of health and safety at work.
D.M. n. 218 del 26/08/1992	Fire prevention standards for school buildings.
D.M. n. 503 del 24/07/1996	Rules for the elimination of architectural barriers in buildings, spaces and public services.
D.M. n. 236 del 14/06/1989	Technical requirements necessary to guarantee the accessibility, adaptability and visitability of private buildings and public residential buildings, for the purpose of overcoming and eliminating architectural barriers.
Legge n. 338 del 14/11/2000	Provisions on housing and residences for university students.

UNI EN 1521:2008	On the relationship between natural ventilation and energy saving, establishing levels of indoor air quality in buildings, evaluating the energy performance of buildings, in relation to quality indoor air, thermal environment, lighting and acoustics.
UNI EN 12845:2015	On recommendations for design, installation, and maintenance of fixed fire-fighting systems in buildings.
UNI/PdR 24:2016	Technical indications for the removal of architectural barriers and guidelines for the redesign of the building based on accessibility for all, analysis of the context, detection of criticalities, and analysis of design choices.
UNI EN 81-41:2011	On safety rules for construction and installation of special lifts for the transport of people and things and vertical lifting platforms for people with reduced mobility.

Therefore, information gathered through the application of the methodologies above mentioned have been matched together and useful insights have been obtained.

4 RESULTS

To verify the data, the information gathered through the questionnaire and the group interviews regarding student population have been compared with quantitative data collected through the number of students enrolled in January 2021 (Table 2). This highlights that people's perception may be incorrect sometimes, or even that it may deviate from reality with the aim of demonstrating a better scenario.

Table 2. Student population - elaboration of the authors

Faculty	Students enrolled at SNU (January 2021)	Projections in 20 years (data gathered through the interviews June 2020)	Projections in 20 years (data gathered through the questionnaire October 2020)
Natural Science	394	2500	4000
Engineering	488	1750	2800
Law	394	500	500
Economy	463	1500	2100
Social Sciences	479	3000	4200
Educational Sciences	1228	1500	1500
Islamic Studies	178		
Veterinary	391	1500	1500
Agriculture	512	1500	2100

It is important to remark that the questionnaire was submitted to the Rector, and therefore should represent the highest reliability on it. Moreover, it was not possible to collect information about the lectures schedule to understand how many people are actively inside the buildings at each moment. Table 2 confirms the misalignment between the Rector's perception and reality. The Rector and the deans of the Faculties' answers evidently demonstrate on one side that they are overestimating the SNU's development and growth process, on the other side that they are still influenced by the idea of building a traditional Italian campus. In fact, African culture is still attached to the idea of the "great Italian model". Therefore, it seems extremely

difficult to eradicate this concept and both the Rector and the deans of faculties try to keep it, avoiding the embrace of the sustainability policy unless it is strongly necessary. Instead, the effort to be made is to provide for their real needs through resources of the African territory. For what concerns the availability and use of raw materials and plants, during the interviews the Rector and the deans of faculties signalled a general lack of plants, in particular of a water drainage system and in specific zones of a waste disposal plant.

Table 3. Coefficients used to dimension the spaces – elaboration of the authors

Space	Mq/person used	Legislative framework	Mq/person (from legislative framework)
Classrooms	1,4	D.L. 18/12/1975; UNI EN 1521:2008	0,8-1,8
Study rooms	1,3	D.L. 18/12/1975; UNI/PdR 24:2016	1,2-1,5
Meeting rooms	1,3	D.M. n. 218 del 26/08/1992; UNI EN 12845:2015	1,2-1,5
Offices	8	D.M. n. 218 del 26/08/1992; UNI EN 12845:2015	6,5-12
Conference rooms	1,2	D.M. n. 218 del 26/08/1992; UNI EN 12845:2015	0,8-1,5
Laboratories	5	D.L. 81/2008; UNI EN 1521:2008	4,5-5,5

Then, the coefficients reported in Table 2 were estimated on the basis of Italian laws and used to dimension the SNU spaces. At first, it was necessary to find a mean value, since the legislative framework gives large parameters to be adapted to the specific case. It was also important to assign specific coefficients for each type of space, so to be easily multiplied by the number of users. Finally, these coefficients were applied to a sample existing building identified as Didactic Module 4, assigned to the Faculty of Engineering. The number of students enrolled (Table 2) was taken into account to proceed with the strategic planning of the buildings in the masterplan, and the sizing of the interior spaces. The estimation of space for the Faculties took into consideration several factors, such as:

- Type of room: classic or equipped, big or small, and laboratory;
- Presence of studying rooms, libraries, conference rooms, meeting rooms, and offices;
- Estimated number of users per faculty;
- Estimated number of seats per room; and
- Total number of each type of room to satisfy users' needs.

Considering the maximum variety of spaces and the maximum capacity of Didactic Module 4, the results obtained will allow an efficient use of spaces, with full satisfaction of users. Therefore, Table 4 shows hypothetical occupancy of buildings in the masterplan, with a double hypothesis on the number of floors per building.

Table 4. Results of the hypothetical occupancy of buildings - elaboration of the authors

Building	Gross area (per floor)	Net area (per floor)	N° of students (total users)	
	sqm	sqm	On 2 floors	On 3 floors
A (first ring – to be strengthened)	770,00	481,25	875	1 313
B (second ring – to be built)	910,00	568,75	1 034	1 551

C (third ring – to be built)	1 060,00	662,50	1 205	1 807
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In consideration of the parametric values adopted and the clustering previously illustrated, it was possible to determine the overall sizing of the Gahayr Campus. The buildings (existing and to be built) within the Gahayr Campus have a total gross area of 100 910 square metres while the net area is 68 850 square metres. The buildings of the existing Faculties, which constitute the first ring around the Rectorate, will be strengthened in order to accommodate the students currently enrolled. At a later stage, simultaneously with the growth of student population, it will be possible to proceed with the construction of the two-floors buildings that will form the two outermost rings. This second phase will be completed over a more fluid time frame than the first one, which will be completed as soon as possible to provide adequate space for meeting actual users' needs. However, considering the number of students currently enrolled in the Faculties (Table 2), it should be noted that there is an average of 100 students per year per Faculty, with only two out of nine Faculties actually exceeding the average, the first with 102 students and the second with 245. Therefore, it is far from the Rector's forecasts, but this allows to carefully monitor the growth of student population on an annual basis in order to be able to intervene at the most appropriate moment, expanding SNU with the new buildings designed in the masterplan to make up for the lack of space in case of need.

5 DISCUSSION AND CONCLUSION

Concerning the specific objective of the consultancy, results can confirm the viability of welcoming the number of people expected. In fact, the occupancy of Didactic Module 4 allows for hosting a large number of people and is very far from saturation point. Moreover, considering the results from the interviews, we can say that the downsizing was quite careful, if we look at the number of actual enrolled students. This is, for sure, due to a positive attitude towards the growth of the SNU. But it probably also depends on a lack of studies on the Somali graduated students that should have been carried out before the project. It would only be possible to develop a project that fits the real needs of a university on the basis of a precise knowledge of how that university works and its evolution trends. These conclusions can be considered reliable thanks to the application of an integrative approach. This led to correctly interpreting the misleading inferences that can occur by taking into consideration only one source of information. Through cross checking quantitative and qualitative methodologies, on the contrary, it has been possible to carefully weigh the data retrieved by different sources (e.g. the questionnaire submitted to several people, group interviews, the number of students enrolled in relation to the university's growth expectations) and therefore obtain consistent information. Consequently, it appears that the size and capacity of the buildings (especially the new ones to be built) need to be carefully calculated, to meet end user's requirements more effectively. This suggests the favourable application of flexible solutions for the classrooms. For example, movable walls, that would allow assembling or separating the spaces according to contingent necessities, can be very useful; two rooms for 25 people could be merged to obtain one for 50. Indeed, "affordability" of a place is up to users. To this extent, it can be important to maximize flexibility of spaces and equipment adaptability (such as foldable walls, movable tables and chairs and writable surfaces) to ease the change and facilitate the interactions between users and spaces. The research development has faced a few limits, some of them in technical-methodological matter, but also in a more general respect. Among the techniques applied for reaching the required level of knowledge, the interview technique may fail to some extent. While it is necessary for collecting qualitative information that only human researchers can bring, thanks to their individual expertise and sensitivity, it is not the most

appropriate method from a scientific point of view. An enormous effort was required above all to elaborate the coefficients derived from the analysis of the Italian and European legislative framework. Last but not least, one of the most restrictive obstacles encountered is the lack of specificity for the development of a university campus in Africa, both in terms of laws and “good examples” to follow. The substantial differences found are between the initial expectations and the reality of the project (for example, the idea of the Italian campus is impossible for all the reasons described above). The challenge is not linked only to the missing legislative material but to the need to adapt the processes to the African reality, very different from the European one. In the African context, the present research can be considered as a pioneering achievement. Hopefully, it will contribute to a shift in mindset that is necessary to boost and advertise the importance of such studies. After the collection of a proper number of case studies, i.e. extending the sample, it will be possible to build benchmarks on new university campus design features and perfect the research methodology. Consequently, the study may provide African universities with useful indications on methods and tools for data collection toward design planning. The opportunity to apply construction times and budget to the project needs to be further investigated. In fact, it is not yet clear what the final budget will be for the whole project, as the buildings will have different benefactors and, it can be assumed, different construction times.

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REFERENCES

- Costa, P. (2014), “Valutare l’architettura. Ricerca sociologica e Post-Occupancy Evaluation”, *Franco Angeli*, Milano.
- den Heijer, A. (2008), “Managing the University Campus in an Urban Perspective: Theory, Challenges and Lessons from Dutch Practice”, *Corporations and Cities: Envisioning Corporate Real Estate in the Urban Future*, 1-9.
- den Heijer, A., Tzovlas, G. (2014), “The European campus – heritage and challenges, Information to support decision makers”, Delft: Delft University of Technology.
- Huhtelin, M., Nenonen, S. (2015), “A Co-creation Centre for university-industry collaboration – a framework for concept development”, *Procedia Economics and Finance*, 21, 137-145.
- Huhtelin, M., Nenonen, S. (2019), “The workplaces of researchers in different disciplines”, *Journal of Corporate Real Estate*, Vol. 21, No. 1, 36-54.
- Kuntz, A. M., Petrovic, J. E., Ginocchio, L. (2012), “A Changing Sense of Place: A Case Study of Academic Culture and the Built Environment”, *Higher Education Policy*, International Association of Universities, 433-451.
- Molas-Gallart, J., Castro-Martínez, E. (2007), “Ambiguity and conflict in the development of Third Mission indicators”, *Research Evaluation*, 16(4), 321–330.
- Nenonen, S., Danivska, V. (2021), “Post-pandemic adaptive university campus management”, *The proceedings of the 20th EuroFM Research Symposium 2021*, European Facility Management Network, 29-39.
- Poutanen, J., Kotilainen, M., Hyökki, S., Urrila, L., Nenonen, S. (2021), “Distributed Academic Workplace and Community – towards a coherent campus within a city”, *The proceedings of the 20th EuroFM Research Symposium 2021*, European Facility Management Network, 51-62.
- Tienari, J., Aula, H-M., Aarrevaara, T. (2016), “Built to be excellent? The Aalto University merger in Finland”, *European Journal of Higher Education*, 6(1), 25-40.

Zeeman, N., Benneworth, P. (2017), “Globalisation, mergers and ‘inadvertent multi-campus universities’: reflections from Wales, Tertiary Education and Management”, 23(1), 41-52.

APPENDIX

APPENDIX A: English version of the questionnaire - elaboration of the authors

General data						
		Area of interest	Period	Question	Number	Notes
Number of users	Educational activity + Researching activity	Students	Present	First-year students		
				Second-year students		
				Third-year students		
				Fourth-year students		
				Fifth-year students		
				PhD students		
			Future	Expected first-year students		
				Expected second-year students		
				Expected third-year students		
				Expected fourth-year students		
				Expected fifth-year students		
				Expected PhD students		
		Structured university personnel	Present	Teachers		
				Full time researchers		
				Fixed-terms lab assistants		
			Future	Expected teachers		
				Expected full time researchers		
				Expected fixed-terms lab assistants		
		Unstructured university personnel	Present	Post-doctoral fellows		
				Fixed-term researchers		
				Temporary teaching assistants		
Future	Expected post-doctoral fellows					
	Expected fixed-term researchers					
	Expected temporary teaching assistants					

General services	<i>Administrative personnel</i>	<i>Present</i>	<i>Secretaries</i>		
		<i>Future</i>	<i>Expected secretaries</i>		
	<i>Support personnel</i>	<i>Present</i>	<i>Maintainers</i>		
			<i>Door-keepers</i>		
			<i>Cleaners</i>		
			<i>Security officers</i>		
		<i>Future</i>	<i>Expected maintainers</i>		
			<i>Expected door-keepers</i>		
			<i>Expected cleaners</i>		
			<i>Expected security officers</i>		
	<i>Rector, vice-rector and support personnel</i>	<i>Present</i>	<i>Rector</i>		
			<i>Vice-rector</i>		
			<i>Support personnel</i>		
			<i>Personnel per department</i>		
		<i>Future</i>	<i>Expected vice-rector</i>		
			<i>Expected support personnel</i>		
	<i>Libraries, exhibition centre, canteen, sports centre, spaces for commercial activities</i>	<i>Present</i>	<i>Librarians</i>		
			<i>Canteen service operators</i>		
			<i>Sports centre instructors</i>		
			<i>Shop assistants</i>		
<i>Future</i>		<i>Expected librarians</i>			
		<i>Expected canteen service operators</i>			
		<i>Expected sports centre instructors</i>			
		<i>Expected shop assistants</i>			
Incubator for start-ups and new companies	<i>Offices, laboratories</i>	<i>Present</i>	<i>Start-ups</i>		
			<i>Workers per start-up</i>		
		<i>Future</i>	<i>Expected start-ups</i>		

				Expected workers per start-ups		
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<i>Educational activity</i>					
<i>Area of interest</i>	<i>Period</i>	<i>Question</i>	<i>Explanation</i>	<i>Answer</i>	<i>Notes</i>
<i>Faculties' presidency</i>	<i>Present</i>	<i>Where is it located now?</i>			
		<i>Which kind of spaces are there now?</i>	<i>Description of what are the main spaces that are part of the presidency. For example: meeting rooms, offices, ...</i>		
		<i>How big is it?</i>	<i>square metres</i>		
	<i>Future</i>	<i>Will it be increased?</i>			
<i>Classrooms</i>	<i>Present</i>	<i>How many classrooms are there now?</i>			
		<i>How big are they?</i>	<i>square metres</i>		
	<i>Future</i>	<i>Will you need more classrooms?</i>			
		<i>How big will they be?</i>	<i>square metres</i>		
<i>Auditorium</i>	<i>Present</i>	<i>Does the auditorium already exist?</i>			
		<i>Which type of events do you host nowadays?</i>	<i>For example: conferences, graduations, keynote lectures, seminars, ...</i>		
		<i>How big is it?</i>	<i>square metres</i>		
	<i>Future</i>	<i>How many seats will you need?</i>	<i>Number of seats</i>		
		<i>Where will it be located in the campus?</i>			
<i>Spaces for students</i>	<i>Present</i>	<i>Do spaces for students exist now?</i>			
		<i>How are they distributed over the campus?</i>			
	<i>Future</i>	<i>How many studying spaces will you need?</i>			
		<i>How many seats per studying space?</i>			
		<i>How many quiet studying spaces will you need?</i>			

		How many studying spaces for groupworks will you need?			
		How many studying spaces where you can talk will you need?			
Educational laboratories	Present	Are there laboratories now?			
		How many seats per laboratory?			
	Future	Which faculties will use the laboratories?			
		How many laboratories per faculty?			
		How many seats per laboratory?			

Researching activity					
Area of interest	Period	Question	Explanation	Answer	Notes
Departments / Institutes	Present	How many departments are there now?			
		Where are the departments located in the campus?			
		How many closed offices?			
		How many open spaces?			
	Future	Will other departments be added?	Number of forecasted departments		
Laboratories	Present	Are there researching laboratories already?			
		How big are they?	square metres		
	Future	Will they be increased?			

General services					
Area of interest	Period	Question	Explanation	Answer	Notes
Rectorate	Present	How big is the rectorate?	square metres		
		Which kind of spaces are there now?	Description of what are the main spaces that are part of the rectorate. For example: meeting rooms, representative rooms, offices, ...		
	Future	Which kind of spaces will be there?	Description of what are the main spaces that should be part of the rectorate. For example: meeting rooms, representative		

			rooms, offices, ...		
		How big will it be?	square metres		
Administration	Present	Is the administration composed of departments?	Description of departments		
		Where is the administration located in the campus?			
	Future	Will they be increased?			
Libraries	Present	Are there any libraries?			
		How many libraries are there in the campus?	One per all the faculties, one per faculty, ...		
		How big are they?	square metres		
		Do they include spaces for students?			
	Future	How many libraries will there be in the new campus?			
		What will they involve?	Description of what are the main spaces that should be part of the libraries. For example: studying spaces, researching spaces, ...		
How big will they be?		square metres			
Exhibition centre	Present	Are there any exhibition centres now?			
		Where are they located in the campus area?			
		Which kind of exhibitions are hosted nowadays?			
		How big is it?	square metres		
	Future	Will you need one exhibition centre or more than one?			
		How big will it be?	square metres		
Canteen	Present	How many canteens are there now?			
		How big are they?	square metres		
	Future	How many canteens will there be?			
		How will they be located in the campus?			

		<i>How big will they be?</i>	square metres		
<i>Sports centre</i>	<i>Present</i>	<i>Is there a sports centre already?</i>			
		<i>How many square metres overall?</i>			
		<i>Which are the most practiced sports?</i>			
	<i>Future</i>	<i>How big will it be?</i>	square metres		
<i>Spaces for commercial activities</i>	<i>Present</i>	<i>Which kind of commercial activities are there now inside or around the campus?</i>			
		<i>How big are they overall?</i>	square metres		
	<i>Future</i>	<i>Will the spaces be increased?</i>			

<i>Incubator for start-ups and new companies</i>					
<i>Area of interest</i>	<i>Period</i>	<i>Question</i>	<i>Explanation</i>	<i>Answer</i>	<i>Notes</i>
<i>Offices</i>	<i>Present</i>	<i>How many offices are there now?</i>	<i>Number of offices</i>		
		<i>How many closed offices are there?</i>	<i>Number of closed offices</i>		
		<i>How many open spaces are there?</i>	<i>Number of open spaces</i>		
		<i>Where are the offices now?</i>			
		<i>Which kind of offices are there?</i>	<i>Researching activities, manufacturing growth, ...</i>		
	<i>Future</i>	<i>Will they be increased?</i>			
		<i>How big will they be?</i>	square metres		
<i>Meeting rooms</i>	<i>Present</i>	<i>How many meeting rooms are there now?</i>			
		<i>How big are they?</i>	square metres		
	<i>Future</i>	<i>Will you need more meeting rooms?</i>			
		<i>Will you need bigger meeting rooms?</i>			
		<i>How big will they be?</i>	square metres		
<i>Classrooms</i>	<i>Present</i>	<i>Are there any classrooms now?</i>			
		<i>How many classrooms are there?</i>			
		<i>How big are they?</i>	square metres		

	Future	Will you need more classrooms?			
		Will you need bigger classrooms?	square metres		
Laboratories	Present	How many laboratories are there now?			
		Which type of activities are carried out?	For example: 3D printer, research products, ...		
		Which products are developed?			
	Future	Will they be increased?			
Event room	Present	Is there an event room nowadays?			
		How big is it?	square metres		
		Where is it located?	Location in the campus		
	Future	Will you need it?			
		How big will it be?	square metres		
Conference room	Present	Is there a conference room?			
		How many seats are there?	Number of seats		
	Future	Will you need a bigger conference room?			
		How many seats will you need?	Number of seats		
Accommodations					
<i>Area of interest</i>	<i>Period</i>	<i>Question</i>	<i>Explanation</i>	<i>Answer</i>	<i>Notes</i>
Student dorms	Present	Are there any dorms nowadays?			
		How many beds are available now?			
		How far are they from the campus?			
		Are they inside or outside the campus?			
	Future	How many beds will you need?			
Which services will you need?		Description of services, for example: canteen, studying rooms, gym, auditorium, ...			
Accommodation for teachers and researchers	Present	Are there any residences nowadays?			
		How many beds are available now?			
		How far are they from the campus?			

		Are they inside or outside the campus?			
	Future	How many beds will you need?			
		Will they be separate buildings from the student dorms?			
		Which services will you need?	Description of services, for example: canteen, studying rooms, gym, auditorium, ...		
Guest house	Present	Are there any residences nowadays?			
		How many beds are available now?			
		How far are they from the campus?			
		Are they inside or outside the campus?			
	Future	How many beds will you need?			
		Will it be in the student dorms or will it be a separate building?			

External area					
Area of interest	Period	Question	Explanation	Answer	Notes
Green areas	Present	How are they used?	Description of how they are used, for example as recreational spaces, studying spaces, ...		
		How big are they?	square metres		
	Future	Will they be increased?			
Parking areas	Present	How do people reach the campus?	By which means of transport, for example: by car, by bike, by bus, ...		
		Which is the most common means of transport?			
		Are there any parking areas?			
		How many parking areas are there now?			
	Future	Do you need parking lots?			
		How many will you need?			

History					
Area of	Period	Question	Explanation	Answer	Notes

<i>interest</i>					
<i>History</i>	<i>Past</i>	<i>How did the campus work?</i>			
		<i>How many faculties were there?</i>	<i>Number of faculties</i>		
		<i>Which faculties were there?</i>	<i>For example: scientific area, humanistic area, ...</i>		
		<i>How many students were there?</i>	<i>Total average number</i>		
		<i>Do you remember how the campus was before the war?</i>			

Budget					
<i>Area of interest</i>	<i>Period</i>	<i>Question</i>	<i>Explanation</i>	<i>Answer</i>	<i>Notes</i>
<i>Budget</i>	<i>Future</i>	<i>How much money will it be available?</i>	<i>Amount for the whole project</i>		
		<i>Will there be any special funds?</i>	<i>Amount for special spaces, for example: the auditorium, researching spaces, ...</i>		
		<i>Will there be any incentives for green areas?</i>	<i>Amount for external spaces</i>		

SESSION 1B: GEOGRAPHY OF NEW WORKING SPACES

Spatial patterns and location factors of collaborative spaces in Poland. Warsaw case study

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ABSTRACT

Transformation of the workplace is now emerging as one of the most globalised cities phenomena we are currently experiencing, with very substantial local and regional impacts. Growing presence of co-working spaces is noticed in a variety of urban locations, including the post-socialist metropolis of Warsaw. Article focuses on the determination of spatial patterns of coworking spaces on the national scale and intra-city scale based on the example of the capital city of Warsaw. Following a comprehensive literature review and spatial analysis, the researchers attempted to determine the most crucial locational factors relevant to the analysed spaces. Included in the analysis was a residential urban concept, the 15-minute city, which determines the spheres of accomplishing the needs of residents. Analysis was based on an up-to-date database of coworking spaces situated in Poland and conducted interviews with users. Findings indicate a tendency for coworking spaces to be located in large cities and metropolitan areas. Peripheral areas have a negligible share of coworking spaces. On a national scale, the capital is strongly dominant as the centre with the largest share of analysed spaces. In addition, the presence of coworking spaces in major metropolitan nodes is also noticeable. Contrary to other European cities, where major location factors are urbanisation advantages and social factors, in Warsaw traditional location assets, such as accessibility and proximity of public transport, tend to be more prominent. Multifunctionality of the areas was also included among the significant pull factors.

Keywords

Co-working spaces, Location factors, Collaborative spaces, Warsaw, Case study.

1 INTRODUCTION

Metropolises are the most important places of concentration of enterprises (Guzman and Stern, 2016), because they offer favourable conditions for the functioning of headquarters and branches of the most important global corporations, as well as innovative start-ups (Oakey et al., 2009; Skog et al., 2016) and creative freelancers. This is due to two main factors of location, related on the one hand to the agglomeration effects (Kolko, 2010; Fang and Yu, 2017) manifested by the concentration of advanced producer services (Martinelli and Moulaert, 1993; Krätke, 2007; Hanssens and Derudder, 2011) as well as research and development (Shearmur, 2012), and on the other hand, by the concentration of diversified and a talented workforce (Florida, 2002; di Marino and Lapintie, 2017; Shearmur, 2017, 2021). In this context Poland and Warsaw, its capital city, are interesting cases of both metropolisation and adaptation to global capital flows in terms of new working space's location. The capital city of Poland, which is ranked as a high-connectivity gateway metropolis (Taylor and Derudder, 2016) because of its high rate of development, may constitute a good laboratory for analysing the spatial

dimension of workplace location and transformation. The development of co-working spaces in Warsaw largely stems from good supply of well qualified, motivated and relatively cheap labour force, as well as the favourable price-quality ratio of office space. In the sectoral dimension, there is noticeable competition for workers between creative industries and the corporate sector of advanced business services. In terms of demographics, the spread of co-working space (hereinafter CSs) is fuelled by the high number of Generation X representatives and Millennials who, after gaining experience in the corporate sector, often decide to start their own specialised, more innovative and flexible businesses, taking clients over from corporations or co-operating with corporations on more independent, project-based terms. These create a group of entrepreneurs establishing their own start-ups as well as small and medium enterprises creating a demand for diversified modern and flexible office space. Co-working has also been strengthened by the growing supply of office space as well as competition between developers and administrators. On one hand they look for attractive locations, and on the other are receptive to new clients' needs. Until recently, the Warsaw commercial property market offered modern office space mainly to large companies which were prepared to rent a whole floor and sign a five-year lease. Small firms, start-ups and freelancers were therefore structurally excluded from the modern office market. The situation changed due to excess supply of modern office space and competition between administrators. This niche resulted not only in offers of short-term leases for large firms (e.g. Regus), but also gave rise to various types of co-working spaces both collective and corporate, including chains (e.g. WeWork, Business Link, MindSpace). Following a comprehensive literature review and spatial analysis, we attempted to determine the most crucial locational factors relevant to the analysed spaces. Analysis was based on an up-to-date database of co-working spaces located in Poland and interviews conducted with users. The aim of empirical analysis was to answer the following research questions: (1) What are the main location patterns of CSs in Poland and Warsaw? (2) What are the key location factors of CSs in Warsaw? (3) Which theoretical approaches provide the most explanatory capacity of CSs location in Warsaw?

2 LOCATION FACTORS OF COWORKING SPACES – A MACROREGIONAL PERSPECTIVE – THEORY

The phenomenon of co-working spaces has been analysed from various disciplinary and interdisciplinary perspectives (Micek, 2020) including economics (Waters-Lynch and Potts, 2017), geography (Akhavan et al., 2018; Coll-Martínez and Méndez-Ortega, 2020; Shearmur, 2021), organisational studies (Gandini, 2015; Garrett, Spreitzer and Bacevice, 2017; Appel-Meulenbroek et al., 2021), urban and economic planning (Fuji, 2015; di Marino, Lilius and Lapintie, 2018; Fiorentino, 2019; Avdikos and Merkel, 2020; di Marino and Lapintie, 2020) as well as psychology and sociology (Merkel, 2015; Gerdenitsch et al., 2016; Rutten, 2017). However, location factors of co-working spaces are one of the most important issues (Bergebál-Mirabent, 2021) raised by many authors (Capdevila, 2015a, 2015b; Mariotti, Pacchi and di Vita, 2017) referencing this problem to one of the most central issues in economic geography (Marshall, 1890; Weber, 1929; Lösch, 1954). Location patterns, that is, tendencies in the distribution of co-working spaces, tend to show concentration in certain, mainly urban, areas and in some cases even form specialised clusters. This high propensity for spatial concentration can be explained by existing economic and spatial theories. While we can assume that the optimal location for a company should allow maximum profit from running the business, empirical studies show considerable complexity in location patterns, and also indicate the different strength of theories explaining this diversity, depending on the spatial scale in question (Shearmur, 2012). Before applying a specific theoretical perspective to this issue, one has to decide what is the rationality of co-working location and how location decisions are in

fact being made. If we assume that CSs locate according to a company-based rationality – then service and industry location theories might have some explanatory capacity. Therefore, reflection on CSs's location can be referenced to a more general theoretical framework including agglomeration economies of economic activity and positive externalities of geographic concentration that are based on availability of pooled labour markets, production factors and technological spillovers (Marshall, 1890, 1920). Applying the Ohlin-Hoover classification (Ohlin, 1933; Hoover, 1937, 1948) McCann (2013) lists three types of agglomeration economies including i) internal returns to scale deriving from the size of the company, ii) localization economies occurring in same sector clusters and iii) urbanisation economies present in urban scale resulting from the metropolitan economic diversity. Since we focus on spatial perspective of CSs location it's possible to derive a more specific model in which co-working space location factors might be analysed along two latter types of agglomeration economies, that is localization economies – when the co-working spaces locate in the area near already established co-workings and companies representing similar sectors and urbanisation economies, in which case CSs would locate near the so-called urban amenities benefiting the CSs from the size and diversity of the city itself (Jofre-Monseny, Marín-López and Viladecans-Marsal, 2014).

2.1 Location economies

The hypothesis of location economies being a primary location factor for CSs in Warsaw has strong background in existing literature and research. For example, Henderson, Kuncoro, and Turner (1995), Viladecans-Marsal (2004) and Jofre-Monseny et al. (2014) find that localization economies are more important than urbanisation economies in mature industries whereas the opposite is true in industries that are technologically more advanced (Henderson, Kuncoro and Turner, 1995; Viladecans-Marsal, 2004; Jofre-Monseny, Marín-López and Viladecans-Marsal, 2014). With respect to the growth of cities, Glaeser et al (1992) found that local competition and knowledge spillovers occur between industries within an urban area (Glaeser et al., 1992). Additionally, Hanson (1994) and Cota (2001) explained that for the case of a less developed country such as Mexico, the industrial agglomeration externalities in the context of economic globalisation are generated by the proximity to labour and input markets related to specialisation among industries (Hanson, 1994; Cota, 2001). Based on empirical studies of 68 CSs location factors in Milan Mariotti (2017) and her team identified three main determinants, namely: i) the high density of business activities, that is a proxy of urbanisation and localization economies, as well as market size and potential; ii) the proximity to universities and research centres, that is a proxy for a skilled labour force's availability and business opportunities; iii) the presence of a good local public transport network, that is a proxy of the degree of accessibility (Mariotti, Pacchi and di Vita, 2017). Moreover, they also confirm the similarity between service sector location patterns (i.e., urbanisation and localization economies; market size and potential; skilled labour force availability and business opportunities; transportation accessibility) and like many other scholars (Schmidt and Brinks, 2017; Avdikos and Iliopoulou, 2019; Merkel, 2019; Spinuzzi et al., 2019; Coll-Martínez and Méndez-Ortega, 2020) find correlation between CSs and creative industries location (Mariotti et al., 2017). This indicates some tendencies of spatial specialisation, sectoral clustering, therefore pointing towards the importance of location economies. Results regarding location of advanced producer services in Warsaw show that traditional APS sectors, like: legal activities, accounting, bookkeeping, audit, tax and management consultancy tend to locate in city centre and business districts, whereas creative sectors, like architecture, advertising and computer programming cluster in locations either surrounding the city centre - especially vibrant areas with high quality urban space – or peripheral, non-business districts with good car accessibility, that provide convenient access to clients. Moreover, authors conclude that the role of urban (especially

cultural and entertainment) amenities doesn't really explain business location patterns and factors in the post-socialist context and therefore might not provide fully adequate practical recommendations for urban planning policies (Smętkowski et al., 2021). This might suggest that classic location factors play a greater role in the Central and Eastern-European macroregion.

2.2 Urbanisation economies

However, if we assume that coworking location decisions follow the workforce demands for location, we need to adjust our hypothesis and look for possible explanations regarding the member's perspective as the main location driver. In that case theoretical explanations are based on urbanisation economies that arise from diversified business activities and benefits offered by surroundings on the scale of individual neighbourhood units (Jacobs, 1961). Moreover, access to common infrastructure, business-related institutions as well as clients provide necessary and favourable conditions for knowledge spill-overs, sharing information and know-how, learning processes as well as building strong and weak business and social ties. These processes are usually located in city centres. In this perspective co-working spaces fill in the void in terms of commercial real estate market flexibility as well as address the growing demand for access of freelancers and start-ups to the metropolitan business ecosystem. What is more, specific urban landscapes, lifestyles, cultures and aesthetics stimulate new ideas, relationships, knowledge sharing and provide inspiration (Helbrecht, 2004). This is in line with the creative class and urban consumption hypotheses (Glaeser, Kolko and Saiz, 2001; Florida, 2002; Glaeser and Gottlieb, 2008) based on the assumption that jobs follow people and people follow amenities. In other words, creative people and specialists seek proximity to knowledge-producing spaces, informal contacts and knowledge-exchange networks on one hand (Florida, 2004; Currid, 2007) and great atmosphere, restaurants, coffee shops, museums, theatres, etc. on the other (Scott, 2010; McCann, 2013). Furthermore, access to culture and recreation (Helbrecht, 2004), visual quality of a district (Smit, 2011), blurred borders between work and leisure, office and living space, contribute to concentration of urban multifunctionality and hybridization of space that translate to the vibrancy of a city (Yamamura and Goto, 2018). These are some of the qualities demanded by the Millennials (Shearmur, 2017; Lukman, Ekomadyo and Wibowo, 2018; Grazian, 2020). Understanding of the role of proximity in this context is also a subject of redefinition towards the notion of 15-minute city and localised hypermobility (Shearmur, 2017) meaning walkability and flexible travels especially by public transport and cycling (Southworth, 2005; Graells-Garrido et al., 2021; Moreno et al., 2021). Studies conducted in global creative metropolises of highly developed economies like London, Paris, Berlin, Amsterdam, Barcelona, New York and Montreal (Schmidt, Brinks and Brinkhoff, 2014; Capdevila, 2015a; Stam and van de Vrande, 2017; Grazian, 2020; Gandini and Cossu, 2021; Shearmur et al., 2021), underline the importance of social, spatial and economic characteristics of urban surrounding. These specific features include: reputation of districts (di Marino, Lilius and Lapintie, 2018; Avdikos and Merkel, 2020), availability of public or semi-private premises (Bilandzic and Foth, 2013; Kojo and Nenonen, 2016; di Marino, Lilius and Lapintie, 2018), job catchment area (di Marino and Lapintie, 2020), walking and biking distances (Kojo and Nenonen, 2016; Stam and van de Vrande, 2017), multifunctionality of the areas (mix-use and provision of public and private services) (Arnoldi et al., 2018; di Marino and Lapintie, 2020), proximity to other industries - creative sectors, business and finance, information technology, art and culture, research and education, marketing and communication, (Florida, Mellander and Stolarick, 2008), social and governmental services (di Marino, Lilius and Lapintie, 2018; Houghton, Foth and Hearn, 2018). On the other hand, some evidence from post-socialist (Radzimski and Gadziński, 2019) and BRICS countries (Mcgranahan and Martine, 2012; Rocco, 2012; McGranahan and Martine, 2014) show that

rapid economic growth and metropolisation seem to negatively influence the quality of urban space, walkability of urban quarters, multifunctionality or hyper-accessibility of urban amenities, especially in terms of intentional urban planning. Taking the above-mentioned theoretical discussion, it is necessary to mention that the theoretical division of agglomeration economies has been put to question by some scholars (Duranton and Puga, 2000; Fujita and Thisse, 2002; Rosenthal and Strange, 2004). Their main argument is that with growing complexity of the metropolitan economy and accelerating technological shifts changing the location factors of work there is growing functional diversity of urban space depending on business sector, business model as well as life cycle of developed products and services (Parr, 2002).

3 DESIGN, METHODOLOGY, APPROACH

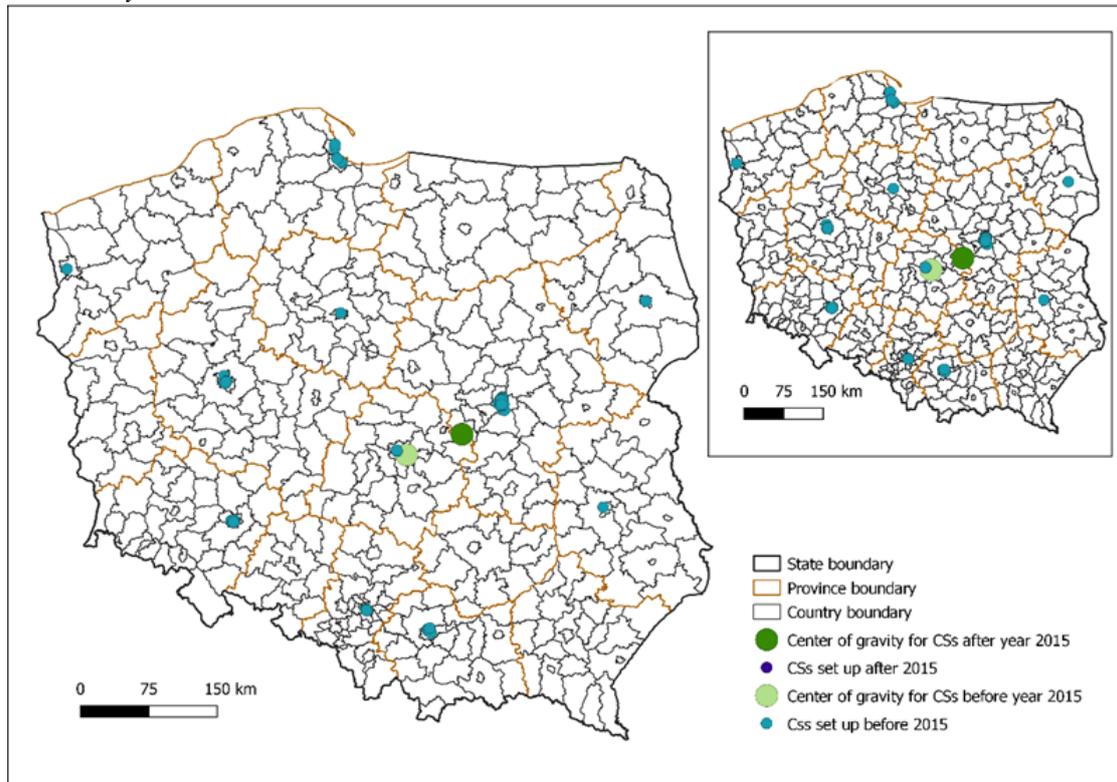
In order to test the theoretical assumptions mentioned above we decided to apply an inductive approach including a comprehensive set of potential location factors and conduct a quantitative micro-scale spatial analysis. The analysis is exploratory and is based on 1742 cadastral (evidential) precincts, which are the smallest possible urban units in Polish land and building register and reflect the notion of walkability. The research was based on a database of co-working spaces, which was developed using the desk research method in the period 2020-2021 and was successively updated until March 2021. Main websites (coworker.com, spacing.pl, sharespace.work) and web inventories of CSs were used to compile the database. Then, as a result of an in-depth and detailed literature review, the authors selected the most important locational factors of space co-working spaces, which were listed by many authors, as well as selected other variables characteristic for the analysed city - such as distance from the airport. Data downloaded from geofabrik.de, which includes free geodata based on projects such as OpenStreetMap and the QGIS software plug-in QuickOSM, along with materials provided from the City of Warsaw, was used to obtain the distribution of selected variables. Additionally, the EMIS database (updated as of July 2021) was used to separate detailed types of business classes, with businesses presented by classifying business establishments through the use of The North American Industry Classification System (NAICS). The developed variables were then merged into a single database that was used for spatial analysis using ArcGIS Pro and SPSS. In order to address research questions we used multiple linear regression to model a dependent variable in terms of its relationships to a set of explanatory variables.

4 FINDINGS

4.1 Spatial patterns

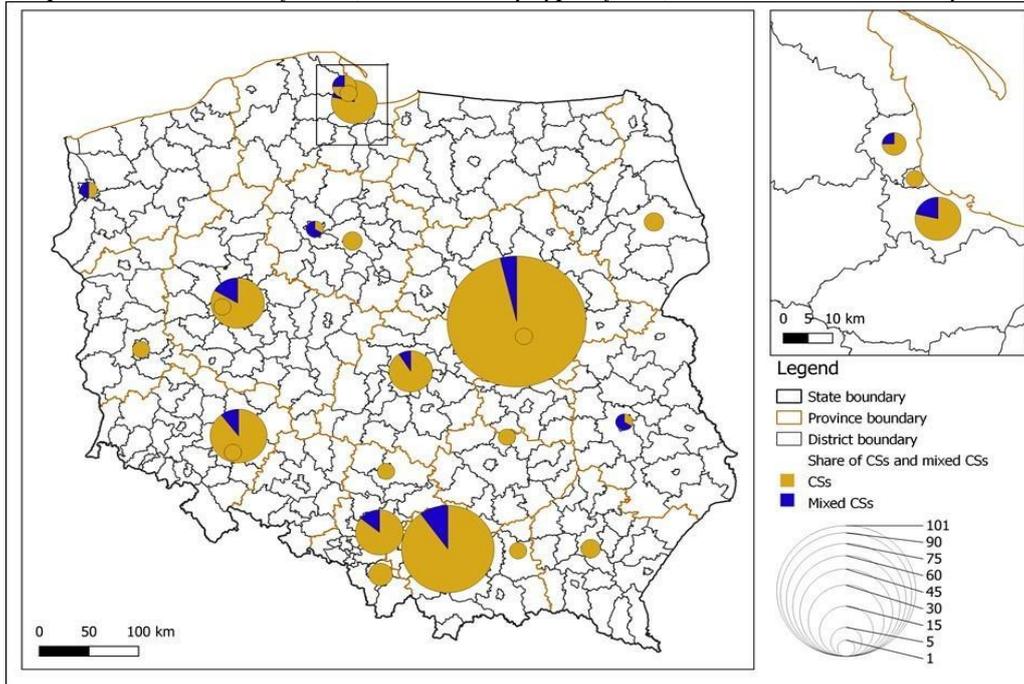
The increasing number of CSs is observed in various urban locations in Poland. A small majority of CS were created after 2015 (53% in total), which is considered a milestone year in terms of CS creation in Poland. Before 2015 CSs were established in the leading regional capital cities. From 2015 the substantial number of new spaces being opened in the capital city led to the shift of the gravity centre closer to Warsaw (Figure 1).

Figure.1. CSs space gravity centres in Poland divided into the period before and after 2015. Source: Elaboration by authors



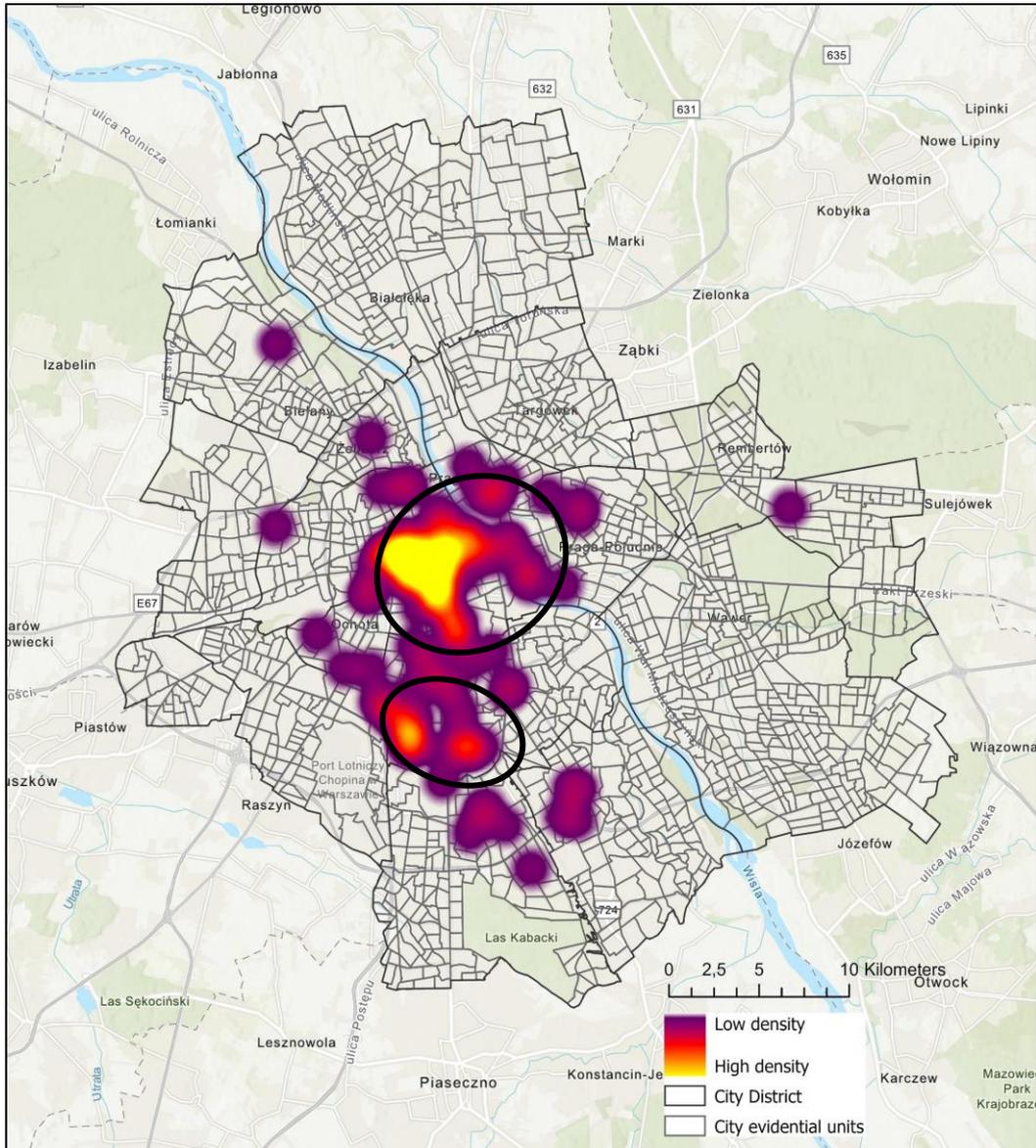
Polish CSs are distributed unevenly, mainly in the central, northern, and southern parts of the country, and their distribution is not homogeneous. Location patterns indicate that spaces relate to the urban hierarchy (with a few exceptions), and it is notable that there are no CSs in peripheral areas. The prevalence of CSs in both large and medium cities is observed, with a lower concentration in metropolitan areas. CSs are being created together with spaces that provide other roles, e.g. start-up accelerators, makerspaces or technology parks (Figure 2). The highest density of CSs was recorded for Warsaw, accommodating 105 spaces. As the capital city of the country, Warsaw holds a high position in global metropolitan rankings and represents a hub for attracting foreign capital along with dynamic development of the higher level service sector (Smętkowski, Celińska-Janowicz and Wojnar, 2019). The second biggest centre, after Warsaw, where CSs occur is Cracow, which is an academic city with highly qualified staff and a strongly developing high-tech industry. The significant dominance of Warsaw in the number of CSs compared to Cracow or Wrocław can be due to increased demand for flexible workspaces in particular for the IT sector.

Figure 2. Spatial distribution of CSs (breakdown by type of use). Source: Elaboration by authors



Central Business District is clearly a major co-working space concentration hub (Figure 3). The Western CBD, which is dominated by high-rise buildings, is the district where their numbers grew most rapidly mainly through national and international CSs chains expansion. This area provides access to a wide range of public transport such as metro, buses, trams, cycling infrastructures and nearby suburban rail links. In addition, the appearance of co-working spaces is related to the already standardised practice of dedicating a proportion of space in new office buildings to co-working, which is attractive both to corporate clients as well as micro businesses, increasing their flexibility and creating opportunities for cooperation and networking. Another factor enhancing the attractiveness of these parts of the CBD is the establishment of large residential developments in the district and its fringe. Co-workings are also developing in the Służewiec SBD - second largest concentration of office buildings. Co-working spaces in the SBD are fairly standard and dominated by fewer chains (Regus, Brain Embassy, Compass Offices). Their clients are often not freelancers, small firms or start-ups, but major corporations, which use the co-working spaces for mid-term or non-standard projects with their clients and subcontractors, by temporarily placing project teams there. Coworking spaces in SBD are therefore not fully autonomous, but rather perform a supplementary role. Key drawbacks to their popularity among the most important target group, the freelancers, are limited transport accessibility, mono-functional and corporate character of the SBD, the uninspiring surroundings, lack of diversity among potential collaborators as well as the underdeveloped residential function and provision of services. Other areas of co-working location are multifunctional and functionally diversified fringes of the CBD and SBD, as well as gentrified hip neighbourhoods and some white-collar residential areas. Majority of CSs located there are independent or small satellite offices of major CSs chains.

Figure 3. Location patterns of CSs in Warsaw (hot-spots). Source: Elaboration by authors



4.2 Location factors

Based on the results of the literature review, we divided the location factors of co-working spaces according to categories presented in Table A1 (see Appendix). The independent variables were analysed according to the inductive approach using the multiple linear regression analysis. In order to confirm the regression results two independent model selection procedures were put in place. Firstly, we performed a backward-elimination strategy that included all potential predictor variables regardless of their category. Variables were eliminated one-at-a-time from the model until only variables with statistically significant p-values remained. The value of $R = 0.77$ suggests a rather strong relationship between the location of co-working spaces and all variables included in the model (Table 1). Moreover, the predictor data in the model are able to explain around 59% of variance in coworking locations in Warsaw. The calibrated model is also a significant predictor of co-working location. $F(12,1505) = 181.544, p < 0.001$.

Table 1. Multiple linear regression model summary. Source: Elaboration by authors

Model	R	R Square	Adjusted R Square	St. Error of the Estimate
1	.769 ^a	.591	.588	.274

a. Predictors: (Constant), station_1km, post office, pub, government, bar, hi-tech, cafe, research, aps, business, All firms, KIS

The results indicate that co-working spaces tend to locate generally near other companies, especially hot spots of advanced producer services, like business, research and hi-tech companies (Table 2). On the other hand, they do not concentrate near knowledge-intensive services. Public services such as post offices and governmental agencies indicate places where CSs are rather not present. Access to intercity train stations and cafes are two of the strongest predictors of CSs location pointing to the importance of metropolitan accessibility and urban amenities.

Table 2. Multiple linear regression coefficient values. Source: Elaboration by authors.

Coefficients ^a						
Model		Coef	SE Coef	Beta	T-Value	P-Value
1	(Constant)	-.007	.008		-.853	.394
	bar	-.049	.010	-.108	-5.128	.000
	cafe	.119	.008	.363	14.690	.000
	pub	.089	.021	.082	4.204	.000
	post office	-.071	.019	-.065	-3.806	.000
	government	-.060	.017	-.071	-3.468	.001
	Hi-tech	.010	.001	.846	6.898	.000
	KIS	-.008	.001	-2.704	-6.048	.000
	aps	.007	.001	1.155	5.362	.000
	business	.003	.001	.414	3.349	.001
	research	.015	.003	.244	4.839	.000
	all_firms	.001	.000	.527	3.720	.000
	Station_1km	1.064	.093	.238	11.389	.000

a. Dependent variable: cw_open

In order to verify these results, we decided to use automated linear modelling in order to propose an alternative regression model predicting co-working location based on the same set of variables and inductive approach. The automated model is able to explain around 62,3% of variance in coworking location in Warsaw. The calibrated model is also a significant predictor of co-working location. $F(62,1140) = 33.085$, $p < 0.001$.

Table 3. Automated linear modelling coefficients values. Source: Elaboration by authors

Coefficients ^a						
Model		Coef	SE Coef	Importance	T-Value	P-Value
1	(Constant)	.601	.347		1.732	.394
	Station_1km	-1.273	.119	.284	-10.743	.000
	cafe	.108	.012	.188	8.734	.000
	research	.019	.004	.048	4.396	.000
	theatre	.187	.043	.046	4.325	.000
	KIS	-0.009	.002	.045	-4.276	.000
	Hi-tech	.017	.004	.038	3.943	.000
	APS	.006	.002	.032	3.628	.000

	All firms	.001	.000	.032	3.621	.000
	government	-0.071	.020	.030	-3.508	.000
	bar	-0.039	.013	.023	-3.059	.002
a. Dependent variable: cw_open						

These results confirm the importance of cafes, unlike bars, as a location factor for co-working spaces pointing towards a narrow understanding of urbanisation economies and multifunctionality of urban space (Table 3). Theatres as cultural amenities are also a significant, but minor factor. On the other hand this model shows that proximity to intercity train stations is not preferred by co-working spaces. On the contrary, they are rather located outside of the immediate pedestrian access zone. Location effects are also visible in this model, especially when it comes to the hi-tech sector and advanced producer services, but not knowledge intensive services. These however are only slightly important. Similar to the previous model, government agencies appear not to be the preferred location factor of CSs. Surprisingly, both models did not include factors related to accessibility or variety of urban amenities.

5 CONCLUSION

Polish CSs are distributed unevenly, mainly in the central, northern, and southern parts of the country, with high concentration in major metropolitan nodes, like Warsaw, Cracow, Wrocław, Poznań and Tri-City and visible lack in peripheral urban environments, small towns, and regions with smaller populations. As the capital city Warsaw is a clear hub accommodating 105 CSs thanks to its attractiveness for foreign capital and high position in global metropolitan rankings. Location patterns of co-working spaces inside the capital city are also concentrated mainly in the rapidly developing parts of the Central Business District (CBD), which attracts national and international CSs chains. Służewiec (SBD), a second largest concentration of office buildings, also attracts CSs, however they are less diversified and mainly represent chains like Regus, Brain Embassy, Compass Offices. Other areas of co-working location are multifunctional and functionally diversified fringes of the CBD and SBD, as well gentrified hip neighbourhoods and some white-collar residential areas. These patterns, on both national and urban scale, can be associated with location patterns of advanced producer services and business sectors rather than creative industries or independent innovation milieus. Furthermore, they suggest centralization of CSs location in the urban space and more conservative location strategies of CSs, which are reflected also in shifting CSs structure characterised by larger, profit-oriented, corporate business models. Analysis of location factors based on regression models stressed the importance of cafes pointing towards a narrow understanding of urbanisation economies and multifunctionality of urban space. The results also indicate that co-working spaces tend to locate generally near other companies, especially hot spots of advanced producer services, like business, research and hi-tech companies with the exception of knowledge-intensive services. Accessibility and multifunctionality of urban space did not prove significant. These results seem to confirm the assumptions based on the literature review concerning the location factors of co-working spaces in Central and Eastern European metropolises pointing towards the dominance of location economies as CSs location factors. Further research is needed to better understand the locational patterns of CSs according to their business model as well as the impact of the pandemic on location patterns and factors of particular types of CSs. Finally, qualitative and longitudinal studies are needed to understand the causalities in terms of urbanisation effects and CSs impacts on their surroundings.

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REFERENCES

- Akhavan, M. *et al.* (2018), "Coworking Spaces and New Social Relations: A Focus on the Social Streets in Italy," *Urban Science*, 3(1), 2, doi:10.3390/urbansci3010002.
- Appel-Meulenbroek, R. *et al.* (2021), "User preferences for coworking spaces; a comparison between the Netherlands, Germany and the Czech Republic," *Review of Managerial Science*, 15(7), 2025–2048. doi:10.1007/s11846-020-00414-z.
- Arnoldi, E. *et al.* (2018), *Coworking and an outer-urban community: what can we learn from a grassroots community coworking hub?* Hawthorn, Australia.
- Avdikos, V., Merkel, J. (2020), "Supporting open, shared and collaborative workspaces and hubs: recent transformations and policy implications," *Urban Research and Practice*, 13(3), 348–357. doi:10.1080/17535069.2019.1674501.
- Berbegal-Mirabent, J. (2021), "What do we know about co-working spaces? Trends and challenges ahead," *Sustainability (Switzerland)*, 13(3), 1–30. doi:10.3390/su13031416.
- Bilandzic, M., Foth, M. (2013), "Libraries as coworking spaces," *Library Hi Tech*. Edited by M. Chen, 31(2), 254–273. doi:10.1108/07378831311329040.
- Bontje, M. *et al.* (2011), "Pathways Toward European Creative-Knowledge City-Regions," *Urban Geography*, 32(1), 80–104. doi:10.2747/0272-3638.32.1.80.
- Brooks, D. (2000), *Bobos in paradise: The new upper class and how they got there*. New York: Simon and Schuster.
- Brown, M.G. (2010), "The Owl, the City and the Creative Class," *Planning Theory & Practice*, 11(1), 117–127. doi:10.1080/14649350903538004.
- Capdevila, I. (2015a), "Co-working spaces and the localised dynamics of innovation in Barcelona," *International Journal of Innovation Management*, 19(3). doi:10.1142/S1363919615400046
- Capdevila, I. (2015b), "Different Entrepreneurial Approaches in Localised Spaces of Collaborative Innovation," *SSRN Electronic Journal* [Preprint]. doi:10.2139/ssrn.2533448.
- Coll-Martínez, E., Méndez-Ortega, C. (2020), "Agglomeration and coagglomeration of co-working spaces and creative industries in the city," *European Planning Studies* [Preprint]. doi:10.1080/09654313.2020.1847256.
- Cota, J.E.M. (2001), "Specialisation, agglomeration and urban manufacturing growth in the northern border cities of Mexico," *Journal of Borderlands Studies*, 16(2), 71–97. doi:10.1080/08865655.2001.9695575.
- Currid, E. (2007), *The Warhol economy: How fashion, art, and music drive New York City*. New Jersey: Princeton University Press.
- Deskmag (2022), *2021-22 Coworking Space Trends*.
- Duranton, G., Puga, D. (2000), "Diversity and Specialisation in Cities: Why, Where and When Does it Matter?," *Urban Studies*, 37(3), 533–555. doi:10.1080/0042098002104.

- Fang, C., Yu, D. (2017), "Urban agglomeration: An evolving concept of an emerging phenomenon," *Landscape and Urban Planning*, 162, 126–136. doi:10.1016/j.landurbplan.2017.02.014.
- Fiorentino, S. (2019), "Different typologies of 'co-working spaces' and the contemporary dynamics of local economic development in Rome," *European Planning Studies*, 27(9), 1768–1790. doi:10.1080/09654313.2019.1620697.
- Florida, R. (2002), *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books.
- Florida, R. (2004), *Cities and the creative class, Cities and the Creative Class*. doi:10.4324/9780203997673.
- Florida, R., Mellander, C., Stolarick, K. (2008), "Inside the black box of regional development - Human capital, the creative class and tolerance," *Journal of Economic Geography*, 8(5), 615–649. doi:10.1093/jeg/lbn023.
- Fujita, M., Thisse, J.-F. (2002), *Economics of Agglomeration*. Cambridge University Press. doi:10.1017/CBO9780511805660.
- Fuzi, A. (2015), "Co-working spaces for promoting entrepreneurship in sparse regions: The case of South Wales," *Regional Studies, Regional Science*, 2(1), 462–469. doi:10.1080/21681376.2015.1072053.
- Gandini, A. (2015), "The rise of coworking spaces: a literature review," in.
- Gandini, A., Cossu, A. (2021), "The third wave of coworking: 'Neo-corporate' model versus 'resilient' practice," *European Journal of Cultural Studies*, 24(2), 430–447. doi:10.1177/1367549419886060.
- Garrett, L.E., Spreitzer, G.M., Bacevice, P.A. (2017), "Co-constructing a Sense of Community at Work: The Emergence of Community in Coworking Spaces," *Organisation Studies*, 38(6), 821–842. doi:10.1177/0170840616685354.
- Gerdenitsch, C. *et al.* (2016), "Coworking spaces: A source of social support for independent professionals," *Frontiers in Psychology*, 7(APR). doi:10.3389/fpsyg.2016.00581.
- Glaeser, E.L. *et al.* (1992), "Growth in Cities," *Journal of Political Economy*, 100(6), 1126–1152. doi:10.1086/261856.
- Glaeser, E.L., Gottlieb, J.D. (2008), "The economics of place-making policies," in *Brookings Papers on Economic Activity*. doi:10.2139/ssrn.1299046.
- Glaeser, E.L., Kolko, J., Saiz, A. (2001), "Consumer city," *Journal of Economic Geography*, 1(1), pp. 27–50. doi:10.1093/jeg/1.1.27.
- Graells-Garrido, E. *et al.* (2021), "A city of cities: Measuring how 15-minutes urban accessibility shapes human mobility in Barcelona," *PLoS ONE*, 16(5 May). doi:10.1371/journal.pone.0250080.
- Grazian, D. (2020), "Thank God it's Monday: Manhattan coworking spaces in the new economy," *Theory and Society*, 49(5–6), 991–1019. doi:10.1007/s11186-019-09360-6.
- Guzman, J., Stern, S. (2016), *The State of American Entrepreneurship: New Estimates of the Quality and Quantity of Entrepreneurship for 32 US States, 1988-2014*. Cambridge, MA. doi:10.3386/w22095.
- Hanson, G. (1994), *Localization Economies, Vertical Organisation and Trade*. Cambridge, MA. doi:10.3386/w4744.
- Hanssens, H., Derudder, B. (2011), "The urban geography of advanced producer service transaction links in Belgium," *Belgeo*, (1–2), 17–28. doi:10.4000/belgeo.6345.
- Helbrecht, I. (2004), "Bare geographies in knowledge societies - Creative cities as text and piece of art: Two eyes, one vision," *Built Environment*, 30(3). doi:10.2148/benv.30.3.194.54299.

- Henderson, V., Kuncoro, A., Turner, M. (1995), "Industrial Development in Cities," *Journal of Political Economy*, 103(5), 1067–1090. doi:10.1086/262013.
- Hoover, E.M. (1937), *Location Theory and The Shoe and Leather Industries*. Cambridge: Harvard University Press.
- Hoover, E.M. (1948), *The Location of Economic Activity*. New York: McGraw Hill.
- Houghton, K.R., Foth, M., Hearn, G. (2018), "Working from the Other Office: Trialling Co-Working Spaces for Public Servants," *Australian Journal of Public Administration*, 77(4), 757–778. doi:10.1111/1467-8500.12317.
- Jacobs, J. (1961), *The death and life of great American cities: The kind of problem a City Is, A Geography of Urban Places*.
- Jofre-Monseny, J., Marín-López, R., Viladecans-Marsal, E. (2014), "The determinants of localization and urbanisation economies: Evidence from the location of new firms in Spain," *Journal of Regional Science*, 54(2), 313–337. doi:10.1111/jors.12076.
- Kojo, I., Nenonen, S. (2016), "Typologies for co-working spaces in Finland – What and how?," *Facilities*, 34(5–6), 302–313. doi:10.1108/F-08-2014-0066.
- Kolko, J. (2010), "Urbanisation, Agglomeration, and Coagglomeration of Service Industries," in Glaeser, E.L. (ed.) *Agglomeration Economics*. Chicago: University of Chicago Press, 151–180. doi:10.7208/chicago/9780226297927.003.0006.
- Krätke, S. (2007), "Metropolisation of the European Economic Territory as a Consequence of Increasing Specialisation of Urban Agglomerations in the Knowledge Economy," *European Planning Studies*, 15(1), 1–27. doi:10.1080/09654310601016424.
- Krätke, S. (2010), "'Creative Cities' and the Rise of the Dealer Class: A Critique of Richard Florida's Approach to Urban Theory," *International Journal of Urban and Regional Research*, 34(4), 835–853. doi:10.1111/j.1468-2427.2010.00939.x.
- Lösch, A. (1954), *The economics of location*. New Haven: Yale University Press.
- Lukman, Y.A., Ekomadyo, A.S., Wibowo, A.S. (2018), "Assembling the Past and the Future of the City through Designing Coworking Facilities," in *IOP Conference Series: Earth and Environmental Science*. Institute of Physics Publishing. doi:10.1088/1755-1315/158/1/012051.
- di Marino, M., Lapintie, K. (2017), "Emerging Workplaces in Post-Functionalist Cities," *Journal of Urban Technology*, 24(3), 5–25. doi:10.1080/10630732.2017.1297520.
- di Marino, M., Lapintie, K. (2020), "Exploring multi-local working: challenges and opportunities for contemporary cities," *International Planning Studies*, 25(2), 129–149. doi:10.1080/13563475.2018.1528865.
- di Marino, M., Lilius, J., Lapintie, K. (2018), "New forms of multi-local working: identifying multi-locality in planning as well as public and private organisations' strategies in the Helsinki region," *European Planning Studies*, 26(10), 2015–2035. doi:10.1080/09654313.2018.1504896.
- Mariotti, I., Pacchi, C., di Vita, S. (2017), "Co-working Spaces in Milan: Location Patterns and Urban Effects," *Journal of Urban Technology*, 24(3), 47–66. doi:10.1080/10630732.2017.1311556.
- Marshall, A. (1890), *Principles of Economics, 1st edition*. Macmillan and Company.
- Marshall, A. (1920), *Principles of Economics, 8th edition*. Reprinted Macmillan.
- Martinelli, F., Moulaert, F. (1993), "The Location Of Advanced Producer Services Firms Theory And Illustrations," *Geographische Zeitschrift*, 81(1/2), 1–17. Available at: <http://www.jstor.org/stable/27818644>.
- McCann, P. (2013), *Modern Urban and Regional Economics Second Edition*.
- Mcgranahan, G., Martine, G. (2012), *Urbanisation and development Policy lessons from the BRICS experience Human Settlements*. London. Available at: www.iied.org.

- McGranahan, G., Martine, G. (eds) (2014), *Urban Growth in Emerging Economies: Lessons from the BRICS*. Taylor and Francis. doi:10.4324/9781315867878.
- Merkel, J. (2015), "Coworking in the city," *ephemera: theory & politics in organisation*, 15(1), 121–139. Available at: www.ephemerajournal.org.
- Micek, G. (2020), "Studies of proximity in coworking spaces: The basic conceptual challenges," *European Spatial Research and Policy*, 27(1), 9–35. doi:10.18778/1231-1952.27.1.01.
- Moreno, C. *et al.* (2021), "Introducing the '15-minute city': Sustainability, resilience and place identity in future post-pandemic cities," *Smart Cities*, 4(1). doi:10.3390/smartcities4010006.
- Moriset, B. (2013), *Building new places of the creative economy. The rise of coworking spaces*. HAL Id: halshs-00914075.
- Oakey, R. *et al.* (eds) (2009), *New Technology-Based Firms in the New Millennium*. Emerald Group Publishing Limited. doi:10.1108/S1876-0228(2009)7.
- Ohlin, B. (1933), *Interregional and International Trade*. Cambridge: Harvard University Press.
- Parr, J.B. (2002), "Agglomeration Economies: Ambiguities and Confusions," *Environment and Planning A: Economy and Space*, 34(4), 717–731. doi:10.1068/a34106.
- Radzimski, A., Gadziński, J. (2019), "Travel Behaviour in a Post-Socialist City," *European Spatial Research and Policy*, 26(1), 43–60. doi:10.18778/1231-1952.26.1.03.
- Rocco, R. (2012), "Location Patterns of Advanced Producer Services Firms: The Case of São Paulo," in van Geenhuizen, M. and Nijkamp, P. (eds) *Creative Knowledge Cities*. Edward Elgar Publishing, 385–412. doi:10.4337/9780857932853.00023.
- Rosenthal, S.S., Strange, W.C. (2004), "Evidence on the nature and sources of agglomeration economies," in *Handbook of Regional and Urban Economics*. doi:10.1016/S1574-0080(04)80006-3.
- Rutten, R. (2017), "Beyond proximities: The socio-spatial dynamics of knowledge creation," *Progress in Human Geography*, 41(2), 159–177. doi:10.1177/0309132516629003.
- Schmidt, S., Brinks, V., Brinkhoff, S. (2014), *Innovation and creativity labs in Berlin Organising temporary spatial configurations for innovations*.
- Scott, A.J. (2010), "Cultural economy and the creative field of the city," *Geografiska Annaler: Series B, Human Geography*, 92(2), 115–130. doi:10.1111/j.1468-0467.2010.00337.x.
- Shearmur, R. (2012), "The Geography of Intrametropolitan KIBS Innovation: Distinguishing Agglomeration Economies from Innovation Dynamics," *Urban Studies*, 49(11), 2331–2356. doi:10.1177/0042098011431281.
- Shearmur, R. (2017), "The millennial urban space economy: Dissolving workplaces and the delocalization of economic value creation," in Moos, M.P.D.V.T. (ed.) *The Millennial City: Trends, Implications, and Prospects for Urban Planning and Policy*. London: Routledge.
- Shearmur, R. (2021), "Conceptualising and measuring the location of work: Work location as a probability space," *Urban Studies*, 58(11), 2188–2206. doi:10.1177/0042098020912124.
- Shearmur, R. *et al.* (2021), "Towards a post-COVID geography of economic activity: Using probability spaces to decipher Montreal's changing workscapes," *Urban Studies* [Preprint]. doi:10.1177/00420980211022895.
- Skog, A. *et al.* (2016), *Chasing the Tale of the Unicorn-A study of Sweden's misty meadows*.
- Smętkowski, M., Celińska-Janowicz, D. and Wojnar, K. (2019), "New metropolitan economic spaces: From a postmetropolis to a patchwork metropolis?," *Studia Regionalne i Lokalne*, 78(4). doi:10.7366/1509499547802.
- Smit, A.J. (2011), "The Influence of District Visual Quality on Location Decisions of Creative Entrepreneurs," *Journal of the American Planning Association*, 77(2), 167–184. doi:10.1080/01944363.2011.567924.

- Soja, E. (2000), "Postmetropolis critical studies of cities and regions. Introduction," in *Postmetropolis critical studies of cities and regions*.
- Southworth, M. (2005), "Designing the Walkable City," *Journal of Urban Planning and Development*, 131(4), 246–257. doi:10.1061/(asce)0733-9488(2005)131:4(246).
- Stam, E., van de Vrande, V. (2017), "Solopreneurs and the rise of co-working in the Netherlands," in Maarten van Ham et al. (eds) *Entrepreneurial Neighbourhoods. Towards an Understanding of the Economies of Neighbourhoods and Communities*. Edward Elgar Publishing, 65–79. doi:10.4337/9781785367243.00012.
- Taylor, P.J., Derudder, B. (2016), *World City Network. A global urban analysis*. 2nd Edition. Abingdon, UK: Routledge.
- Viladecans-Marsal, E. (2004), "Agglomeration economies and industrial location: city-level evidence," *Journal of Economic Geography*, 4(5), 565–582. doi:10.1093/jnlecg/lbh040.
- Waters-Lynch, J., Potts, J. (2017), "The social economy of coworking spaces: a focal point model of coordination," *Review of Social Economy*, 75(4), 417–433. doi:10.1080/00346764.2016.1269938.
- Weber, A. (1929), *Theory of the location of industries*. Chicago: University of Chicago Press.
- Yamamura, S., Goto, H. (2018), "Location patterns and determinants of knowledge-intensive industries in the Tokyo Metropolitan Area," *Japan Architectural Review*, 1(4), 443–456. doi:10.1002/2475-8876.12039.

APPENDIX

Table A1. Location factors of co-working spaces.

Location Factor	Description	Source
Accessibility and infrastructure		
bicycle_parking	Number of parking spaces for bicycles	OSM
railway_station	Number of suburban railway stations	OSM
bus_stop	Number of public bus stops	OSM
tram_5_min	Access to tram stop within 5 minutes by foot, assignment according to 0/1 system	OSM
station_1km	Access to intercity train station within 1km by car, assignment according to 0/1 system	OSM
airport_10km	Access to airport within 10 km by car, assignment according to 0/1 system	OSM
Art and Culture		
art_centre	Number of art centres	OSM
cinema	Number of cinemas	OSM
museum	Number of museums	OSM
theatre	Number of theatres	OSM
Beauty and Wellness		
sport_centre	Number of local sport centres	OSM
fitness_centre	Number of fitness centres	OSM
shop_beauty	Number of non-hairdresser beauty shops, spas, nail salons, etc.	OSM
shop_hairdresser	Number of hair salons	OSM
shop_massage	Number of massage parlours	OSM
Education Research		
university	Number of institutes of higher education	Desk research
educational_institution	Number of offices for an educational institution	OSM
office_it	Number of offices for an IT specialist	OSM

office_ngo	Number of offices for non-profit and NGOs.	OSM
office_research	Number of research and development offices	OSM
Food Services/ NightLife		
cafe	Number of cafes	OSM
fast food	Number of fast-food restaurants	OSM
pub	Number of pubs and bars	OSM
restaurant	Number of restaurants	OSM
convenience	Number of convenience stores	OSM
kiosk	Number of kiosks	OSM
supermarket	Number of supermarkets	OSM
Public Services		
bank	Number of banks with customer service	OSM
townhall	Number of town hall offices	OSM
childcare	Number of childcare venues other than kindergartens	OSM
kindergarten	Number of kindergartens	OSM
post office	Number of post offices	OSM
school	Number of schools (building)	OSM
government	Number of central government offices	OSM
Agglomeration factors		
Creative industries	Number of creative companies based on OECD definition	EMIS
Hi-tech	Number of hi-tech companies based on OECD definition	EMIS
ICT	Number of ICT companies based on OECD definition	EMIS
R&D	Number of R&D companies based on OECD definition	EMIS
KIS	Number of KIS companies based on OECD definition	EMIS
APS	Number of APS companies based on OECD definition	EMIS
Business & Finance	Number of business and finance companies	EMIS
Arts & Culture	Number of arts and culture companies based on OECD definition	EMIS
Research & Education	Number of research and education companies based on OECD definition	EMIS
Marketing & Communication	Number of marketing and communication companies based on OECD definition	EMIS
All firms	Number of all companies	EMIS
Other		
Av_prop_value	Average property value in PLN	RREP
Co-working spaces		
CW_open	List of all open coworking spaces (current as of July 2021).	Desk research

* RREP - Warsaw register of real estate prices and values

A systematic literature review of the effects of Coworking Spaces on residential areas and their potential for implementation in existing buildings

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ABSTRACT

Coworking is a labour method based on sharing a working environment, typically an office, with other people, but in which workers' activities are carried out individually or in small groups. Coworking spaces (CSs) differ from traditional offices because the workers do not necessarily belong to the same company or working field. The spread of CSs has increased over the last decade with the rise of freelancers, digital nomads, itinerant workers, and commuters. This activity, which is strongly driven by a spirit of sociability, independence, shared values, and synergy, tends to increasingly break away from the typical working districts of the city. CSs become satellite stations that grow in less predisposed areas of the city, such as industrial districts, rural areas, and residential zones. Hence, a literature review is elaborated to identify the current state of science and technology regarding the implementation of CSs in residential areas. Further possible effects of CSs on the residential area or region are deduced by a qualitative analysis of the identified literature. Findings show on the one hand correlations between the implementation of a CS and socio-cultural factors such as the well-being of the residents. On the other hand, economic effects on the region can be identified, as the potential of start-ups is growing, the commuting would be reduced and therefore residents would stay for a longer period in the direct neighbourhood and consume more goods there. The line of discussion is focused on the possibility of the implementation of CSs in existing residential buildings and the effects on the residential area or region.

Keywords

Systematic literature review, PRISMA, Coworking spaces, Residential areas, Existing buildings.

1 INTRODUCTION

The concept of Coworking as it is known today is attributed to a fairly recent event: in 2005 in San Francisco, the software engineer Brad Neuberg left a start-up in which he worked to seek an individual entrepreneurial experience, but without willing to give up the resources commonly available in his previous working environment and community (Rus, et al., 2015). Only recently coworking spaces have taken off, providing a space for creativity and professionalism for millions of professionals with different backgrounds in all parts of the world (Bouncken, et al., 2019). From a simple spatial point of view, CSs are designed as spaces with open-plan working areas, quiet and private areas, and common areas run by coworking managers, providers, or proprietors. Modern settings foster ties among users that promote inspiration, productivity, and creativity (Bouncken, et al., 2020) but, according to some of the studies, these are conceived as something bigger, which can influence our society. According

to studies investigating this topic, CSs influence our society in many ways. Described as an urban phenomenon that has great potential in terms of revitalising and regenerating the urban fabric, they also contribute to the creation of jobs, and the reuse of abandoned (often industrial) buildings. Moreover, they can facilitate the creation of real creative districts that can involve the local population and other local activities (Tuvani, et al., 2018), by creating some initiatives such as community gardens and art projects (Merkel, 2015). Coworking also seems to be able to bring great cultural influences on society by reducing gender inequality, along with other intersecting forms of inequality, in members' interactions and experiences through shared goals and equal comparisons in decision-making processes (Sargent, et al., 2021). Other studies found that CSs could give knowledge workers who often work from home a possibility to avoid social isolation and create community by working in CSs. Further studies that investigate phenomena of Cohome or Hoffice that describe coworking in residential homes show an increase in productivity of the participants and their social interaction. The shared experience of homeworking and awareness of the challenges of personalised professional work create cognitive proximity in home-based coworking (Reuschke, et al., 2021). In conclusion, it can be said that coworking spaces are not common offices but have the potential to positively influence the people that they involve and the surrounding environment. Nevertheless, the literature on CSs is quite new and various aspects are unexplored (Yu, et al., 2019). This systematic literature review aims to investigate one of the under researched facets of this topic, looking at the influence of CSs on the surrounding environment with a special focus on residential areas. Therefore, the contribution of this work lies in the methodological approach selected: the PRISMA (preferred Reporting Items for Systematic Reviews and Meta-Analyses) is applied in this work. Following the PRISMA checklist items, this paper aims to fill this research gap and analyse what we know about the influence of coworking spaces on residential areas. In particular, this review attempts to answer the following research questions:

- What are the effects of CSs on residential areas, existing residential buildings, and the residents?
 - What do we know so far about the integration of Coworking activities in residential spaces?
- The PRISMA approach can integrate various globally significant studies and shed light on the effects of CSs on individuals and the built environment of residential areas; also identify existing gaps in the literature and propose future research lines. Further, the findings of this study can be transferred to housing stockholders and policymakers to be considered in designing tailored policies for the revitalization of existing residential buildings or areas to meet the new flexibility that goes along with the new ways of working. This paper is organised into four main sections. The introduction is followed by the methodological approach section. The third section discusses the findings to address the research questions outlined above. The final section summarises the primary outcomes and introduces future lines of research.

2 METHODOLOGY

To verify compliance and increase the research value the authors decided to use the 27-items defined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to perform this literature review (PRISMA, 2022). The aim was to systematically investigate the extensive research that the scientific community has conducted on coworking spaces, specifically focusing on the impact of CSs on residential areas and the implementation of Coworking in existing residential buildings. The initial phase - data collection - consisted of sourcing research on the topic and managing a database through Excel, where an increasingly gradual pruning of data was carried out until having some qualitative data that could compose a report that argued the topic. In the scope of this work, the authors used three scientific databases as search engines (ScienceDirect, Scopus, and Web of Science) to identify relevant

articles that allow conclusions to be drawn about the research topic. Besides, backward and forward research was applied after the evaluation process on the studies found. Therefore, the references and citations of the identified articles were analysed to increase the number of articles. The research included peer-reviewed scientific papers that were published after the year 2009 and are available in English. Further eligible criteria were defined regarding the research questions. Hence, the articles must deal with the interrelationships of CSs in residential buildings or areas and their impact on the surrounding neighbourhood and its residents or the users of the CSs. To have a clear and “coherent” search it is important to define a unique search string that can lead to a precise set of results. In this first operational phase, the aim was to set a search string capable to facilitate the objective, combining a series of keywords and implementing them with the use of Boolean operators (AND, OR, and NOT) and Wildcards (*, ? and \$), which are essential for defining a clear search string. The keywords used are the following:

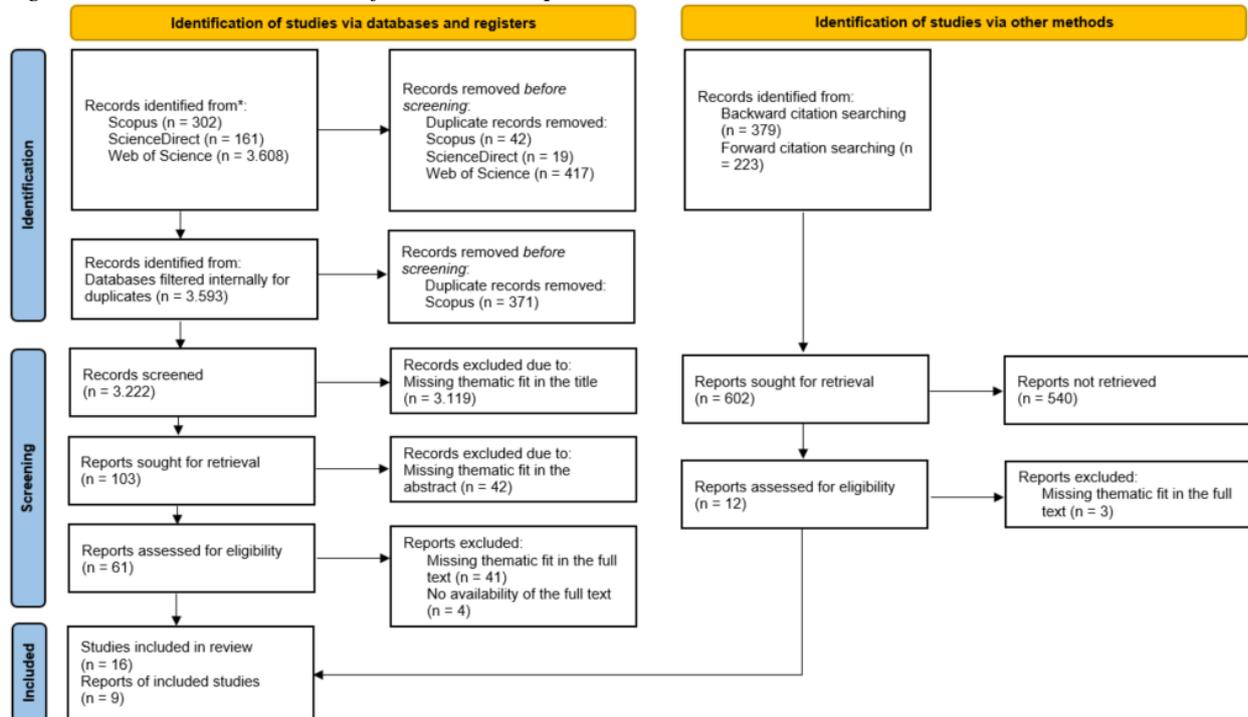
- Cowork*/co-work*
- Residen*
- Hous*
- Domestic

From the combination of mentioned terms the following research string was derived:

TITLE-ABS-KEY(((cowork* OR co-work*) AND (residen* OR hous* OR domestic)))

As the databases are structured differently some adjustments regarding the search string shown above needed to be executed to provide consistent research. The first data were extracted on 8th December 2021. The research provided 4071 potentially useful publications on this topic that were extracted and stored inside an Excel database. Hereby the data were prepared for the selection process, which was divided into three main steps: Screening, eligibility, and inclusion. The first phase was carried out by identification of the potential articles for the screening process and the removal of existing duplicates first in the individual databases and then in the merged database. Then, in the second step, the screening process was carried out by checking the titles for the defined search terms and whether they matched the topic. Subsequently, the abstracts of the remaining articles were examined for thematic fit with the research questions. In the last step of the screening phase, the full texts of 61 selected articles were analysed for eligibility. Thereby further 45 articles were excluded due to a lack of thematic consistency or availability. Finally, 16 relevant articles were included for the final qualitative evaluation. To increase the number of findings the authors applied backward and forward citation research to the selected articles. Therefore 9 further papers could be identified as relevant from 602 references and were included in the qualitative analysis, as shown in the flowchart below.

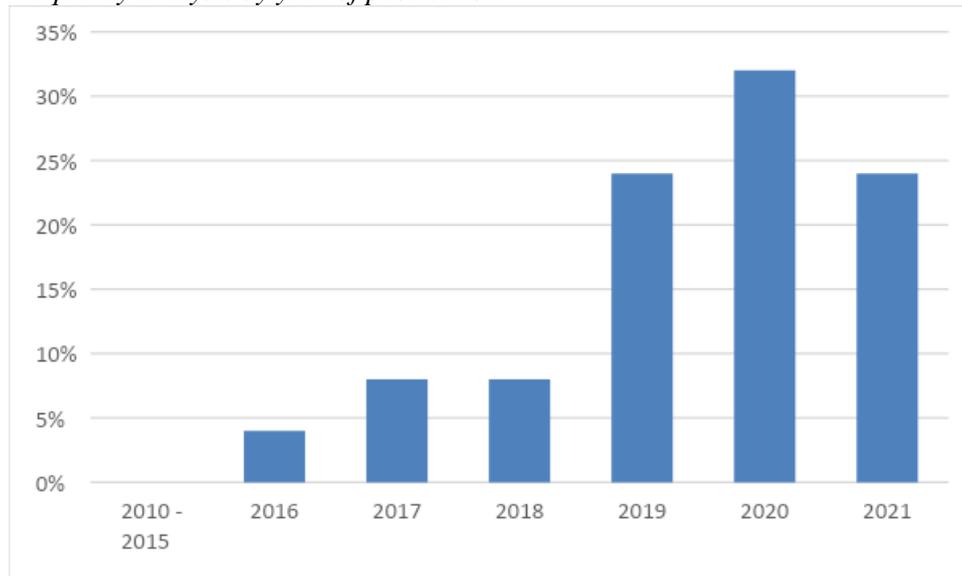
Figure 1. PRISMA Flowchart of the selection process



3 RESULTS

The number of articles shows sparse research regarding the effects of CSs on residential areas, existing residential buildings, and/or the residents using the PRISMA approach. The 25 studies show research activities around the world. About 20% of the studies found were executed from institutions based in Germany, the UK, and the US (with both 16%), the Czech Republic and Canada (both with 12%), and Italy (8%). Just 4% of the studies were found in the APAC region (Asia Pacific) where only Indonesia published one article. This shows great potential for further cross-national research and investigations in countries outside the European Union or North America. As mentioned in chapter 2 the period of investigation was from 2010 to 2021. The frequency analysis in figure 2 shows that no studies were found between 2010 and 2015, which clarifies that the research on CSs in residential areas only started recently and initially gained some momentum in the last three years, in which three-quarters of the 25 used articles were published. The first relevant publication was in 2016, with a slight increase in 2017 and 2018. From 2019 the topic becomes more investigated and the data shows a strong increase that continues in 2020 (8 articles) and restabilizes with 6 articles in 2021. Overall, this indicates that the analysed topic has been investigated just recently and developments are still in process. The topic also seemed to have been unnoticed for a large part of the researched time frame since the first article, which met the previously described criteria, was published in 2016.

Figure 2. Frequency analysis by year of publication



The analysed articles are addressing different impact factors of CSs on residential areas, residential buildings, and/or their residents allowing a conclusion to be drawn on the implementation of CSs in existing residential buildings. These factors could be categorised as “quality of life”, “economical consequences”, “environmental impact”, and the “impact on physical factors”. Performing a frequency analysis on these categories shows that the articles are mainly focusing on the quality of life (56%), followed by the economical aspects (44%). While the research on the environmental effects of CS in residential areas and their physical space factors seems to be 12% each under investigation. Some of these categories can be divided into further subcategories. Therefore “quality of life” is divided into the *individual* and the *residential community quality of life*, while the “economic impact” consists of *macro* and *micro* economical aspects.

3.1 Impact on people's quality of life

This category is cited by 14 studies and is divided into two subclasses: individual and collective-community quality of life. Psychological well-being is what this category refers to in terms of productivity, sociability, work-life balance, and other consequences found in the sphere of well-being among individuals and collectives. *Individuals' quality of life*. The available evidence about the impacts of CSs on coworkers who are practising coworking in their homes or residential areas was unequivocal and derived from 8 studies. People experiencing extreme proximity to working and living spaces, such as individuals practising work from home, might bear several negative effects, including loss of social contacts, a sense of precariousness, and the loss of the concept of the original designation of domestic spaces - which induces more distraction and a more pronounced focus to external elements such as noises. For this reason, CSs in residential environments can have positive effects on coworkers, who practise Cohome or Hoffice and might lose track of time and get distracted by the juxtaposition of living and working spaces (Reuschke, et al., 2021; De Peuter, et al., 2017; Orel, 2020; Robelski, et al., 2019). Positive effects, like high work satisfaction in the individuals, can occur in three different configurations: agility housing, knowledge housing, and social housing (Bouncken, et al., 2020). At the same time, this solution leads to avoiding all the slowdowns and obstacles of working at home and improving the comfort of employees - who could suffer confinement in residential spaces (Mariotti, et al., 2021). In other words, social proximity to residential areas could also slow the spread of diseases. However,

combining work-from-home and coworking can be an ideal solution to increase social capital and earnings for home-based entrepreneurs (Rodríguez-Modroño, 2021). Sometimes, coworking spaces and residential spaces not only coexist but also overlap, as in the case of Cohome and Hoffice groups (widespread in Germany, Sweden, France, Belgium, and the UK). Hereby, residential apartments and buildings serve as CS during the daytime. Their purpose is to stimulate the productivity of individual workers through the use of clear scheduling of collective activities and a familiar work environment (Reuschke, et al., 2021). CSs in collaboration with housing (i.e., co-living and social housing) have also greatly increased the concept of flexibility. This development is encouraging and contributing positively to the increase of digital nomads that seek to create ties with the creative community of a place both in their homes and elsewhere (Lee, et al., 2019). *Residential community quality*. One focus of this work lies on the impact of CSs on residential areas and therefore their residential communities. This is differentiated from the much-discussed subject of the coworking community, which is not considered in this work. The impact of CSs on the residential community is discussed in 7 studies. Two studies found an effect of CSs on urban and socio-economic regeneration processes by involving the creative urban population (Thees, et al., 2020; Durante, 2018). This leads to a valorization of spaces for leisure, art, and an expanded offer of cultural activities, such as readings, workshops, concerts, art performances, and exhibitions. Thees et al. (2020) found that CSs can be seen as a platform for innovation, networking, and sociability, which brings together parallel interest groups. Such groups thrive when contact points and meeting spaces between working, living, and leisure seekers are shaped based on a common understanding (Thees, et al., 2020). Camilleri et al. (2017) conclude that CSs that implement interactive platforms for residents and have peer-to-peer experiences can increase the attractiveness of the area to tourists and the participation between communities within CSs and their neighbours. Further, Camilleri et al. (2017) assume that the overall job satisfaction of the residents increases when they interact with coworkers. Meanwhile, it could also overextend the users' social needs and obligations (Bouncken, et al., 2020). Other researchers confirm that recently, CSs have shown interest in collaborating with some informal organisations to tackle social isolation and thus create communities between coworkers and the residents living in the same neighbourhood, by offering recreational activities involving the residential areas (Akhavan, et al., 2019; Chuah, 2016). Besides the positive effects, one study also shows that CSs do not always act as promoters of sociability in residential spaces and nearby activities, as highly educated but economically insecure creative workers tend not to engage with existing community groups of the surrounding neighbourhood and vice versa (Brown, 2017).

3.2 Economical consequences for the area

The economic consequences were investigated in 11 articles and are divided into two subgroups: The micro and macro economical factors. While microeconomics is taking the immediate neighbourhood into account, the macro economical factors describe the effects on a larger scale.

Micro-economic impacts. The effects of CSs on a micro-economic level of residential areas are discussed in three studies. Brown (2017) shows, on the one hand, the economic benefits for CS users by analysing the WeWork Group strategy to attract young creative professionals, helping them to overcome the sometimes-prohibitive housing costs of big cities by offering them an affordable combination of co-living and CS concepts. Consequently, this combination allows businesses to rent out their spaces at a lower price. On the other hand, he shows the complaints of cleaning companies claimed to be underpaid and resorted to the intervention of the unions to curb the harsh treatment by the coworking company. Reuschke and Ekynsmith (2021) report that there is economic potential for occupations given by CSs in residential areas. Defining the

residential spaces of the city as places where microeconomic activities can grow and pulsate due to the considerable increase in gig working, self-employment, and freelancing and the flexibilization of the labour market (Reuschke, et al., 2021).

Macro-economic impacts. Nine studies emphasise how much the increase of CSs is related to the economic growth within a local context. Reuschke et al. (2021) found that home-based coworking can be compatible with cities' outskirts and rural areas and could be a sufficient solution to solve the issue of the shortage of CSs perceived by some freelance professionals. New forms of sharing such as synergy-driven coworking and cohousing, address the challenge of housing and employment shortages that damage the entrepreneurial activity in the city (Thees, et al., 2020). However, three articles investigated also found negative contributions to the regional economy. Grazian (2020) describes the gentrification effects caused by WeWork in the United States, through the displacing of poorer residents and weaker commercial activities from the neighbourhoods in which it operated. Other articles found gentrification effects due to the investment behaviour of financial institutions that seek to increase their profits arising from investments in CSs (De Peuter, et al., 2017; Orel, et al., 2020). Grazian (2020) analysed the allocation of CSs in the USA and found out that they are often clustered around white-collar business districts that are characterised by established firms and high-end residential areas, which could lead to a further increase in the price level. Opposite this stands the positive effects of CSs on the economy of peripheral or structurally weak rural regions (Mariotti, et al., 2021). Jamal (2018) found the same positive impact regarding desolated city centres. Moreover, Spinuzzi et al. (2019) found in a case study conducted in a CS in Austin Texas, that the implementation of CSs not only had a social impact on the area but also an economical one. Therefore, the coworkers launched an initiative and a start-up to find solutions for Austin's housing issues (Spinuzzi, et al., 2019). Similar is the case of the coworking group TEEM in the Harlem district of New York, which supports the 2003 rezoning plan for the growth of its residential department (Chuah, 2016).

3.3 Environmental impacts

The impact on the environment is discussed in three studies. CSs are often defined as 'Third Places' that are located close to the place of residence which consequently leads to a reduction of daily commuting and therefore CO₂ emissions of the residents (Hölzel, et al., 2021). This effect is confirmed by the study of Ohnmacht et al. (2020), who found a positive effect on residential mobility due to spatial independence between home and regular workplaces. Further, Ohnmacht et al. (2020) assume that other residents could be attracted to coworking by the availability of a CS nearby and reduce their commuting habits too. Another impacting factor for the environment is described by Thees et al. (2020), who see positive effects on the environment of the residential areas by the sharing habits that go along with the implantation of a CS, which allows resources to be managed more innovatively and efficiently (Thees, et al., 2020).

3.4 Impact on the physical factors of a CS in residential buildings or areas

Layout factors for the CS in residential areas or residential buildings were discussed in three articles. Reuschke et al. (2021) found that it is challenging to transform residential buildings to work environments. The difficulty goes along with the space that is mainly based on the resident's needs and decreases with the increasing density of an area. Consequently, there are not many coworking activities taking place inside homes, but two practical examples of Hoffice and Cohome allow conclusions on how domestic space needs to be shaped to enable coworking activities (Reuschke, et al., 2021). Hereby Reuschke et al. (2021) provide characteristics of Cohome, which are performed in small flats, located in central areas of the city, close to companies and other CSs. Further, the authors describe the adaptableness of the objects and spaces, e.g., flexible furniture. Conversely, Reuschke et al. (2021) found that Hoffice is located

in suburban areas, using more spacious accommodation such as large, detached houses and farmhouses close to natural amenities. The authors also give a reference to the organisation as they mention that the hosts prepare the space for the coworking sessions each time by cleaning, moving furniture, preparing refreshments, and even arranging fresh flowers to freshen the environment. The authors conclude that the conformation of the spaces and the "sense of home" given by the host's preparations and the customizability of the workers can enhance the workers' attachment to the place, in turn spurring their productivity. According to some interviews, a further aspect influencing productivity – regarding brainstorming activities – is the preference of workers toward open spaces such as living rooms (Thees, et al., 2020). Besides, Grazian (2020) describes the impact of CS on the physical layout of residential buildings by analysing WeWorks residential subdivision WeLive. Their additional services are implemented in the residential area and range from relaxation and recreation areas to gyms. Another study found that coworking could be incorporated into a residential activity by occupying former commercial spaces on the ground floor, thus changing the flow of people, the entrance, and the configuration of the pertinent spaces (Thees, et al., 2020).

4 DISCUSSION AND CONCLUSION

This systematic literature review identified – after following the steps of the PRISMA methodology and starting with 4,071 papers – 25 journal articles that addressed the effects of CSs on residential areas, residential spaces, or their residents. The results show that, in the past decade, Europe has recorded the highest number of publications and the research increased with the COVID-19 pandemic. Further, the research shows that the majority of the investigated articles are dealing with the effects on the well-being of the individual or the residential community as well as the economy of the region while the environmental impacts and physical layout factors were addressed less frequently. One of the main effects found in the creation of a community could be an important alternative to the home office that could cause distraction and a sense of loneliness (Craig et al., 2021). Findings imply that the implementation of a CS in a residential area reduces the commuting between work and home which reduces the CO₂ emissions of the residents and enhances the well-being of the coworkers and the residential community. Above all, the CO₂ reduction that goes hand in hand with the implementation of a CS could be an effective measure for residential areas to reduce their CO₂ footprint in times of heated discussions about sustainability and the entry into force of new emission standards for buildings. Further studies show that the relationships with the surrounding communities are strengthened and the residents, as stakeholders of the CSs, are positively influenced by the creative and regenerative activities offered in the CSs (Tuvani, et al., 2018; Merkel, 2015). In addition, positive and negative effects on the regional economy were found in terms of revitalization of old building stocks which lead to a higher quality of life for the residents on the one hand and increased real estate prices as well as the negative effects of gentrification that goes along with it on the other hand. Moreover, a few articles found that with Hoffice and Cohome some forms of coworking are already existing in residential buildings that make monofunctional spaces in central or peripheral areas more flexible and enhance the productivity and creativity of the coworkers and avoid social isolation and mental diseases. But still, there is a lack of research on the implementation of CSs in existing buildings. Although some of the articles report statements supporting the positivity of the link between coworking spaces and residential areas, some limitations go along with the restricted availability of relevant studies, making it hard to draw solid conclusions based on the studies reviewed in this paper. Consequently, we performed backward and forward research to increase the number of studies. Peer-reviewed scientific studies have been limited to date and the language. Further, most of the literature is from Europe and a handful of other countries; hence, generalizability to

different cultures is limited. Based on the findings of this review, the implications of CSs on residential areas are manifold. With its ability to foster a community of specialised and well-trained people, coworking can be a starting point for revitalising residential areas and strengthening the economy of the region. New forms of CSs can be integrated across different forms of housing and enhance the flexibility of the building and the well-being as well as the productivity of coworkers and its residents. Following this perspective, it is possible to see further benefits for residential areas and housing stocks. For example, the integration of a CS could strengthen the relationships between the occupants and enhance the integration process of new residents. Besides, an integrated CS could enhance the attractiveness of a building to reduce vacancies and stop the decay of existing buildings. Based on the outcome of this review, there is a lack of studies analysing the physical implementation of CS in existing residential buildings. A case study would be important to assess the technical and economic feasibility of this project. Besides the implementation of a CS also the socio-cultural relationship between CSs and residential areas has not been fully investigated yet. For a better understanding of the effects of CSs on residential areas, more in-depth studies should be conducted. Therefore, quantitative studies investigating the configurational effects of residential space and coworking interaction could give insights into occupants' needs and future demands. Further, feasibility studies and cost analysis could give first assumptions about the added value of a CS in residential buildings. Becoming widespread, CSs can become a three-way benefit for their users, the residential setting, and the broader local community in which these spaces interact. However, further studies need to be conducted to provide evidence of their effects on those systems and to also understand the possible downsides of the interaction.

REFERENCES

- Akhavan, M. [et al.] (2019), "Coworking Spaces and New Social Relations: A Focus on the Social Streets in Italy", *Urban Sci.* Vol. 3 (1), 11.
- Bednář, P., Danko, L. (2020), "Coworking spaces as a driver of the post-fordist city: a tool for building a creative ecosystem", *European Spatial Research and Policy*, Vol. 27 (1), 105-124.
- Bouncken, R. [et al.] (2020), "Coworking spaces: Empowerment for entrepreneurship and innovation in the digital and sharing economy", *Journal of Business Research*, Vol. 114 (10), 102-110.
- Bouncken, R., Aslam, M. M. (2019), "Understanding knowledge exchange processes among diverse users of coworking-spaces"; *Journal of Knowledge Management*, Vol. 23 (10), 2067-2085.
- Bouncken, R., Aslam, M. M., Qiu, Y. (2020), "Coworking spaces: Understanding, using, and managing sociomateriality", *Business Horizon*, Vol. 64 (7), 119-130.
- Brown, J. (2017), "Curating the "Third Place"? Coworking and the mediation of creativity", *Geoforum*. Vol. 82 (9), 112-126.
- Camilleri, J., Neuhofer, B. (2017), "Value co-creation and co-destruction in the Airbnb sharing economy", *International Journal of Contemporary Hospitality Management*, Vol. 29 (9), 2322-2340.
- Chuah, V. (2016), "Beyond the Core: The Role of Co-working Spaces in Local Economic Development", 76.
- Craig, C. M., Neilson, B. N., Altman, G. C., Travis, A. T., Vance, J. A. (2021), "Applying Restorative Environments in the Home Office While Sheltering-in-Place", *Human Factors*.
- De Peuter, G., Cohen, N., Saraco, F. (2017), "The ambivalence of coworking: On the politics of an emerging work practice", *European Journal of Cultural Studies*, Vol. 20 (6), 687 – 706.

- De Peuter, G., Cohen, N., Saraco, F. (2017), "The ambivalence of coworking: On the politics of an emerging work practice", *European Journal of Cultural Studies*, Vol. 20 (6), 687-706.
- Durante, T. (2018), "Coworking, the Sharing Economy, and the City: Which Role for the 'Coworking Entrepreneur'?"
- Grazian, D. (2020), "Thank God it's Monday: Manhattan coworking spaces in the new economy", *Theory and Society*, Vol. 49 (8), 991-1019.
- Hölzel, M., De Vries, W. T. (2021), "Digitization as a Driver for Rural Development-An Indicative Description of German Coworking Space Users" *Land*, Vol. 10 (3), 321-346.
- Ivaldi, S., Galuppo, L., Calvanese, E., Scaratti, G. (2020), "Coworking space as a practised place between welfare working and managerial challenges".
- Jamal, A. C. (2018), "Coworking spaces in mid-sized cities: A partner in downtown economic development", *Environment and Planning A: Economy and Space*, Vol. 50 (4), 773-788.
- Lee, A. [et al.] (2019), "The social infrastructure of Co-spaces: Home, work, and sociable places for digital nomads", *CSCW*, Vol. 3, 1-23.
- Lowe, N., Vinodrai, T. (2020), "The Maker-Manufacturing Nexus as a Place-Connecting Strategy: Implications for Regions Left Behind Strategy" *Economic Geography*, Vol. 96 (4), 315-335.
- Luchman, J. N., González-Morales, G. (2013), "Demands, control, and support: A meta-analytic review of work characteristics interrelationships.", *Journal of Occupational Health Psychology*. Vol. 18 (1), 37-52.
- Mariotti, I., Akhavan, M., Rossi, F. (2021), "The preferred location of coworking spaces", *European Planning Studies*, 1-23.
- Merkel, J. (2019), "Freelance isn't free.' Co-working as a critical urban practice to cope with informality in creative labour markets" *Urban Studies*, Vol. 56 (3), 526-547.
- Merkel, J. (2015), "The Elgar Companion to Innovation and Knowledge Creation" *Coworking and innovation*, 570-586.
- Ohnmacht, T., Z'Rotz, J., Dang, L. (2020), "Relationships between coworking spaces and CO2 emissions in work-related commuting: first empirical insights for the case of Switzerland with regard to urban-rural differences" *Environmental Research Communications*, Vol. 2 (12), 14-28.
- Orel, M., Dvoulety, O. (2020), "Transformative Changes and Developments of the Coworking Model: A Narrative Review" *Technological Progress, Inequality and Entrepreneurship - From Consumer Division to Human Centricity*, 21-42.
- Orel, M. (2020), "Supporting work-life balance with the use of coworking spaces" *Equality, Diversity and Inclusion: An International Journal*, Vol. 39 (5), 549-565.
- Reuschke, D., Clifton, N., Fisher, M. (2021), "Coworking in homes – Mitigating the tensions of the freelance economy", *Geoforum*, Vol. 119 (10), 122-132.
- Reushke, D., Ekinsmyth, C. (2021), "New spatialities of work in the city", *Urban Studies Journal Limited*, Vol. 58 (11), 2177-2187.
- Robelski, S. [et al.] (2019), "Coworking Spaces: The Better Home Office? A Psychosocial and Health-Related Perspective on an Emerging Work Environment", *International Journal of Environmental Research and Public Health*, Vol. 16 (13), 2379-2391.
- Rodríguez-Modroño, P. (2021), "Non-standard work in unconventional workspaces: Self-employed women in home-based businesses and coworking spaces", *Urban Studies*, Vol. 58 (11), 2258-2275.
- Rus, A., Orel, M. (2015), "Coworking: A community of work", *TEORIJA IN PRAKSA*, Vol. 52 (6), 1017-1038.

- Sargent, A. C., Yavorsky, J. E., Sandoval, R. (2021), "Organisational Logic in Coworking Spaces: Inequality Regimes in the New Economy" *GENDER & SOCIETY*, Vol. 35 (1), 5-31.
- Spinuzzi, C. [et al.] (2019), "Coworking Is About Community": But What Is "Community" in Coworking?" *Journal of Business and Technical Communication*. Vol. 33 (2), 112-140.
- Sutriadi, R., Fachryza, D. M. (2021), "A phenomenon in urban disruption: the emergence of Coworking Spaces in Bandung", *Heliyon*, Vol. 7 (7), 76-83.
- Thees, H., Zacher, D., Eckert, C. (2020), "Life and leisure in an urban ecosystem - co-creating Munich as an Entrepreneurial Destination", *Journal of Hospitality and Tourism Management*, Vol. 44, 171-183.
- Tuvani, M., Durante, G. (2018), "Coworking, the Sharing Economy, and the City: Which Role for the 'Coworking Entrepreneur'?", *Urban Science*, Vol. 2 (3), 83-104.
- Yu, R., Burke, M., Raad, N. (2019), "Exploring impact of future flexible working model evolution on urban environment, economy and planning", *Journal of Urban Management*, S2226585618302140. <https://doi.org/10.1016/j.jum.2019.05.002>
- PRISMA (2022), "PRISMA - TRANSPARENT REPORTING of SYSTEMATIC REVIEWS and META-ANALYSES", available at <http://www.prisma-statement.org/> (accessed 16 January 2022).

The rise of coworking spaces in the Italian Mezzogiorno during the COVID-19 pandemic

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ABSTRACT

Besides the digitalization, especially the change of work and living behaviour require new concepts and strategies to satisfy the new demand. This change is taking place from the classic flat preferably in the city centre, to flexible work and living concepts in more rural areas. This change is being enormously amplified by the current pandemic situation, as home offices are becoming more and more important and many people are relying on a workplace outside the office. Firstly, your own home is converted into a workplace, but especially in cramped conditions, this cannot be a permanent solution. Therefore, detached workplaces such as Coworking spaces near to home are getting more important and could reveal unexpected potentials or issues for the rural regions or the residents of the housing areas. Hence, a literature review is elaborated to identify the current state of science and technology regarding the implementation of Coworking spaces in residential areas. Further possible effects of Coworking spaces on the residential area or region are deduced by a qualitative analysis of the identified literature. Findings show on the one hand correlations between the implementation of a Coworking space and socio-cultural factors such as the well-being of the residents. On the other hand, economic effects on the region can be identified, as the potential of start-ups is growing, the commuting would be reduced and therefore residents would stay for a longer period of time in the direct neighbourhood and consume more goods there. The line of discussion is focused on the possibility of the implementation of Coworking spaces in existing residential buildings and the effects on the residential area or region.

Keywords

Systematic literature review, PRISMA, Coworking, Residential areas, Existing buildings.

1 INTRODUCTION

During the COVID-19 pandemic, many public and private employees and highly skilled professionals started working remotely for significant periods (remote working/teleworking). As a result, there has been a new demand for publicly owned new working spaces in Italy, following northern European countries' case (Bellandi et al., 2021; Mariotti et al., 2021). Within this context, in Italy a key role is played by the Associazione di Promozione Sociale “South Working – Lavorare dal Sud” (SW-LdS, www.southworking.org), which promotes the idea that people in remote working will be able to live, although for limited periods, in the South of Italy and the Italian inner areas, working in coworking spaces, called “*presidi di comunità*” (Militello and Mirabile, 2020). This strategy aims to positively impact territorial cohesion to reduce economic, social, and territorial divergences. The paper presents the case of a few coworking spaces settled in the South of Italy and subsidised by labour, social innovation, and local development policies. It describes the rationale behind their opening,

their business strategy, the supplied services, the type of users, and the effects on the local context they have had or aim to achieve. Four sections structure the paper. The introduction is followed by a paragraph dedicated to the definition of coworking space. Section 3 describes the Italian case, focusing on the policies promoting coworking spaces and the South Working association. Specifically, some coworking spaces are presented and the effects on the local context are discussed. Section four concludes the paper.

2 COWORKING SPACE

The advent of digital technology has contributed to the rise of alternatives to traditional workplaces, such as 'new workplaces', primarily coworking spaces, where self-employed and employed workers and small businesses can take advantage of social and professional interaction in order to reduce the risks of isolation (particularly in the case of home working) and foster trust and friendship relationships and new business opportunities. From the very beginning, coworking is a form of social innovation: a service that satisfies a social need (the creation of new workplaces) in a more effective way than existing alternatives and that, at the same time, favours the creation of new relationships and new collaborations. The most widespread type of new workplace is the coworking space defined as a "serendipity accelerator" to host creative people and entrepreneurs (Moriset, 2014). Coworking spaces allow "knowledge workers", who carry out activities with high technological, professional and research content and have self-employment positions, to carry out their activities by renting a workstation for a variable period, depending on their needs, and taking advantage of the services offered (i.e. secretariat, wi-fi connection, meeting rooms, kitchen, leisure spaces, training and coaching courses, baby-sitting) (Spinuzzi, 2012).

3 THE ITALIAN CASE

3.1 Policy interventions favouring coworking spaces

The first coworking space was developed in Italy in 2008. In 2020 Italian coworking registered 700 spaces in our country; of these, 119 were in the city of Milan since coworking is a predominantly urban phenomenon. During the COVID-19 pandemic period, the number of spaces decreased overall, but suburban and peripheral areas became more attractive for these new workplaces that could host remote workers, including south workers, and there is a renewed attention of local administrations towards these spaces (Manzini-Ceinar, Mariotti, 2021; Mariotti et al., 2022). Their intervention, from the outset, can be traced back to three main modes: labour, social innovation, and local development policies. The pandemic has redefined the balance.

1. Labour policy-oriented initiatives supporting coworking have taken the form of individual vouchers issued directly to workers, mainly freelancers. The first initiatives in this direction were born in 2013 by the City of Milan and the Tuscany Region. These measures proved effective in providing support to a particularly fragile category of workers and, at the same time, in promoting awareness and mapping of coworking spaces, thus indirectly supporting their diffusion. During the pandemic emergency, freelance workers were severely affected by the freezing of consultancy activities and received less compensation than employees and entrepreneurs (Pais et al., 2021); despite this, no administration seems to have found it helpful to introduce this instrument.
2. The second strand of public intervention is oriented toward social innovation through partnerships with the private social sector. In this case, public-private collaboration is played out in projects that go beyond financial support and often involve associations' management of public spaces. Coworking becomes an integrated service in the broader offer, within hybrid spaces aimed at supporting initiatives oriented to specific objectives but of general

interest: from family-work reconciliation to ecological transition to support for social entrepreneurship. During the pandemic emergency, the logic of co-design underlying these experiences favoured the reorganisation of the offer to respond to new needs while maintaining the objective orientation (Mariotti et al., 2021b). An example is the Municipality of Vimercate (MB, in north west), which signed an agreement with the cultural association Slowworking born in 2014, oriented to the promotion of "work at the pace of life", which also provides for the entrusting of a disused public space, which the association committed to redevelop. In this case, the space was interpreted as a facilitator for the community that had already formed around the association and its projects. The founders, whom we interviewed, state: "We were very clear that the goal had to be a public space, to make the project sustainable but also to give a civic relevance to what we were doing" and add "in fact, the coworking has become a cultural centre [...] freed from the ballast of the costs of renting space we have taken off in the design [...] this affects the coworking because here come people who are aware that they enter a place where they do not simply find a workstation but a group of active and socially engaged people". During the pandemic, they registered an increase in employees and men compared to the traditional female users, and they repurposed a shop window previously used to give visibility to artisan activities, in favour of an increase in workstations; moreover, thanks to a co-project that involved the municipality, Caritas, various associations in the area and the Fondazione delle Comunità di Monza e Brianza as co-financer, they offered summer and accessible centre in the coworking courtyard, open to the coworkers' children and to the children of the neighbourhood. A similar case is that of the space The Green Hub, born from the collaboration between the municipality of Cava de' Tirreni (SA, south) and the Terra Metelliana ETS Association - Circolo Legambiente, which "aims to make young people protagonists in the implementation of a physical and virtual space, a pole of excellence at European level, based on the innovative foundations (both technological and social) of the green-economy and sharing-economy". The hybrid form allows coworking spaces to be made available at reduced prices, especially for young people interested in starting a business in sustainability. During the lockdown, the centre was closed to the public but activities were reprogrammed digitally, including interviews with professionals who had returned to the area because of the pandemic.

3. The third strand of intervention, more explicitly oriented towards local economic development, focuses on the transformations following the pandemic. The first case of public coworking in Italy aimed at territorial expansion was recorded in 2011 in Veglio, a municipality of 500 inhabitants in the province of Biella (north west), thanks to funding from the Permanent Secretariat of the Alpine Convention to combat the depopulation of Alpine areas and reduce commuting. That experience came to an end over the years, and few others were launched in the following years, mainly due to difficulties on the part of the public in facilitating the development of economic communities arising in shared spaces. The pandemic created the opportunity to emerge new public work spaces, particularly in southern Italy and linked to the phenomenon of 'south working', the subject of this volume.

3.2 The role of coworking spaces, according to South Working

In March 2020, the Association "South working - Working from the South" "South Working – Lavorare dal Sud" (SW-LdS, www.southworking.org) was born within a group of young professionals and students linked to the "Community Global Shapers Palermo Hub" and united by the condition of expat or out-of-towner. Southworking promotes the idea that people in teleworking will be able to live, although for limited periods, in the South of Italy and the Italian inner areas, working in coworking spaces, called 'community garrisons' (*presidi di comunità*) (e.g., coworking, rural hubs, "new" public spaces, shared private spaces) that have

stations for agile work, as well as the mapping of services offered by them (Militello and Mirabile, 2020). This strategy aims to positively impact territorial cohesion to reduce economic, social, and territorial divergences. 230 spaces are currently associated with the South Working network, 63 are located in the South of Italy. These spaces are private (business lead) and public, and their main objectives are (Di Marino, Mariotti, 2022):

- diffuse coworking as a new way of working on hosting remote workers and south workers.
- Promote teleworking habits among entrepreneurs, freelance and employees.
- Raise awareness and create synergies with other peripheral areas.
- Attract south workers and retain talents (that moved to work to the north of Italy or abroad) to rural areas.
- Contribute to the economic, social and territorial cohesion, thus reducing inequalities.

While the public coworking spaces of ten years ago were promoted directly by the local administration, the initiative comes from private citizens who share an interest in the establishment of 'community garrisons' and for this, they get public support. This initiative comes from private citizens who share an interest in the establishment of 'community centres' and therefore receive public support. The initiative of people who take direct action for the economic development and attractiveness of the area in which they live is not new. Still, so far, they have been entrepreneurs. In this case, however, they are employees of companies whose headquarters are hundreds or thousands of kilometres away. This investment in local development is also strategic because housing choices depend not only on the possibility of working remotely but also on the quality of services available in an area. It is worth noting that coworking spaces are often located within structures that host other public services, especially cultural ones (museums, libraries), and this also allows a revitalisation of these activities. The library system of Vibo Valentia (south), for example, saw an increase in the number of workers in its halls during the pandemic and decided to dedicate a space to coworking. The initiative was stimulated by a young computer engineer working remotely in an emergency job, who says: 'I wanted to go back to the base, to my beloved land, to give something back [...] also to give other young people the chance to choose whether they want to leave or not'. The head of the library confirms: 'the young people who come here not only manage to work but also manage to commit themselves to the area'. Also, in the case of Castelbuono, a municipality of 8,500 inhabitants in the province of Palermo (south), the initiative came from a group of workers who had temporarily returned to their village: "We said to the mayor: let's do everything we need to do. We have a software engineer, a web designer, a lawyer, a project manager, a cybersecurity expert... just give us the chance to invest in our skills. And he said yes, partly because he knows us all well and considers us reliable". The mayor, who has made available unused space in the headquarters of the nature museum and the civic museum, comments: "We are demonstrating that villages and territories can be enhanced by bringing the excellence of our young people who have left and who can now make a contribution to our territories". The founders add: "We're doing it because this is our home, we wouldn't do it anywhere else, we're all volunteers, we're not interested in money, we're doing it with economic ambitions, we were interested in creating a place like this so that we could use it and so that dynamics could be created among us. A non-profit start-up has already been created in these rooms. The same ingredients - unused public spaces, the initiative of remote workers, attention to local development - can also be found in Tursi (MT), in Basilicata (south), where a coworking space has been opened in a former 17th-century convent, which now houses permanent exhibitions. The councillor for youth policy says: "The pandemic was an opportunity to have these professionals back in our area and it is an opportunity for us to have their professionalism at the service of the community". One of the founders' comments: "The building has been renovated but it is not lived in every day, in olden days; instead, with this

initiative we aim to bring this building and the historic centre back to life. [...] I don't intend to make a business out of this activity also because there is no way to do it through coworking in a small centre. It's more of an innovative service offered to the community, I invest in it. I'm aiming for sustainable tourism by attracting digital nomads. The coworking hosted two Sicilian professionals who, during their stay, made and published a video of the historic centre that went viral.

4 CONCLUSIONS

The pandemic has triggered a new or latent demand for public workspaces along the lines of successful experiences in northern Europe. Coworking spaces and community garrisons are imagined, in the long-term vision of the South Working proposal, as places in which to stimulate the local creative ecosystem and establish a fruitful relationship between the south worker community and the local communities impoverished over the decades not only in socio-economic terms but also in terms of human capital due to skilled migrations (Mirabile and Derito, 2020). In this context, the recent National Recovery and Resilience Plan (PNRR) provides resources to promote the expansion of broadband, the recruitment and development of human capital, with particular attention to women, and smart-working in public administration. The expansion of broadband is an unavoidable precondition for enhancing measures to support distance working - and therefore also South Working -, female participation in the digital economy and the promotion of entrepreneurship (including female entrepreneurship), the training of young people, and the digitalisation of different age groups. Investments in broadband can also bring benefits in terms of work-life balance and change the way people are valued, favouring the achievement of objectives rather than mere presence in the office. In addition, the PNRR also envisages a plan to create Territorial Poles for recruitment, training, coworking and remote working, which could build on the experience of the community garrisons and coworking spaces created during the pandemic.

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REFERENCES

- Bednar P., Mariotti I., Rossi F., Danko L. (2021), "The evolution of coworking spaces in Milan and Prague: spatial patterns, diffusion, and urban change". In Orel, M., Dvoulety, O., Ratten, V., eds., *The flexible workplace: coworking and other modern workplace transformations*, Springer Nature, 59-78.
- Di Marino M., Mariotti I. (2022), *Regenerating peripheral regions of Norway and Italy. Profiling coworking and exploring the COVID-19 effects*, paper presented at the IV International Forum of Gran Sasso and Euro-African Conference of Rectors, Teramo, September 30, 2021 – October 2, 2021.
- Italiancoworking (2021), *Italian coworking survey 2021, I numeri del coworking in Italia*, 30 gennaio 2021, <https://www.italiancoworking.it/i-numeri-del-coworking-in-italia>
- Manzini Ceinar, I., Mariotti, I., (2021), *Teleworking in post-pandemic times: may local coworking spaces be the future trend?* *Romanian Journal of Regional Science*, 15(1): 52-76.

- Mariotti I., Di Marino M., Akhavan M. (2021a), “The emergence of coworking models in the face of pandemic”, In Bryson J.R., Lauren A., Reardon L., Ersoy A., eds., *Living with Pandemics: People, Place and Policy*, Edward Elgar, 129-139.
- Mariotti I., Manfredini F., Giavarini V. (2021b), *La geografia degli spazi di coworking a Milano. Una analisi territoriale*, Milano Collabora, Comune di Milano, https://collaboriamo.org/media/2021/07/Coworking_a_Milano.pdf
- Mirabile M., Derito M. (2020). *Il South Working: azioni e strumenti per le comunità*, in «Urban@it», Centro nazionale di studi per le politiche urbane, 7 ottobre 2020, disponibile online.
- Moriset, B. (2014), *Building new places of the creative economy The rise of coworking spaces*. 2nd Geography of Innovation International Conference 2014 Utrecht University, Utrecht, 23-25 January.
- Pais I., Manzo C., Gerosa A. (2021), *La trasformazione dei coworking di Milano nell'emergenza pandemica*, Milano Collabora, https://collaboriamo.org/media/2021/07/Coworking_a_Milano.pdf
- Spinuzzi, C. (2012), *Working Alone, Together: Coworking as Emergent Collaborative Activity*. *Journal of Business and Technical Communication*, 26(4), 399–441. <https://doi.org/10.1177/1050651912444070>

SESSION 1C: SUSTAINABLE WORKSPACES

Sustainable Development Goals (SDGs) and knowledge work – a responsible match?

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ABSTRACT

The responsible workplace for knowledge work is multifaceted phenomena. It is an attraction and value-statement for individual employees. It is part of the sustainability agenda of the employer.

So far sustainability-related practices in workplace management have been connected to ecological, economic and social factors. In terms of ecological sustainability energy efficiency is a much used sustainability indicator. It is also a known fact that an organisation can decrease a large part of their emissions by improving their methods of business travel. Space use efficiency can be identified as an economic sustainability factor as occupying less space usually means smaller rental cost. There are different environmental tools to develop green practices connected to the working environment. All United Nations members adopted the 2030 Agenda for Sustainable Development in 2015. At the core of the agenda are 17 Sustainable Development Goals (SDGs). Since, many organisations, public or private, in different countries are committed to these SDGs. However, how these SDGs are practised in knowledge work and in responsible workplace management is not investigated thoroughly. Therefore, the indicator framework for SDGs needs more intense conceptual and methodological considerations to support the development of responsible workplace management. The goal of this paper is to connect SDGs and sustainable practices of knowledge work environments. The research question asked is: What are the potential SDGs to indicate the responsibility of knowledge in the workplace? How can these SDGs be practised and measured? The method to this qualitative study is focus group interviews. The focus group will consist of workplace management practitioners in Finland. The qualitative and explanatory approach opens the insights to adaptation of SDGs in workplace management. The result of this provides insights to different SDGs as part of responsible workplace management.

Keywords

Sustainable Development Goals, Knowledge workplace, Responsibility, Indicators, Workplace management, Sustainable workplace.

1 INTRODUCTION

The quest of organisations for sustainability may include planned strategic efforts and day-by-day efforts to de-naturalise patterns of consumption in the workplace. There is a broad consensus that corporate greening shall be achieved by minimising environmental impacts from core business (greening products and services) as much as from workplace activities (Süßbauer and Schäfer, 2018). Policies intended to reduce the environmental impact of organisations are usually focused on formal and organisational-level practices such as green technologies, sustainability reporting, pollution prevention measures or the implementation of

environmental management systems (Boiral et al., 2015). These organisational-level practices are essential to environmental management. The sustainability agenda got new inspiration and framework when Sustainable Development Goals (SDGs) were published by United Nations 2015 (UN, 2015). The global adoption of the SDGs presents a major change in the institutional environment in which companies and organisations operate. Aligning the core business and support functions with the SDGs to improve positive and reduce negative impacts is a key strategic sustainability challenge for companies. The SDGs have been designed to consider the environment, people, human rights, regional and cultural differences, economic perspectives, and their applicability to all parts of the world. (UN, 2015). However, many environmental initiatives are based on individual, voluntary, and informal behaviours, which are not considered by formal management systems (Boiral et al. 2016). The responsible workplace for knowledge work is multifaceted phenomena. Even though the core business of the organisations varies and sets different avenues to develop SDG agenda it is essential to investigate how these SDGs are practised in knowledge work and in workplace management. The goal of this paper is to connect SDGs and sustainable practices of knowledge work environments. The research question asked is: What are the potential SDGs to indicate the responsibility of knowledge in the workplace? How can these SDGs be practised and measured?

2 SUSTAINABLE DEVELOPMENT GOALS AND WORKPLACE MANAGEMENT

2.1 Facility management and sustainability development goals

All United Nations members adopted the 2030 Agenda for Sustainable Development in 2015. In the core of the agenda are 17 Sustainable Development Goals. The SDGs are an ambitious step towards sustainable development, taking a much broader view of sustainability than ever achieved previously (Fleming et al, 2016). Implementing the SDGs specifically invites the creation of “an integrated, holistic, multi-stakeholder approach”. This implies the need for systems thinking in practice, a tradition that draws on systems theories, tools, and techniques able to facilitate better conversation and cooperation between agencies (Reynolds et al. 2017). Facility management (FM) and workplace management (WM) are based on collaboration between different stakeholders. According to Junghans (2011) FM contributes directly to a sustainable development of the built environment within the three major areas of responsibility: support and improvement of the “main activities”, preservation and development of supply of services in the areas of both “space and infrastructure” and “people and organisation”. The FM sector is engaging with a sustainable development agenda as the whole built environment continues to evolve (Opoku & Lee, 2022). A study by the International Facility Management Expert Centre (IFMEC) in the Netherlands revealed that strategic sustainable FM has the potential for the realisation of the 17 SDGs. The FM profession has the advantage of incorporating the SDGs at all levels of organisation, from corporate to the operational levels, and can influence behavioural changes at the individual level by providing the enabling environment for sustainable practices (IFMEC, 2018). Table 1 is summarising the SDGs and the contribution of FM.

Table 1. FM and sustainable development goals (applied from IFMEC 2018 and Oboku and Lee, 2022)

SDG number	Facility management contribution
1 No poverty	Providing economic and social improvement for individuals through job creation
2 Zero hunger	Organising the food supply chain in many organisations including companies, schools, hospitals

3 Good health and well-being	Co-creating the workplace and the working condition of employees
4 Quality education	Managing educational facilities globally, improving quality education for all
5 Gender equality	Providing equal rights in wages and career opportunities for women, demonstrating gender equality in the sector
6 Clean water and sanitation	Providing the efficient management of water in buildings by reducing water losses through avoidable leakages
7 Affordable and clean energy	Managing building energy usage
8 Decent work and economic growth	Providing economic and social improvement for individuals through job creation
9 Industry, innovation, and infrastructure	Adopting relevant technologies such as artificial intelligence (AI), Internet of Things (IoT) as parts of the sector's smart building agenda
10 Reduced inequalities	Providing a model for other sectors to follow in terms of its record of a diverse workforce of all nationalities
11 Sustainable cities and communities	Being responsible for the sustainable maintenance of buildings in cities and communities
12 Responsible consumption and production	Promoting policies and practices that source food and other resources through sustainable and circular procurement strategies to ensure only healthy products (eco-friendly) with no or minimum damage to health and the environment
13 Climate action	Taking care of policies and actions, which will lower the sector's CO ₂ emission and carbon footprint
14 Life below water	Taking care of policies and actions which will lower the sector's CO ₂ emission which could be absorbed into oceans and seas which is critical for the planet
15 Life on land	Buying wood-related products with a sustainable certificate to prevent the loss of biodiversity
16 Peace, justice, and strong institution	Maintaining safety and security in and around building facilities
17 Partnerships for the goals	Working in partnership with people, organisations, and authorities

Even though the FM profession has a potential role to play towards the realisation of SDGs, Kwawu et al (2011) argue that facility managers will require knowledge and skills to be able to fully embrace the opportunities of integrating sustainability principles into core FM business strategies and operations.

2.2 Workplace management and sustainable development goals

Workplace management is a complex matter that requires more strategic attention to add value for various stakeholders (Appel-Meulenbroek and Danivska, 2021). The practices of new ways of working, such as flexible, activity-based, agile, and smart working, have been implemented over the last 30 years with origins dating back to the 1970s (van Meel, 2011). The sustainability focus has been a lot in building space optimisation for the most efficient usage (Junghans, 2011). There are different environmental tools, e.g., Lean thinking (Jylhä, 2022) can enhance the development of green practices connected to the working environment. For real estate and workplace managers, learning to see waste and reducing it, means doing the right things with as few resources as possible. This leads to resource efficiency and effectiveness meaning, for

example, lower costs, future-proofed allocation of resources, and contribution to the sustainability goals (Jylhä, 2022). In terms of ecological sustainability an organisation can decrease a large part of their emissions by improving their methods of business travel. Redlein et al. (2020) argues that WM needs a collaboration with Human Resource Management (HRM), Facility Management (FM), Corporate Real Estate Management (CREM), and other support functions, like marketing and the support of management. WM is a collaborative task towards aligning the workplace with the organisation and the employees using it (Danivska and Appel-Meulenbroek, 2022). Sustainable Human Resource Management (SHRM) takes into consideration the influence of internal and external factors such as social and environmental policies and regulations, governmental and community pressures, consumers' needs, and employees' welfare (Lucio and Stuart, 2011). Human resource managers are in a preferable position to promote the sustainable development of organisations (Chang and Kuo, 2008; Hitchcock and Willard, 2009) by influencing employees' activities and changing employees' working environment through behavioural patterns (Timur and Timur, 2016). In terms of digital workplace and green IT (Information Technology) Bengtsson & Ågerfalk (2011) state that information systems can play a central role for improving sustainability indicators and routines- Thereby they constitute an important change agency. According to Thakore et al. (2022) the balance between various contextual themes and processes, such as economic activities, ecological constraints, social behaviour and influences, organisational behaviour and growth, cultural influences and the political environment are important parts of sustainability. Responsible WM includes metrics for physical, social, and digital workplaces. Fleiming et al. (2017) argue that the process of identifying the goals and indicators must include conceptualisation and operationalisation to warrant the relevant indicator framework. The number of indicators may differ depending on the theme or issue: social and economic themes may require a larger number of indicators. There can also be correlations between potential indicators. Practical considerations such as data availability play a crucial role as well as an agreed maximum number of indicators per theme (Hák et al., 2016). While SDGs and their targets are assessed by indicators (both quantitative and qualitative), a special attention must be paid to neglected or insufficiently explored SDG aspects: immeasurable (e.g., Bell and Morse, 1999, Attaran, 2006,) and intangibles (e.g., Burford et al., 2013). Thakore et al. (2022) emphasise that the emerging theory of sustainability requires organisations to drive their workplace strategies based on the principle of resource efficiency and resilience. It is important to use valuable human resources effectively when making a resilient organisation. Thorough consideration of how the SDGs can be part of responsible WM on strategic, tactical, and operational level is needed.

3 METHOD

The qualitative and explanatory approach opens the insights to adaptation of SDGs in workplace management. The method chosen to respond to the research questions is a focus group interview. The focus group consists of workplace management practitioners in Finland. Focus group or focus group interview is a qualitative technique for data collection. A focus group is "a group of individuals with certain characteristics who focus discussions on a given issue or topic" (Anderson, 1990, p.241). According to Denscombe (2007, p.115), "focus group consists of a small group of people, usually between six and nine in number, who are brought together by a trained moderator (the researcher) to explore attitudes and perceptions, feelings and ideas about a topic". A focus group interview provides a setting for the relatively homogeneous group to reflect on the questions asked by the interviewer. The research design in this study contained two different focus group interviews contributed in workshops related to the topic of future resilient working environments and WM. There were a total of 27 different

organisations and their representatives participating in these group interviews that took place in 2021. The discussed results were documented in a digital group working tool. The discussed questions were:

- Focus group 1: Which SDG goals are the most important for knowledge work?
- Focus group 2: In which SDG goals workplace management has the strongest impact?

In focus group 1 interview the participants were first briefly introduced to SDG goals in general. As individual work they were then asked to pick a maximum of six SDGs they found the most important ones for knowledge work. Then the findings to explore the ideas were discussed in smaller groups with questions:

1. What kind of actions, ways of working, knowledge-based work culture, could be connected to SDG goals?
2. How could hybrid ways of working influence climate actions and responsibility?

In focus group 2 interview the participants were at first shortly introduced to the results of the first interview. After that all participants voted individually on which three SDGs they found to have the strongest impact on responsible WM. Then the findings were discussed and explored in smaller groups the similar way as in focus group interview 1. In the focus group discussions, one of the aspects was to identify different stakeholders and their roles in SDGs. Also, discussing the SDGs from individual, team, or organisational level, plus identifying social, digital, and physical aspects to these SDGs were encouraged. The focus group interview documentation was analysed in the peer group among five researchers. After analysis the summaries of the findings were documented.

4 RESULTS

4.1 Importance and impact of sustainability development goals

In focus group 1 interview the identified top three SDGs gaining 17 votes per each were:

- SDG 3 Good health and well-being
- SDG 12 Responsible consumption and production
- SDG 13 Climate action

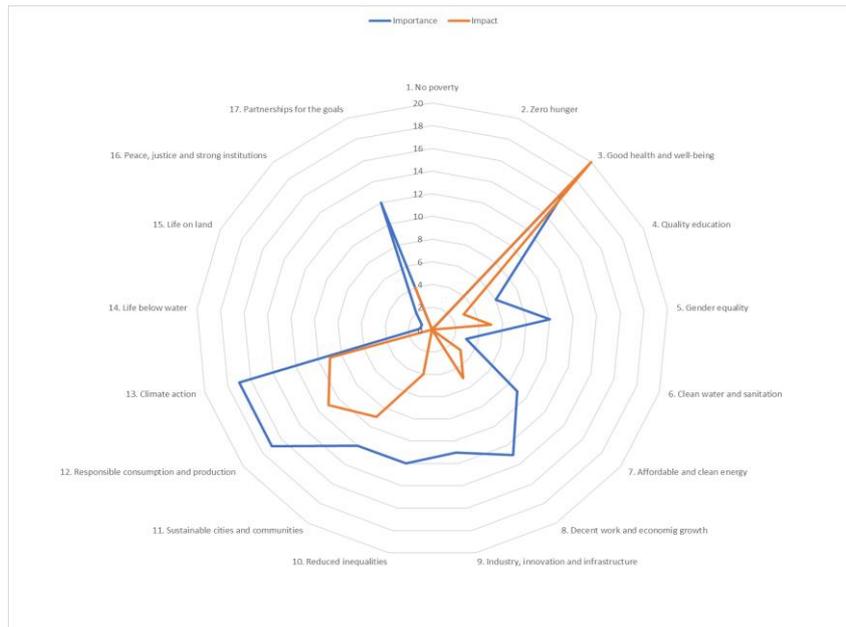
It is notable that the variation between identified SDG goals was large as 15 out of 17 SDGs received votes.

In focus group 2 interview the top four SDGs were

- SDG 3 Good health and well-being
- SDG 12 Responsible consumption and production
- SDG 11 Sustainable cities and communities
- SDG 13 Climate action

The SDG 3 Good health and well-being resulted with 20 votes, SDG 12 Responsible consumption and production with 11 votes, and both SDG 11 Sustainable cities and communities and SDG 13 Climate action with 9 votes. The same three SDGs as in focus group 1 interview were identified supplementing with SDG 11 Sustainable cities and communities. The summary of these SDG voting results can be found in Figure 1.

Figure 1. Importance and impact of SDGs according to the focus group interview results



According to the results it can be clearly notified that SDG 3 Good health and well-being and SDG 12 Responsible consumption and production are considered as very important SDGs where also the possibility to have an impact is high. In focus group discussions it was noted that SDG 3 includes diverse perspectives: good indoor air and healthy buildings are managed by technical maintenance services, HRM is responsible for the support of healthy work life while the catering services have their role in healthy food provision. The physical and cognitive ergonomics are also part of good health and well-being in the workplace. Designing office layouts with flexible and adjustable furniture, and actively promoting walking meetings, encourage physical activities that increase well-being during the office hours. This discussion shed light to the pattern that one SDG can have many stakeholders. SDG 12 Responsible consumption and production as part of responsible WM was somewhat harder to describe in focus group interviews. In discussions, it was referred to SDG 17 Partnerships for the goals, as in practice WM is a lot about managing the service providers and other stakeholders. Then the responsible way of procurement plays a key role. When discussing SDG Sustainable cities and communities, it was noted that the sustainable strategies cities and municipalities have should be identified as the basic layer. Cities may have strategies and roadmaps for sustainable transportation or carbon neutrality. Also, how existing buildings and infrastructures are valued in urban development and permitting policies may vary between cities. On the other hand, SDG 13 Climate action, seemed to tie quite many earlier SDG discussions together as aims to decrease CO2 emission has to do with responsible consumption, partnerships, and well-being. In focus group discussions it was noted that SDG 7 Affordable and clean energy did not come to light when voting for impact. The role of energy in a responsible built environment should not be forgotten. For example, when deciding where and in what kind of office building the organisation should be located, energy efficiency and the use or renewable energy sources can be influenced in the context of WM. Also, some SDGs that one may consider important and impactful such as SDG 9 Industry, innovation and infrastructure, were not recognised as very impactful in WM.

4.2 Perspectives to indicators for responsible WM

A regenerative work culture enables responsible WM, which contributes to individual, team and organisational levels. The pandemic era and remote working reduced commuting and thus commuting emissions. Similarly, well-being was identified as an important factor for

responsible WM as working from home increased. The collaboration with HRM is essential and the new indicators for work satisfaction and workplace experience have been created based on the factors related to individual life situations and living conditions as well as the quality and nature of the work. The lessons learned during the pandemic era will feed directly into responsible WM. The SDGs serve well as public influencers, but they need to be structured in everyday life. The goals, subgoals and indicators were discussed in the groups to identify those SDGs with high impact. As an example, good indoor air is a topic that many stakeholders and service providers, such as building technology experts, cleaning companies, interior design firms and furniture manufacturers, have an impact on. The components of the phenomenon relating to the working environment were broken down according to the owner or owners of the phenomenon. These areas may be divided into even smaller entities. The next layer underneath the owners can be divided into functionalities, which can then be specified with a metre. Responsible WM is measured by a range of metrics of the digital, physical, and social work environment. Energy consumption is a typical measure for the physical environment. Social working environment includes well-being at work and healthy working conditions. Principles for commuting, hybrid practices and working from home are metric contents for the verification of responsible WM. This explains that the responsible WM indicators can have different business owners within the organisation or with partners and service providers. Responsible WM affects more than one SDG with the same indicator. The 17 SDGs are a systemic entity that also materialises in the systemic model of responsible WM. A responsible way for the end-user to operate in the working environment may affect more than one SDG at a time. For example, the provision of vegetarian food, its volume, and the measurement of food waste, can be used to monitor both SDG 3 Health and well-being and SDG 12 Responsible consumption and production, as well as SDG 17 Partnerships for the goals. Connecting SDG 14 Life below water, to the goal of responsible WM may seem distant. The importance of water as a responsible workplace experience, when further explored, is highlighted. This is related to the SDG 12 Responsible consumption and production, and SDG 6 Clean water and sanitation, as well. The use of single-use plastic bottles can be minimised by placing, displaying, and providing drinking water filling points for durable bottles as part of a work environment service for responsibility and well-being. It would be important to make it visible to the users what the different concepts and measures contribute to. This would strengthen the concreteness of the objectives that have become known to all, while also strengthening the individual's commitment to these objectives.

5 CONCLUSION

According to this study, a responsible working environment in knowledge-based work highly relies on SDG 3 Good health and well-being and SDG 12 Responsible consumption and production. Those may be considered as the most important and impactful SDGs in WM. The identified SDG indicators in WM may serve more than one SDG at the time and they may be owned or provided by different functions or partners. These results are aligned with the earlier studies e.g., about FM and SDGs, as well as contribute to sustainable HR practices. The greener future can be achieved on an individual and organisational level by making the SDGs transparent, operational, and shared by different stakeholders. This would mean joint commitment to the relevant SDG objectives and aligning the goals into every day management practices with relevant measures. In the end, the choices and targets should be clearly communicated and visible to the individual end-user. The focus group interviews took place while the COVID-19 pandemic was ongoing and some restrictions and recommendations for how to utilise office spaces took place. General discussion was very much focused on the hybrid ways of working and the mystery of future resilient working environments. As the

geopolitical situation in Europe and its neighbourhood changed, SDGs such as SDG 16 Peace, justice and strong institutions, SDG 2 Zero hunger, and SDG 6 Clean water and sanitation, are even more considered as basic needs. The applicability of the focus group interviews is limited to time of peace where knowledge work is possible. In addition, the findings could implicate that the WM practitioners have not familiarised themselves in the SDG goals and hence, do not perhaps identify themselves as having a role and influence when applying SDG goals into practice. SDGs are widely considered as important goals and different organisations have made action plans and roadmaps to achieve them. However, according to the focus group interviews SDGs are not yet considered as the everyday framework for sustainable and responsible working environments. More concretising is clearly needed on how different SDGs apply to knowledge based working environments. It is noteworthy that it is not a game for one function only, but it needs wide stakeholder support within the organisation and with its service providers and partners. To conclude, the practices, measures, and ways of communicating SDG supported working environments need to be studied further from the perspective of different stakeholders. Research on how to integrate WM closer to HRM when developing collaborative ways of aiming SDG goals would benefit organisations. Responsible procurement research of different methods, criteria and purchaser-provider models would be useful to different stakeholders. According to this study there is novelty in demonstrating SDGs together with WM and hence the subject would require more research.

REFERENCES

- Anderson, G. (1990), *Fundamentals of educational research*. London: The Falmer Press.
- Appel-Meulenbroek, R., Danivska, V. (eds.) (2021), *A Handbook of Theories on Designing Alignment between People and the Office Environment. Transdisciplinary Workplace Research and Management*, vol. 1, 1 edn, Routledge, London. <https://doi.org/10.1201/9781003128830>.
- Attaran, A., (2006), Correction: an immeasurable crisis? A criticism of the millennium development goals and why they cannot be measured. *PLoS Med.* 3 (5), e224. <https://doi.org/10.1371/journal.pmed.0020318>
- Bell, S., Morse, S. (1999), *Sustainability Indicators: Measuring the Immeasurable? Earthscan Publication*, London, UK. BIO Intelligence Service.
- Bengtsson, F., Ågerfalk, P. (2011), Information technology as a change actant in sustainability innovation: Insights from Uppsala. *The Journal of Strategic Information Systems.* 20. 96-112. <https://doi.org/10.1016/j.jsis.2010.09.007>
- Burford, G., Hoover, E., Velasco, I., Janousková, S. Jimenez, A., Piggot, G., Podger, D., Harder, M.K. (2013), Bringing the “missing pillar” into sustainable development goals: towards intersubjective values-based indicators. *Sustainability* 5 (7), 3035–3059. <https://doi.org/10.3390/su5073035>
- Chang, D., Kuo, L.R. (2008), The effects of sustainable development on firms’ financial performance - an empirical approach. *Sustainable Development* 16: 365–380. <https://doi.org/10.1002/sd.351>
- Danivska, V., Appel-Meulenbroek, R. (Eds.) (2022), *A handbook of management theories and models for office environments and services*. (Transdisciplinary workplace research and management). Routledge. <https://doi.org/10.1201/9781003128786>
- Denscombe, M. (2007), *The good research guide for small-scale social research projects*. (3rd ed.). New York: McGraw-Hill.
- Fleming, A., Wise, R., Hansen, H. Sams, L. (2017), The sustainable development goals: A case study. *Marine Policy.* 86. 94-103. <https://doi.org/10.1016/j.marpol.2017.09.019>

- Hák, T., Janoušková, S., Moldan, B. (2016), Sustainable Development Goals: A need for relevant indicators, *Ecological Indicators*, Vol. 60, 565-573, <https://doi.org/10.1016/j.ecolind.2015.08.003>.
- Hitchcock, D.E., Willard, M.L. (2009), *The Business Guide to Sustainability: Practical Strategies and Tools for Organisations*, Earthscan: Oxford, UK.
- IFMEC. (2018), *Facility Management Approach to Realising the Sustainable Development Goals*; International Facility Management Expert Centre (IFMEC): Roden, The Netherlands.
- Junghans, A. (2011), State of the Art in Sustainable Facility Management. Paper presented at the 6th *Nordic Conference on Construction Economics and Organisation*, 13–15th April Copenhagen, Denmark, in the Occupations, Edward Elgar.
- Jylhä, T. E. (2022), The Toyota Production System: Applying the concept of waste in real estate management. In Danivska, V., Appel-Meulenbroek, R. (Eds.), *A Handbook of Management Theories and Models for Office Environments and Services*, 152-162, Taylor & Francis. <https://doi.org/10.1201/9781003128786-13>
- Kwawu, W., Elmualim, A. (2011), Sustainability in facilities management: A review of drivers and policy issues. In *Proceedings of the 27th Annual ARCOM Conference*, Bristol, UK, 5–7 September 2011; Egbu, C., Lou, E.C.W., Eds.; Association of Researchers in Construction Management: Reading, UK, 1185–1194.
- Lucio, M.M., Stuart, M. (2011), The state, public policy and the renewal of HRM. *International Journal of Human Resource Management* 22 (18), <https://doi.org/10.1080/09585192.2011.622915.3991-367>
- van Meel, J. (2011), The origins of new ways of working: Office concepts in the 1970s. *Facilities*. 29. 357-367. <https://doi.org/10.1108/02632771111146297>
- Opoku, A., Lee, J.Y. (2022), The Future of Facilities Management: Managing Facilities for Sustainable Development. *Sustainability*, 14, 1705. <https://doi.org/10.3390/su14031705>
- Redlein, A., Höhenberger, C., Turnbull, P. (2020), Workplace management. In A. Redlein (Ed.), *Modern Facility and Workplace Management*. Switzerland: Springer International Publishing.
- Reynolds, M., Blackmore, C., Ison, R., Shah, R., Wedlock, E. (2017), *The Role of Systems Thinking in the Practice of Implementing Sustainable Development Goals*. https://doi.org/10.1007/978-3-319-63007-6_42
- Süßbauer, E., Schäfer, M. (2018), Greening the workplace: conceptualising workplaces as settings for enabling sustainable consumption, *International Journal of Innovation and Sustainable Development*, Vol. 12, 3, 327-349, <https://doi.org/10.1504/IJISD.2018.10012682>
- Timur, S., Timur, A.T. (2016), Employee Ownership and Sustainable Development in Tourism: A Case in North Cyprus. *Sustainable Development* 24, 89–100. <https://doi.org/10.1002/sd.1610>
- Thakore, R., Kavantera, A., Whitehall, G. (2022), Systems-thinking theory. Decision-making for sustainable workplace transformations. In V. Danivska, & R. Appel-Meulenbroek (Eds.), *A Handbook of Management Theories and Models for Office Environments and Services*, 25-35, Taylor & Francis. <https://doi.org/10.1201/9781003128786-3>
- United Nations (UN) (2015), *Transforming Our World: The 2030 Agenda for Sustainable Development*. United Nations. Available online: <https://sdgs.un.org/2030agenda> (accessed on 25 January 2022).

Sustainability in office buildings: a comparison in the measurement of environmental impacts

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ABSTRACT

Users and not buildings are responsible for environmental degradation. Even if the in-use phase of building life cycle consumes more resources, the construction industry has principally focused on design and construction stages. Several studies carried out energy evaluation of office buildings to improve environmental impact, but energy is just one component. Moreover, most efforts have focused on technologies, which improve buildings' efficiency, but over the long term the effectiveness depends on users' behaviours. Therefore, sustainability science needs a solution-oriented approach to explain the complex human-nature interaction in the built environment during the in-use stage of office buildings. To overcome the gap, the present research develops a model, based on a sustainability index, namely Ecological Footprint (EF). The objective of the method is to identify the environmental impact of office buildings during their in-use stage by highlighting the effects of users' behaviours and occupancy. The model is based on nine addenda (Built-up, Energy Consumption, Water Consumption, Material Consumption, Food & Drink, Mobility, Waste Generation, Recycle Potential, and Occupant). To test the model, the present research interviews the facility managers of three companies on year 2020 data. The comparison demonstrates the importance of monitoring users' behaviours to minimise office buildings footprints. Indeed, in all case studies the Food & Drink addendum represents a high percentage of the total footprint. The main limit of the research is the collection of data. All the facility managers found it difficult giving data about consumptions of a specific asset, as they have some general expenditures for consumption. Moreover, other information, such as the amount of hours each employee spends in the building, are collected in different ways and makes it hard to define a standard procedure for data collection. Therefore, the paper comments on the results and gives back some possible overcomes of the limits.

Keywords

Environmental sustainability, Environmental impact, User behaviours, User occupancy.

1 INTRODUCTION

According to the U.S. Energy Information Administration (2013), office buildings are responsible for 20% of total commercial buildings' energy consumption. Generally, Dixit et al. (2012) identify office buildings as the largest consumer of energy worldwide. The great challenge of the XXI century is introducing in the global market sustainable development (SD), defined as the balance between strategies, technologies, innovation, and ecosystems (Vollenbroek, 2002). To introduce SD in real estate, office buildings represent a key element. The European Union, which is working to make Europe the first climate-neutral continent by 2050 (Green Deal, 2019), has focused on the construction industry by establishing several legislative frameworks since the beginning of the new Millennium (Economidou et al., 2020). These directives (such as, Energy Performance of Buildings Directive 2010/31/EU or Energy Efficiency Directive 2012/27/EU) concentrate on the building energy expenditures. However, the European building stock is far from being sustainable (Jiménez-Pulido et al., 2020).

Estimates highlight that only 25% of the existing European buildings complies with the current sustainable standards (Verma, 2020). On the other hand, a literature review on sustainability in the construction field (Limac et al., 2021) shows that most sustainable applications focus on the optimization of design and construction phases of building life cycle (BLC). This represents a limit of the existing literature, especially considering that the in-use stage of BLC has a greater impact on consumption (Menassa, 2011). In addition, those studies that analyse the in-use buildings minimise the energy consumptions (Yeheyis et al., 2013). Improving building energy performance has a positive influence on buildings' environmental impact, but energy is just one component of consumption. Indeed, buildings are not just consumers of natural resources and energy, but they play an important role in satisfying society's needs (Doan et al., 2017). United Nation's Sustainable Development Goals (SDGs) are the key parameters to manage the built environment through sustainable development (Goubran, 2019). Several countries and international organisations have developed different rating systems to assess buildings' performance (Azhar et al., 2011). Certified buildings are considered as consuming less energy and materials, providing a better environment, and contributing to a better reputation of the property (Azhar et al., 2011). However, globally, more than 600 different sustainable certifications have been developed (Gui and Gou, 2020), which makes comparisons of buildings' sustainable performance hard. Each rating system is the result of building standards that vary among countries (Rivas et al., 2016). For example, BREEAM is based on European Standards, while LEED from the North American ones. They also use different categories to identify the environmental claims and different weights to evaluate the identified categories. Finally, Green Certifications fail in assessing building (in-)efficiency (Brownell, 2019). Green Certifications do not assess the effect of users' behaviours in the buildings' environmental impact (Rivas et al., 2016). Wackernagel and Rees (1996) pointed out that "It might be sustainable to operate a gas guzzling Rolls Royce if it was shared among twenty friends and maintained for a long time. On the other hand, it might be unsustainable for everybody to own an electric car". If this concept is translated into the building field, it would express that a high-performance building may be sustainable if shared among users. Therefore, the identification of the effects of users' behaviours in the environmental impact of buildings become a key point to evaluate buildings' (in-)efficiency. The present research reasons on this concept by proposing a new conceptual model for office buildings, based on the Ecological Footprint (EF) index. After a literature review on the applications of EF into the built environment, the model is introduced. Then, the results report the application of the model on three case studies. Finally, the discussion presents the limitations and future developments of the research.

2 ECOLOGICAL FOOTPRINT IN THE BUILT ENVIRONMENT

The Ecological Footprint index (EF) has been firstly developed by Wackernagel and Rees (1996). EF has been established to compare demand and supply of resource consumption. The demand is represented by the footprint of a given population. While the supply is the biocapacity of the ecosystem to absorb emissions and regenerate resources produced and consumed by the population. Biocapacity depends on the number of lands available on the ecosystem and the degree of technology of the ecosystem. For humans, the ecosystem is represented by the Earth; thus, the biocapacity is defined by the equivalent productive lands, which are built-up land, forest land, fishing land, pastureland, cropland, and CO₂ sinks (Wackernagel and Rees, 1996). EF is a scalable index, that can assess the environmental impact of ecosystems through different lenses (Brownell, 2019). EF's possibility to assess the environmental impact of a country, a person, a city, or a building is its first strength. By comparing footprint and biocapacity, EF expresses the effects of the population's activity on

the environment through a meaningful unit of measurement, namely the global hectare per year (gha). EF is based on converting impact sources (such as, emitted pollutants and consumed materials) into gha (Wachernagel and Rees, 1996). To do it, the Global Footprint Network (GFN)², the international body responsible for the EF index, defines the factors, namely World Yield Factor (WYF), which converts impact sources in tons of CO₂, and Equivalence Factor (EF), which converts tons of CO₂ in gha. The factors are defined globally by comparing the Earth's biocapacity with the human footprint. This converting system based on international analysis is the second strength of EF. Indeed, EF can overcome one of the Green Certifications' limits, as it would allow cross-countries comparison based on equivalent factors (Bastioni et al., 2006).

2.1 Ecological Footprint index in the construction industry

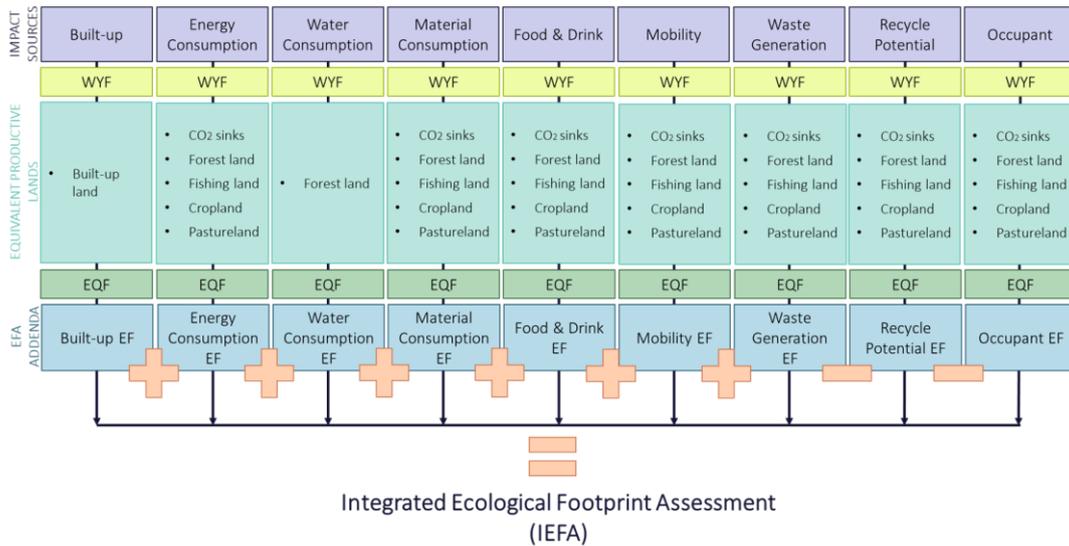
The interest in applying the EF in the construction sector started at the beginning of the Millennium. First, Wood and Lenzen (2003) developed a hybrid ecological footprint to evaluate the gas emissions of a case study over the generic land disturbance. Second, Bastianoni et al. (2006) used EF to develop a model for assessing environmental performance of the construction of two buildings. They used the embodied energy to convert the use of materials during construction into equivalence productive lands. Third, Acosta and More (2010) were the first to implement an Ecological Footprint Assessment (EFA) to evaluate the building's environmental impact of a company. However, Jin et al. (2009) critiqued Acosta and More study because EFA could not track the environmental impact overtime as it was applied once over the building life cycle. They tried to overcome the problem of time by integrating system dynamics, which increased the complexity of the application. Finally, Husain and Prakas (2018) developed a framework based on EF for all stages of the building life cycle. Even if this is a good compromise for assessing buildings' environmental impact overtime, the study of Husain and Prakas still failed in assessing the effects of users on the building's environmental impact. In this regard, Brownell (2019) highlighted the relevance of evaluating the impact of building in-use. Brownell (2019) proposed a theoretical framework which included the estimation of operational footprint, which assesses the impact of users' behaviours. However, Brownell (2019) did not implement the framework through calculations. The state of the art shows the potential of EF in highlighting users' effects in the evaluation of buildings' environmental impact. However, some of the previous applications of EF present some limitations. The previous studies identified different impact sources that evaluated different resource consumptions and pollutants emitted. Moreover, the impact sources do not consider all the elements that affect the impact. Finally, just Brownell (2019) stressed the importance of the users' behavioural effects, without implementing any calculations. Therefore, a complete framework is still missing for assessing the environmental impact of buildings through detecting the effects of users' behaviours and occupation.

2.2 Integrated Ecological Footprint Assessment

Based on the state of the art, the present research proposes a new application of the Ecological Footprint for assessing the environmental impact of in-use office buildings. The model, named Integrated Ecological Footprint Assessment, IEFA, (Pomè et al., 2021), is composed of nine impact sources, as reported in Figure 1.

² Global Footprint Network. Available online: <https://www.footprintnetwork.org/>

Figure 1. The Integrated Ecological Footprint Assessment model – elaboration of the author.



The nine impact sources are converted into addenda, expressed in gha, through WYF and EQF, available online on the GFN website. The model develops an algebraic sum of the nine addenda, as shown in Figure 2.

Figure 2. Calculations for the Integrated Ecological Footprint Assessment model – Pomè et al., 2021.

IEFA = BU + EC + WC + MC + F&D + M + WG - RP - O [gha]	
Addendum	Calculations
BU	BU = total building surface area $\left(\frac{ha}{year}\right) \times EQF$ of built up $\left(\frac{gha}{ha}\right)$
EC	EC = Fuel Consumption EF + Electricity Consumption EF
	Fuel Consumption $\left(\frac{gha}{year}\right) = \text{Fuel Consumption} \left(\frac{GJ}{year}\right) \times \text{Emission factor}_{fuel} \left(\frac{tCO_2}{GJ}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$
	Electricity Consumption $\left(\frac{gha}{year}\right) = \text{Electricity Consumption} \left(\frac{kWh}{year}\right) \times \text{Emission factor}_{electricity} \left(\frac{tCO_2}{kWh}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$
WC	WC $\left(\frac{gha}{year}\right) = \text{Water Consumption} \left(\frac{m^3}{year}\right) \times \text{Emission factor}_{water} \left(\frac{tCO_2}{m^3}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$
MC	MC $\left(\frac{gha}{year}\right) = \text{Hour per use of material } i \left(\frac{h}{year}\right) \times \text{Emission factor}_{material} \left(\frac{tCO_2}{h}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$,
F&D	FD $\left(\frac{gha}{year}\right) = \sum (\text{Energy land for item } i \left(\frac{gha}{t}\right) \times \text{total amount of item } i \text{ delivered in 1 year} \left(\frac{t}{year}\right))$
	Energy land for item $i \left(\frac{gha}{t}\right) = \frac{\text{associated to the embodied energy} (tCO_2)}{\text{tons}(t)} \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$
M	M $\left(\frac{gha}{year}\right) = \frac{\text{Number of people}(\text{unit}) \times \text{Distance}(\text{km})}{\text{Maximum capacity of the transport}(\text{unit})} \times \text{Average fuel efficiency} \left(\frac{t}{km}\right) \times \text{Emission factor}_{fuel} \left(\frac{tCO_2}{t}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$,
WG	WG $\left(\frac{gha}{year}\right) = \text{Tons of waste} (t) \times \text{Emission factor}_{material} \left(\frac{tCO_2}{t}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$
RP	RP $\left(\frac{gha}{year}\right) = \text{Tons of reused materials} (t) \times \text{Emission factor}_{material} \left(\frac{tCO_2}{t}\right) \times \text{CO}_2$ sink factor $\left(\frac{gha}{tCO_2}\right)$
O	O $\left(\frac{gha}{year}\right) = \text{Influence factor} \times (\text{BU} + \text{EC} + \text{WC}) \left(\frac{gha}{year}\right)$
	Influence factor = $\frac{\text{Spent hours in the building}(h)}{\text{Hours in a year}(h)}$

Built-up (BU), Energy Consumption (EC), Water Consumption (WC), Material Consumption (MC), Food & Drink (F&D), Mobility (M), and Waste Generation (WG) are summed together as they represent consumed resources and emitted pollutants. While Recycle Potential (RP) and Occupant (O) are subtracted because they represent recreated benefits. Recycle Potential assesses the materials reuse in the office building. For example, if the office building produces

electricity through a photovoltaic plant, the energy consumed over the year will be reduced. Occupant highlights the benefit of simultaneous building's occupation by multiple users.

3 METHODOLOGY

To test the Integrated Ecological Footprint Assessment (IEFA) model, the author assessed the footprints of three administrative headquarters (Building A, Building B, and Building C) located in Milan, Italy. The three office buildings have been chosen due to their differences in real estate assets and of the companies' businesses. Building A, built in 2000, is leased to a multinational company. The company entered the building in the first months of 2001. Building A has ten floors, all dedicated to offices. Building B, built in 2003, is leased to a commercial information company. The company entered the building in 2017, without heavily renovating the spaces. Building B is made of nine floors, all dedicated to offices. Building C is an historical building in the centre of Milan, which has been renovated between 2018 and 2020. Since the first months of 2020, this building has hosted a coworking space. Building C is made of seven floors, all dedicated to offices and supporting spaces for workers. Only Building C is ranked through a Green Certification system, certified in 2020 LEED Gold. In order to assess and compare IEFA for the three office buildings, the following steps have been implemented by the author:

1. Interview: the facility managers, responsible for the Facility Manager Division of the companies, have been interviewed between June and October 2021. These have been based on a set-of predefined questions on Excel (reported in Appendix A). Interviews found the system for data-collection easy to understand; however, they do not have all data available. Both Building A and Building B made a special effort to collect data related to maintenance activities and food and drink provisions. Indeed, both the companies outsourced all the services provided to employees, and they did not perform periodic checks of activities. While Building C found difficult the collection of data for Mobility EF. As Building C is a coworking-space, the facility management division does not check coworkers' residence and ways of transportations to the office.
2. Collected data homogenization: for some addenda the interviewed companies used different systems of reporting data. This happened especially for the estimation of Mobility EF, Material EF, and Occupancy EF. Therefore, the author had to adjust calculations in order to assess the ecological footprint of each addendum.
3. Calculation: after the homogenization of the unit of measurements, the author assesses the IEFA for the three companies;
4. Comparison and Result: this section is discussed above.

4 RESULTS

IEFA was assessed for three office buildings by collecting data through interviews to the three facility managers and refers to the year 2020. The author was able to define all the impact sources, instead of Recycle Potential, because no headquarters present any systems for energy production or recycling. Building C, certified LEED, has just the predisposition for the photovoltaic system, which has not been installed yet. In order to interpret the results, the number of employees allocated to the headquarters and the average occupancy of employees and external people are relevant data. Building A has 693 employees, with an average occupancy of 225; Building B has 850 employees with an average occupancy of 100 people; and, Building C has 450 coworkers, with an average occupancy of 450. As reported in Table 1, the 2020-total IEFA for Building A is 909,86 gha; for Building B is 616,56 gha; and for Building C 246,32 gha.

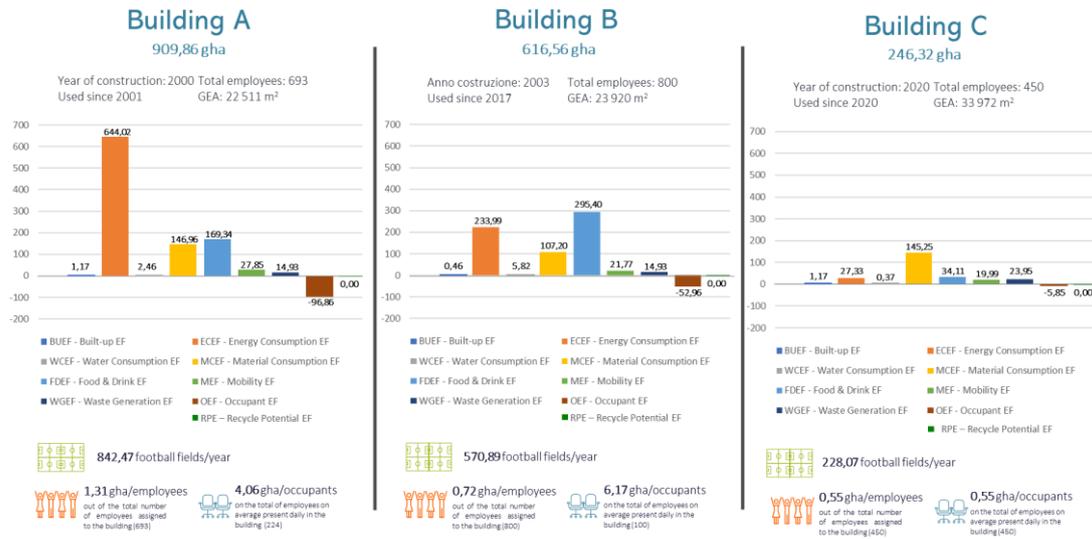
Table 1. Results of the Integrated Ecological Footprint Assessment for the three analysed buildings.

Addenda		BUILDING A End of construction: 2000	BUILDING B End of construction: 2007	BUILDING C End of construction: 2020
BU	Built-up EF	1,17	0,46	1,17
EC	Energy Consumption EF	644,02	223,99	27,33
WC	Water Consumption EF	2,46	5,82	0,37
MC	Material Consumption EF	146,96	107,18	145,25
FD	Food & Drink EF	169,34	295,37	34,11
M	Mobility EF	27,85	21,77	19,99
WG	Waste Generation EF	14,93	14,93	23,95
O	Occupant EF	96,86	52,96	5,85
IEFA [gha]		909,86	616,56	246,32

BU, which depends only on the gross external area of the office buildings' ground floor, and WC, which reveals the water consumption, do not affect a lot the total IEFA for all the three office buildings. EC depends on fuel and electricity consumption. Building C has a very low EC because it consumes only electricity. While Building A and Building B also consume methane, which has a significant environmental impact for the heating systems. MC estimates the footprint of cleaning and maintenance activities. As Building C is a new building, its MC seems high compared to the other two buildings. However, Building C is a coworking space, highly occupied over the years. Thus, to maintain high standards of cleaning, Building C needs to increase the hours of cleaning, especially for the shared spaces of the coworking space. M is estimated by combining the distance from home of every worker, and the main transport used to reach the headquarters. FD shows the food and drink consumptions. Building A and Building C offer a bar service inside the headquarters; while Building A and Building B offer the canteen service to all their employees, and have several water, coffee, and grocery distributors. Hence, Building C has a very low FD footprint. This means that inside the building, users consume few foods and drinks, and go outside for breaks. Building A has the highest M due to its location, outside to the city centre of Milan. This means that a higher number of employees use cars as transportation. WG really depends on the number of occupants; therefore, Building C, which has the highest occupancy rate, shows the highest WG footprint. Finally, O is estimated through the time users stay inside the building. Therefore, more time spent in the headquarters by users make O higher. Indeed, O represents a correction rate of the overall IEFA, as it shows that the use of resources shared among users decrease the environmental impact (Pomè et al., 2021). O is affected by BU, EC, WC, FD, and WG. Therefore, higher consumptions for those addenda make O higher. Building A, which presents higher consumptions of EC, FD, and WG, reports also higher O footprint. The author plots the IEFAs of the three buildings into a histogram (see Figure 3) in order to compare the results. First, the analysis shows that a building, such as Building A, built through old technological systems consumes more resources. This confirms the importance of renovating existing buildings to reduce the environmental impact of the construction sector. Second, offering a canteen service increases IEFA. While water consumption, mobility, and waste generation seem to not affect IEFA a lot. Third, no headquarters are located in a green lot or reuse water or produce renewable energy. Thus, the Recycle Potential is equal to zero. This is a missed opportunity of the three locations, which also do not positively affect the IEFAs. Finally, Building C, which represents the smart sustainable building for the sample of this research, shows that complex technological systems need accurate maintenance activities.

Figure 3. IEFA of Building A, Building B, and Building C for the year 2020 – elaboration of the author.

Integrated Ecological Footprint Assessment for the year 2020



To better understand the IEFAs of the three headquarters, Figure 3 reports the results in different units of measurements, namely football fields per year, gha per employees (allocated to the building), and gha per occupants. The number of football fields aims to represent the necessary land to absorb the emissions and regenerate the consumed resources of the three headquarters. Building A needs about 843 football fields to cover its demand; Building B about 571; and Building C about 228. Moreover, by comparing the results scaled on the numbers of employees allocated to the headquarters, it is possible to understand the building environmental impact for each employee. An unrenovated building has a higher impact on their employees. However, the same building, that is occupied by more people seems to be more performing than a newer building that is used by fewer workers at the same time. Indeed, Building A impacts 1,31 gha per employee, while Building B 0,72; but, Building A, occupied by 224 employees, has an impact on each occupant of 4,06 gha, while Building B, occupied by 100 employees, has an impact on each occupant of 6,17 gha.

5 CONCLUSIONS

IEFA, which is intended to assess the environmental (in-)efficiency of in-use office buildings, seems to be a useful tool for facility managers to evaluate office buildings' footprints. The application of IEFA on three case studies makes evident that users play a key role in the definition of office buildings' environmental impact. The extent to which users can contribute to the office buildings' footprint depends not only on their behaviours, but also on the simultaneous occupancy. Habits in waste generation and food and drink consumption may optimise the environmental sustainability performance of office buildings. Moreover, the comparison among Building A and Building B, which presents a lower IEFA but similar construction characteristics, shows that the footprint per occupier decreases if the space is shared among more people. Hence, IEFA provides a measure that shows the over-consumption based on users' behaviours and the (in-)efficiency in the use of buildings' space. Still the IEFA model presents some limitations. First, the case study presents data of a complex year for office buildings. Italy in 2020 was mainly in lockdown for COVID-19 pandemic and results cannot properly identify the effects of users' behaviour on the environmental impact. Future experimentations will focus on other years of analyses to individuate the effect of behaviours.

Second, the collection of data still represents a limit. The author has developed a scheme through Excel sheets (Appendix A) to support the facility managers' interviews. However, as the quality of inventory is a major element for consistency of IEFA, the research will reason on a systematic collection of data by integrating digital technologies. Third, the IEFA model does not present any benchmarks. This research is the first cross-companies comparisons implemented throughout IEFA. So, future developments will evaluate case study with different features to implement evaluation benchmarks. Finally, even if IEFA is based on international factors, which allow cross-countries comparisons, a crucial question yet to be answered is if the unit of measurement of EF (gha) will induce users to adopt more sustainable behaviours to reduce office buildings' environmental impact. This last question may also be answered by implementing a comparison between IEFA and other frameworks for evaluating in-use environmental sustainability of office buildings.

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REFERENCES

- Acosta, K., Moore, J. (2010), "Creating an Ecological Footprint Assessment: Using Component and Compound Economic Input Output Methods together with the Natural Step to Develop Sustainability Management System". In Proceedings of the *State of the Art in Ecological Footprint Theory and Applications, Colle Val d'Elsa, Italy, June 2010*; Bastianoni, S., Ed.; British Columbia Institute of Technology (BCIT): Burnaby, BC, Canada.
- Azhar, S., Carlton, W.A., Olsen, D., Ahmad, I. (2011), "Building Information Modelling for sustainable design and LEED rating analysis". *Automation Construction*, 20.
- Bastioni, S., Gall, A., Niccolucci, V., Pulselli, R.M. (2006), "The ecological footprint of building construction". *Sustain. City*, 4, 345–356.
- Brownell, E.B. (2019), "Determining Architecture's Footprint: Preliminary Methods for Measuring the True Environmental Impact of Buildings", Koç, G., Christiansen, B., (Ed.), *Reusable and Sustainable Building Material in Modern Architecture*, IGI Global Publishing: Hershey, PA, USA, 2019, 28–59.
- Dixit, M.K., Fernández-Solís, J.L., Lavy, S., Culp, C.H. (2012), "Need for an embodied energy measurement protocol for buildings: A review paper". *Renewable and Sustainable Energy Reviews*, 16, 3730-3743.
- Doan, D.T., Ghaffarianhoseini, A., Naismith, N., Zhang, T., Ghaffarianhoseini, A., Tookey, J. (2017), "A critical comparison of green building rating systems". *Building and Environment*, 123, 243-260.
- Economidou, M., Todeschi, V., Bertoldi, P., D'Agostino, D., Zangheri, P., Castellazzi, L. (2020), "Review of 50 years of EU energy efficiency policies for buildings". *Energy & Buildings*.
- Goubran, S. (2019), "On the role of construction in achieving the SDGs". *J. Sustain. Res.*, 1 (2).
- Gui, X., Gou, Z. (2020), "Association between green building certification level and post-occupancy performance: Database analysis of the National Australian Built Environment Rating System". *Building Environment*, 179, 1–14.
- Husain, D., Prakas, R. (2018), "Life Cycle Ecological Footprint Assessment of an Academic Building". *J. Inst. Eng.*, 100, 97–110.

- Jiménez-Pulido, C., Jiménez-Rivero, A., García-Navarro, J. (2020), “Improved sustainability certification system to respond to building renovation challenges based on a literature review”. *Journal of Building Engineering*, 45.
- Jin, W., Xu, L., Yang, Z. (2009), Modelling a policy making framework for urban sustainability: Incorporating system dynamics in the Ecological Footprint. *Ecol. Econ.*, 68, 2938–2949.
- Limac, L., Trindaded, E., Alencara, L., Alencarb, M., Silva, L. (2021), “Sustainability in the construction industry: A systematic review of the literature”. *Journal of Cleaner Production*, 289.
- Menassa, C.C. (2011), “Evaluating sustainable retrofits in existing buildings under uncertainty”. *Energy Building*, 43, 3576–3583.
- Pomè, A.P., Tagliaro, C., Ciaramella, G. (2021), “A Proposal for Measuring In-Use Buildings’ Impact through the Ecological Footprint Approach”. *Sustainability*, 13, 355.
- Rivas, S., Cuniberti, B., Bertoldi, P. (2016), “Effective Information Measures to Promote Energy Use Reduction Across EU Member States”. *European Union: Brussels, Belgium*.
- U.S. Energy Information Administration (2013), available at <https://www.eia.gov/totalenergy/data/annual/> (accessed 28 March 2022).
- Verma, S. (2020), “The crest of the Renovation Wave: a toolkit to decarbonise the European building stock”, available at, <https://www.buildup.eu/en/news/crest-renovation-wave-toolkit-decarbonise-european-building-stock> (accessed 28 March 2022)
- Vollenbroek FA. (2020), “Sustainable development and the challenge of innovation”. *J Cleaner Production*, 3, 215–23.
- Wackernagel, M., Rees, W. (1996), *Our Ecological Footprint: Reducing Human Impact on the Earth*, New Society: Gabriola, BC, Canada, 9–148.
- Wood, R., Lenzen, M. (2003), “An application of a modified Ecological Footprint method and Structural Path Analysis in a Comparative Institutional Study”. *Local Environment*, 8, 365–386.
- Yeheyis, M., Hewage, K., Alam, M.S., Eskicioglu, C., Sadiq, R. (2013), “An overview of construction and demolition waste management in Canada: A lifecycle analysis approach to sustainability”. *Clean Technol. Environ. Policy*, 15, 81–91.

APPENDIX A

IEFA - Interview	
Addendum	Questions
BU	<ul style="list-style-type: none"> • Lot size (sqm) • Gross External Area of a type floor (sqm) • Gross Ground Attack (sqm) • Parking Area (sqm) • Gardens (sqm) • External paved (sqm)
EC	<ul style="list-style-type: none"> • Which type of FUEL is used for building's systems? Select the type of fuel used and indicate the consumption in the defined unit of measurement • How much was the ELECTRICITY year consumption? • Does the amount of consumed electricity include renewable energy? • Are there other type of consumption?
WC	<ul style="list-style-type: none"> • WATER consumption in the reference year? (m³)
MC	<p>Ordinary Cleaning:</p> <ul style="list-style-type: none"> • How often are CLEANING SERVICE for toilets scheduled in a week? • How often are CLEANING SERVICE for offices and other spaces scheduled in a week? • Indicate the annual cost for ORDINARY CLEANING SERVICE. • Are you using ecologic products for cleaning? <p>Extra-ordinary Cleaning:</p> <ul style="list-style-type: none"> • How often are CLEANING SERVICE for extra-ordinary systems / devices scheduled in a year? • Indicate the annual cost for EXTRA-ORDINARY CLEANING SERVICE. • Are you using ecologic products for cleaning? <p>Ordinary Maintenance</p> <ul style="list-style-type: none"> • Indicate the annual expenditure for BUILDING ORDINARY MAINTENANCE in the reference year? <p>Extra-ordinary Maintenance</p> <ul style="list-style-type: none"> • Indicate the annual expenditure for BUILDING EXTRA-ORDINARY MAINTENANCE in the reference year? <p>Ordinary Maintenance for green areas</p> <ul style="list-style-type: none"> • How often are the ORDINARY MAINTENANCE for green areas are performing in a year? • Indicate the annual expenditure for ORDINARY MAINTENANCE for green areas in the reference year? <p>Extra-Ordinary Maintenance for green areas</p> <ul style="list-style-type: none"> • How often are the EXTRA-ORDINARY MAINTENANCE for green areas are performing in a year? • Indicate the annual expenditure for EXTRA-ORDINARY MAINTENANCE for green areas in the reference year?
F&D	<ul style="list-style-type: none"> • Is there a KITCHEN AREA inside the building? • How many people use the KITCHEN AREA on average in a working day? • Is there a BAR inside the building? • How many people use the BAR on average in a working day? • Is there a CANTEEN inside the building? • How many people use the CANTEEN on average in a working day? • Are there COFFE MACHINE DISTRIBUTORS inside the building? • How often COFFE MACHINE DISTRIBUTORS are replenished in a month? • How many WATER DISPENSERS are inside the building? • Are there FOOD and GROCERY DISTRIBUTORS inside the building? • How often are FOOD and GROCERY DISTRIBUTORS replenished in a month? • How often do you use CATERING SERVICE in a year? • What is on average the number of people that uses CATERING SERVICE in a year?

IEFA - Interview	
Addendum	Questions
M	<ul style="list-style-type: none"> • Number of employees • How many employees live in the SAME CITY of the building? • How many employees live in the PROVINCE as the building? • How many employees live in the REGION as the building?
WG	<p>Are you following a system of differentiated waste?</p> <ul style="list-style-type: none"> • Number of PLASTIC bins (bidoni) • Number of PAPER bins (bidoni) • Number of TIN bins (bidoni) • Number of GLASS bins (bidoni) • Number of HUMUS bins (bidoni) • Number of GARDEN bins (bidoni) • Number of UNDIFFERENTIATED bins (bidoni) <p>How many times per week are the bins emptied by the garbage collection service?</p> <ul style="list-style-type: none"> • PLASTIC • PAPER • GLASS • TIN • HUMUS • GARDEN • UNDIFFERENTIATED
RP	<p>Circular Economy: energy</p> <ul style="list-style-type: none"> • Is there any system of renewable energy production? • How much energy was produced? <p>Circular Economy: water</p> <ul style="list-style-type: none"> • Is there a WATER RICIRCULATION system? • How much water is recirculated in a year? <p>Circular Economy: waste</p> <ul style="list-style-type: none"> • Do you have an internal system for COLLECTING & REPUTTING WASTE into the system (= building)? • Do you have an internal system for COLLECTING & REPUTTING EMISSIONS into the system (= building)? • Is there other recycling system? <p>Potentiality of Green</p> <ul style="list-style-type: none"> • Indicate, if there are, how many trees are planted in the outdoor area of the building
O	<ul style="list-style-type: none"> • Indicate the number (or %) of total employess that usually spend maximum 4 hours inside the building • Indicate the number (or %) of total employess that usually spend maximum 8 hours inside the building • Indicate the number (or %) of total employess that usually spend more than 8 hours inside the building • "Do you have any policy of smart working?" • How many visitors enter in the building in a working day? • Indicate the number of average hours per day that external users spend inside the building

Smart Building Envelope – Toward Increased Building Sustainability: A Literature Review

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ABSTRACT

Societal advancement toward new technologies creates a demand for greater and increasing energy requirements. This increased energy consumption emphasises the importance of advanced, responsive, and energy-efficient building facades to provide interior comfort with less energy consumption. Building facades act as a barrier between a building's interior and exterior and perform multiple functions that eventually affect the building's performance. Smart and interactive facades may offer higher efficiency and better performance compared to conventional construction. To analyse the application of connectivity, intelligence, flexibility, and efficiency of building façade systems, this paper addresses new smart technologies that could be used, or are being used, in the construction industry. To accomplish these goals, a literature review was conducted, which resulted in the identification of a set of approximately 40 research papers with innovative ideas, techniques, and inventions for building façade systems. These new ideas and inventions may provide increased levels of building sustainability, energy-efficient systems, and eco-friendly buildings. The findings could help design, construction, and facility management professionals develop more, easier, and cheaper ways to produce and practice Smart Building Envelopes for the benefit of generations to come.

Keywords

Smart building, Sustainable construction, Energy efficient buildings, Smart construction materials, Building skins, Workplace.

1 INTRODUCTION

A building envelope acts as a barrier between the exterior and interior environments of a building, including resistance to air, water, heat, light, and noise. The building envelope consists of all elements in the outer shell that maintain a dry, heated, or cooled indoor environment, and it facilitates climate control. Building envelope configuration is a specific area of design and designing practice that draws from all areas of building sciences and indoor environment control. Smart buildings appeared simultaneously with human evolution and technology advancements. The industrial revolution played a very important role in this transformation. Use of machines and mass production drove the first and second Industrial Revolutions, while electronics and further advanced automation enabled the third revolution. In the current era, the fourth industrial revolution is controlled by connectivity, intelligence, flexibility, and efficiency. The utilisation of new innovations permits the design and development of productive structures that does not just diminish energy utilisation to be more reasonable; in addition, it works on the solace of a building's clients. This development improvement has been propelled by the need to enhance structures by upgrading solidness, supportability, and solace (Ruiz et al., 2020). A major discussion exists between ideas related

to smart buildings or intelligent buildings; a few elements differentiate them. While intelligent buildings are receptive, smart buildings are prescient and responsive. Smart buildings undoubtedly adjust to various settings and conditions considering inhabitants as well as user comfort factors at various times of day and seasons. Smart buildings adjust to the climate by streamlining each of three fundamental components of the structure: actual design, framework, and administration. Smart buildings have four points of support: knowledge undertaking, control, material, and design. Knowledge alludes to the capacity to control the climate, while the venture point of support permits smart structures to take care of business information, for example, work time and inhabitants, to adjust to the climate. Control implies the capacity to functionally manage the entire structure. Smart buildings' frameworks and administrations are planned with savvy materials, which assist with saving energy and increasing client comfort. Responsive building envelopes can accomplish significant performance levels through real-time responses to information, based on parameters like outside conditions and the number of tenants. These depend on a blend of smart materials and dynamic mechanisation frameworks. Materials, for example, smart glass for windows, have expanded throughout recent years. According to the National Renewable Energy Laboratory, United States, almost 30 percent of the electrical load for heating and cooling gets lost through fenestration as windows occupy 15-20 percent of a conventional building envelope. Smart glass includes frosting with light- and heat-sensing properties, known as photochromic and thermochromic glazing. These kinds of coating can modify the transmission of light and heat, either latently or by external application. By controlling these properties, smart glass can decrease building energy utilisation by bridging outer energy getting through the windows when there is daylight and retaining energy internally when open-air conditions are colder (Ruiz et al., 2020). The purpose of this paper is to provide a better understanding of the human advancements towards the future buildings and discuss existing innovations and prototypes that could aid humans and following generations with attaining a more sustainable, green and smart built environment. The following sections describe the research methods applied and the literature search findings in three major areas: green building practices, responsive building envelopes, and the use of Building Automation Systems (BAS) for smart building envelopes.

2 RESEARCH METHODS

The Smart Building is a broad category of invention, development, design, and maintenance that encompasses a variety of concerns. This research examines innovative components, technology, materials, and sustainability considerations in a building's external shell and its components. The articles included in this paper were gathered from around the world to obtain the most current and reliable data and findings possible. Green Building Envelope, Responsive Building Envelope, and Building Automation System (BAS) are the three sub-topics identified for the purpose of this study. After sampling data from the keywords, a Qualitative analysis was performed to determine the criteria for selection of references. A detailed review of articles, research papers, conference proceedings, and other literature was conducted, with the material examined for relevance to the research topic and its relationship to it, as well as for key findings. The broader topic was subdivided into three sub-topics, along with a citation of each piece of literature under the appropriate sub-topic. The conclusions summarise the major findings of the papers, as well as the authors' perspectives.

3 RESEARCH FINDINGS

3.1 Green building envelope

According to the World Green Building Council (n.d.), a green building is a structure that reduces adverse effects on the environment through its design, construction techniques or

usage. A green building could also promote positive effects on the ecosystem and climate. Green buildings protect valuable resources to provide a better quality of life. This section consists of ideas, products and designs that aid in providing a sustainably sound built environment. Buildings consume around 40% of total energy consumption in the United States (Mumme et al., 2020). Excessive energy consumption leads to global warming, which further exacerbates the energy crisis (Yuan et al., 2020). The fundamental idea of this investigation imagines an ideal design envelope system depicted by the limit of continually changing (inside an enclosure) a piece of its thermo-physical and optical properties. The critical justification behind the energy proficiency of a structure relies on Window-to-Wall-Ratio (WWR) (Goia and Cascone, 2014). The expense and energy investment for vernacular structures and Autoclaved Aerated Concrete (AAC) structures (made with fine aggregates, cement, and an expansion agent that causes the fresh mixture to rise like bread dough – about 80% of total volume is air) have been evaluated and it is observed that AAC structures increment energy utilisation is reduced by 47.83% contrasted with vernacular structures (Homod et al., 2021). A basic part of ensuring comfort is a structure's envelope, with building warming and cooling loads consuming huge measures of energy. This energy maintains the indoor climate in agreeable circumstances for the inhabitants (Mumme et al., 2020). Additionally, to accomplish the goal for all new structures to be “net Zero Energy buildings” (n-ZEB), two elective design techniques are embraced: exclusive (the building envelope is seen as an obstruction), and selective (which regulates the heat and mass stream by utilising versatile or responsive building components and system) (Goia and Cascone, 2014). Compared with conventional buildings, energy saving is a significant objective sought by green structures. (Yuan et al., 2020). In a study conducted by Saroglou et al., 2019, an energy efficiency analysis was completed between three single-skin and four double-skin envelopes of a high-rise building located in the Mediterranean climate. Later, it was discovered that the energy saving level rose between single-skin and dual skin facade, with the conclusion being that current practices are inappropriate from an energy point of view (Saroglou et al., 2019). The research performed by Ayçam (2020) studied the specification of traditional architectural parameters for houses in a hot and dry climatic region to create less energy-consuming and more sustainable environments in association with traditional building street texture (Brito and Gomes, 2020). Pneumatic multi-layer foil construction with a kinetic shading mechanism has the potential to effectively respond to dynamic climatic factors, such as solar radiation. The study provides additional insight into the optical behaviour of multi-layer foil constructions. Analysis conducted by Flor et al., 2018, showed that the optical performance of switchable ethylene-tetrafluoroethylene (ETFE) cushions, originally invented by Dupont as an insulation material for the aeronautics industry, is highly dependent on the solar incidence angle. Extensive green rooftops were found to improve the arrangement of biological system administrations in metropolitan conditions, especially in semiarid locales. The green rooftop was more successful at impeding an upward warmth transition during the day and smothering warmth discomfort during the evening (Imhof et al., 2016). Additionally, the demand for air-conditioning systems has risen from 50% in 1989 to 90% per household in 1993 (Cheung, et al., 2005). The benefits of high-performance, ecologically responsible design, construction, and operation are numerous. Above and beyond the elements associated with the building envelope, all types of buildings, including commercial properties, educational institutions, healthcare facilities, libraries, courts, and research institutes, should incorporate sustainable and high-performance strategies and systems that consider the building's entire life cycle. As we go towards a greater need for energy, advancements in green building considerations, when coupled with technology and tactics, are proving to be quite important and effective.

3.2 Responsive building envelope

From an energy standpoint, designing a zero-emission neighbourhood (ZEN) offers the advantage of dispersing loads over time by constructing a mosaic of buildings that may not have a zero-emission balance individually, but do so collectively. Responsive Building Envelopes (RBEs) are projected to play a key part in the design of ZENs and future smart, sustainable cities. RBEs are beneficial for balancing multiple energy flows at the single- and multi-building scale, as well as actively managing both on-site renewable and purchased energy. Additionally, they increase user experience and indoor comfort by offering an interactive interface with the outdoors. This section deals with ideas and innovations inherently responsive to natural situations, or through human intervention. Over 50 years, solace research led by perceptions in environment chambers has been directed by the quest for an all-around pertinent arrangement of ideal solace conditions basically founded on physiological models. Over the most recent 20 years, "genuine world research" has featured the deficiencies of these models for the expectation of genuine client fulfilment, particularly for warm solace, accordingly, pointing out for more the investigation of human fulfilment in genuine settings and for widening the solace banter likewise, to the mental and conduct viewpoints (Pastore and Anderson, 2022). To limit heat loss, the building envelope has been regarded as a thermal barrier. Adaptive building skins help with energy efficiency and design. However, building skin design is hampered by ambiguity, and as a result, little progress in architectural design and energy efficiency has been made (Shahin, 2019a). Dual Skin Facades (DSFs) have been presented as a cost-effective and responsive building technology, with the ability to estimate how well DSF systems would operate in a real building being critical to their deployment (Lucchino et al., 2019). One flexible alternative technique is a design employing "responsive building envelopes", which might go beyond the generally stated limitations of cost-optimal facade design. Cachat et al., 2019, provide a roadmap to assist architects and building designers in identifying paths for the adoption of RBE solutions in ZENs and smart sustainable cities. Solar screening automation systems are crucial in the advancement of high-performance smart skin technology (Brugnaro et al., 2014). Adaptivity refers to the ability to comprehend and react to changes in the overall climate. A brilliant envelope that integrates daylighting, screening, and regular ventilation frameworks has the potential to significantly reduce the amount of energy used by building tasks (Shahin, 2019b). As the subject becomes complicated and requires further computation, the use of two limits - warmth and light - is extremely important in the investigation, with both being entirely regulated in a single framework (Verma and Devadass, 2013). The thermal, lighting, acoustic, and visual comfort, and well-being of inhabitants, as well as aesthetics, economics, and durability, are all factors to consider when designing a transformable building envelope (Matheo et al., 2020). For all orientations, the greatest reduction in energy consumption is achieved in the building's primary energy requirement of cooling. In general, north-facing facades have lower energy-saving potential, especially for those with long response times, while monthly and daily adaptive facades can save up to 20% and 30%, respectively (Favoino et al., 2014). The development and real-world deployment of innovative multifunctional and sustainable materials for energy savings in buildings is currently a major focus of research and technological transfer. Materials have been recognized as responsible for defining indoor thermal quality and outdoor microclimate mitigation through their passive role in determining building thermal-energy efficiency (Perino and Serra, 2015). Including Phase Change Materials (PCM) seems to have no effect on thermal emittance. In fact, the thermal conductivity of microencapsulated PCM-filled concrete was found to be greater than that of conventional concrete (Pisello et al., 2017). Another study of coal-fired power plants explored the standards and rules in place to regulate Sulphur dioxide (SO₂) outflow at the barometric level. The regulation standards for coal-burning thermal plants must become increasingly strict. The impact of Flue Gas Desulfurization systems (FGD) was

then discovered to be extremely ant acidic (Jang and So, 2017). The relationships between architecture and its environment can be created, verified, or changed using digital modelling. Physical prototyping strategies enhance the wind-based design by complementing the computational approach (Kabošová et al., 2019). A research trend that focuses on material systems, in which adaptive performance is dependent on material behaviour, can be identified (Barozzi et al., 2016). Real-time sensing, kinetic climate-adaptive elements, smart materials, automation, and the capacity for user override are all features of a responsive building skin, similar to those of an "intelligent" building skin. However, interactive features like computational methods that allow the building system to self-adjust and learn over time, as well as the capacity for residents to physically alter sections of the building envelope to manage environmental conditions, are also included.

3.3 Building automation systems

Building automation refers to the use of a Building Management System (BMS) or a Building Automation System (BAS) to automate the operation of a building's heating, ventilation, and air conditioning (HVAC), electrical, lighting, shading, access control, security systems, and other interconnected systems. Improved occupant comfort, efficient building system operation, reduced energy consumption, reduced operating and maintenance costs, increased security, historical performance documentation, remote access/control/operation, and improved life cycle of equipment and related utilities are all goals of building automation. In a constructed environment, a variable façade plays an important role. Creating self-adjusting and self-changing architecture is perhaps the most demanding development. Materials with adaptable characteristics that react to environmental changes may trigger movement in the built environment (Yoon, 2020). Building envelope solutions that are versatile or responsive are becoming more well-known and used in design (Matin and Eydgahi, 2019). The subject of responsive and variable structural arrangements is broad, encompassing development, practical movement, ecological responsiveness, and aesthetic goals. Because of the development cycle and materials used, it is possible to accept that the structural envelope's layout could be beneficial in providing both cost and efficiency gains (Lommi, 2018). The growing demand for more energy-efficient buildings has sparked widespread interest in the various structural components' functions and capabilities. According to the study, two-fold skin exteriors may result in a relatively large portion of warmth passing through the building envelope, substantially more than 25%. This stream's strength surpasses the heat flow through the evaluated exterior's foggy components (Theodosiou et al., 2019). Because buildings consume around 40% of total energy in the United States, making features more energy efficient is desirable (Johnsena et al., 2015). Energy-conscious houses might be equipped with energy reenactment devices to monitor and improve energy usage (Kamel and Memari, 2018). Space heating and cooling consumes over half of all energy. Thus, when considering the normally long reaction time and energy consumption of evacuation, the energy-saving potential for building applications should be carefully examined (Cui and Overend, 2019). The goal of these studies is to identify current flexible framework typologies based on their key characteristics. Designers offer responsive exteriors as the most comprehensive type of Adaptive Facades, AF, that allow for client collaboration (Tabadkani et al., 2021). The abundant energy validates the framework's reachability and power, as well as its broad use across a variety of sensors and applications (Lin et al., 2020). In France, the new "Energy Plus Construction Minus" (E + C-) method is a clear example of how to address glass development in an energy-efficient manner. Water-filled glass (WFG) was introduced for the first time in 2007 and was licensed by the inventor Dr. Matya Gutai. This effort also compares the Smart Water-Filled Glass, SWFG, envelope to other innovations such as electrochromic windows or hazy photovoltaic boards (PV) (Gutai and Kheybari, 2021). Sociocultural, inventive, political/financial, and ecological

factors have all influenced the design and development of responsive exteriors (Matin and Eydgahi, 2019). Several technical roadblocks must be overcome before some innovations will reach the commercial market (Deb et al., 2001). BAS use sensors and actuators scattered throughout buildings to regulate heating, ventilation, and air conditioning. New applications, like enhanced energy management and intelligent fire and evacuation control, have evolved as a result of more effective integration approaches. BAS is trending in the direction of wireless smart object network systems due to the lower installation costs of wireless technology.

4 DISCUSSION

The number of structures being built around the world is quickly increasing, yet this rapid growth is not keeping pace with the knowledge generated about designing buildings to best suit local conditions. Furthermore, from the mid-twentieth century onwards, greater transparency of the building envelope resulted in large energy loads, which were particularly noticeable in high-rise construction. The goal of this research was to find both sustainable and energy efficient strategies that enhance human development. The main goal was to gain a sense of how well and how long various smart building envelope technologies might operate. As science progresses, the discoveries and prototypes will be used for future study and investigation, as most of the findings, when applied, could prove to be useful. It is vital to focus on decision-making processes, particularly for building envelope components, to establish a more comprehensive technique for energy efficient building refurbishment.

5 CONCLUSION

Building façades had a focal impact in the field of Indoor Environmental Quality and energy research. Studies pointed toward looking at client solace and conduct according to façade plan and activity have normally centred around two primary regions: favoured physical and radiant circumstances in office conditions, and tenant fulfilment and conduct towards the control of windows and concealing gadgets. Façade components can quantifiably affect inhabitants. Transformable building envelope design is important for energy efficiency and the long-term sustainability of the built environment, considering inhabitants' thermal, lighting, acoustic, and visual comfort, as well as aesthetics, economics, and durability. When compared to traditional static building envelopes, kinetic building envelopes may provide a real-time process of reconfiguration, improving environmental performance and end-user comfort. Transformable systems could be directly applied to building facades, thus managing natural lighting, ventilation, and temperature of interior rooms using their own surface layouts and materials. Transformable building envelope design is a concept used in architectural education to describe an integrated approach to architectural evolution in terms of morphology, structure, and construction. Students are introduced to the design logic of responsive systems in terms of sustainability, materiality, utility, and aesthetics on the one hand, and structural kinematics and stability on the other. The pedagogical approach taken in the various projects emphasises nonlinear technology-driven design and analysis at numerous scales, ranging from the element to the system and building envelope. Conceptualization, inquiry, and analysis of kinetic mechanisms in physical models, geometrical simulations, motion studies, and daylight performance are the primary goals of the projects discussed in this paper.

REFERENCES

- Barozzi, M., Lienhard, J., Zanelli, A., Monticelli, C. (2016), "The sustainability of adaptive envelopes: developments of kinetic architecture." *Procedia Engineering*, 155, 275-284.
- Brito, J., Gomes, M.G. (2020), "Special Issue-Building Thermal Envelope". *Energies*, 13, 1061.

- Brugnarò, G., Caini, M., Paparella, R. (2014), "Energy saving through Building Envelope Innovation: Smart Skin Design". *Recent Advances in Urban Planning, Sustainable Development and Green Energy*, 35-44.
- Cachat, E. T., Grynning, S., Thomsen, J., Selkowitz, S. (2019), "Responsive building envelope concepts in zero emission neighbourhoods and smart cities - A roadmap to implementation.". *Building and Environment*. 149, 446-457.
- Catto Lucchino, E., Goia, F., Lobaccaro, G., Chaudhary, G. (2019), Modelling of double skin facades in whole-building energy simulation tools: A review of current practices and possibilities for future developments. *Building Simulation*, 12(1), 3–27.
- Cheung, C.K., Fuller, R.J., Luther, M.B. (2005), "Energy-efficient envelope design for high-rise apartments." *Energy and Buildings*. 37, 37-48.
- Cui, H., Overend M. (2019), "A review of heat transfer characteristics of switchable insulation technologies for thermally adaptive building envelopes.". *Energy & Buildings*. 199, 427-444.
- Deb, S.K., Lee S.H., Tracy E.C., Pitts, J.L., Gregg, B.A., Branz H.M. (2001), "Stand-alone photovoltaic-powered electrochromic smart window", 93, 339-347.
- Favoino, F., Jin, Q., Overend, M. (2014), "Towards an ideal adaptive glazed facade for office buildings." *Energy Procedia*. 62, 289-298.
- Flor, J.F., Liu, D., Sun, Y., Baccarelli, P., Chilton, J., Wu, Y. (2018), "Optical aspects and energy performance of switchable ethylene-tetrafluoroethylene (ETFE) foil cushions." *Applied Energy*, 229, 335-351.
- Goia, F., Cascone, Y. (2014), "The Impact of an Ideal Dynamic Building Envelope on the Energy Performance of Low Energy Office Buildings." *Energy Procedia* 58 (1876): 185–192.
- Gutai, M., Kheybari, A.G. (2021), "Energy consumption of hybrid smart water-filled glass (SWFG) building envelope". *Energy & Buildings*. 230. 110508.
- Homod, R.Z., Almusaed, A., Almssad, A., Jaafar, M.K., Goodarzi, M., Sahari, K.S.M. (2021), "Effect of different building envelope materials on thermal comfort and air-conditioning energy savings: A case study in Basra city, Iraq." *Journal of Energy Storage*, 34, 101975.
- İdil, A., Niloufar, V. (2016), "The Analysis of Form, Settlement Pattern and Envelope Alternatives on Building Cooling Loads in Traditional Yazd Houses of Iran." *Gazi University Journal of Science*, 29(3):503-514
- Imhof, L., Suárez, E., Cáceres, N., Robbiati, F., Cáceres, C., Broilo, A., Pellizari, L., Hick, E., Matoff, E., Galetto, L. (2016), "Thermal performance of an extensive green roof under semi-arid conditions in central Argentina." *Journal of Green Building*. 16(1),17-42.
- Jang, H., So, S. (2021), "Physical Properties and Environmental Performance of Steam-cured Concrete containing Flue-gas Desulfurization Gypsum." *Journal of Green Building*. 16(1), 3-15.
- Johnsena, K., Wintherb, F. (2015), "Dynamic facades, the smart way of meeting the energy requirements." *Energy Procedia*. 78, 1568-1573.
- Kabošová, L., Foged, I., Kmet, S., Katunský D. (2019), "Hybrid design method for wind-adaptive architecture." *International Journal of Architectural Computing*. 17(4), 307–322.
- Kamel, E., Memari A.A., (2018), "Automated Building Energy Modelling and Assessment Tool (ABEMAT)". *Energy*. 147, 15-24.
- Lin, Q., Zhang, Y., Mieghem, A.V., Chen, Y., Yu, N., Yang, Y., Yin, H. (2020), "Design and experiment of a sun-powered smart building envelope with automatic control". *Energy & Buildings*. 223. 110173.

- Lommi, M., (2018), “The Mediterranean smart adaptive wall. An experimental design of a smart and adaptive facade module for the Mediterranean climate”, *Energy and Buildings*, 158, 1450-1460.
- Matheo, M., Couvelas, A., Phocas, M. C. (2020), “Transformable building envelope design in architectural education.” *Procedia Manufacturing*. 44, 116–123.
- Matin, N.H., Eydgahi, A., (2019), “Factors affecting the design and development of responsive facades: a historical evolution”. *Intelligent Buildings International*. 12(4), 257-270.
- Mumme, S., James, N., Salonvaara, M. (2020), “Smart and Efficient Building Envelopes: Thermal Switches and Thermal Storage for Energy Savings and Load Flexibility.” *Published in ASHRAE Transactions*. 126 (2).
- Pastore, L., Andersen, M. (2022), “The influence of façade and space design on building occupants’ indoor experience.” *Journal of Building Engineering*, 46(103663), 2352–7102.
- Perino, M., Serra, V. (2015), “Switching from static to adaptable and dynamic building envelopes: A paradigm shift for the energy efficiency in buildings.” *Journal of Facade Design and Engineering*. 3, 143-163.
- Pisello, A. L., D’Alessandro, A., Fabiani, C., Fiorelli, A. P., Ubertini, F., Cabeza, L.F., Materazzi, A. L., Cotana, F., (2017), “Multifunctional analysis of innovative PCM-filled concretes.” *Energy Procedia*. 111, 81-90.
- Ruiz, I. E., Gopal, G., Coates, J. (n.d.). *Smart building envelope*. Smart Building Envelope FMJ November/December 2020. Retrieved March 4, 2022, from http://fmj.ifma.org/publication/?i=679917&article_id=3813310&view=articleBrowser&vr=html5
- Saroglou, T., Meir, I.A., Theodosiou, T., Givoni, B. (2017), “Towards energy efficient skyscrapers.” *Energy and Buildings*, 149, 437–449.
- Saroglou, T., Theodosiou, T., Givoni, B., Meir, I. A. (2019), “A study of different envelope scenarios towards low carbon high-rise buildings in the Mediterranean climate - can DSF be part of the solution?” *Renewable and Sustainable Energy Reviews*, 113, 109237.
- Shahin, H. S. M. (2019a), “Adaptive building envelopes of multistory buildings as an example of high-performance building skins.” *Alexandria Engineering Journal*, 58, 345–352.
- Shahin, H. S. M. (2019b), “Biomimetic building skins: An adaptive approach.” *Renewable and Sustainable Energy Reviews*. 79, 1472–1491.
- Tabadkani, A., Roetzel, A., Xian, Li, H., Tsangrassoulis, A. (2021), “Design approaches and typologies of adaptive facades: A review”. *Automation in Construction*. 121, 103450.
- Theodosiou, T., Tsikaloudaki, K., Tsoka, S., Chastas, P. (2019), “Thermal bridging problems on advanced cladding systems and smart building facades”. *Journal of Cleaner Production*. 214, 62-69.
- Verma, S., Devadass, P. (2013), “Adaptive[skins]: Responsive building skin systems based on tensegrity principles.” *FUTURE TRADITIONS 1st Education and research in Computer Aided Architectural Design in Europe, Regional International Workshop Proceedings*. Porto. University of Porto. Faculty of Architecture. 155–170.
- World Green Building Council (n.d.). *What is green building?*. Retrieved March 5, 2022, from <https://www.worldgbc.org/what-green-building>.
- Yoon, J. (2020), “Design-to-fabrication with thermo-responsive shape memory polymer applications for building skins”. *Architectural Science Review*. Vol. 64, 1-2, 72-86
- Yuan, Z., Zhou, J., Qiao, Y., Zhang, Y., Liu, D., Zhu, H. (2020), “BIM-VE-Based Optimization of Green Building Envelope from the Perspective of both Energy Saving and Life Cycle Cost.” Accessible at: www.mdpi.com/journal/sustainability, Accessed on: March 5th, 2021.
- Zhang, S., Hu, W., Li, D. Zhang, C., Arici M. (2021), “Energy efficiency optimization of PCM and aerogel-filled multiple glazing windows.” *Energy*, 222, 119916.

SESSION 2A: HYBRID CAMPUS

Taking Advantage of the Pandemic Hybrid Experience: Rational Workplaces for Academic and Business Activity

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ABSTRACT

Modern business organisations rely on knowledge and its management as a key asset. It should, therefore, be expected that the workplaces in organisations follow the models of the workplaces at universities in terms of knowledge creation and dissemination and vice versa – the workplaces at universities follow the models of the workplaces in organisations in terms of transfer, use and implementation of knowledge. The COVID-19 pandemic made universities introduce online work and education or take advantage of the hybrid mode combining in-person and e-work offering another approach to the concept of workplace. A lot of research has been done with a focus on the strengths and weaknesses of traditional, online and hybrid modes in an academic environment. With this regard, the authors made a survey on the attitudes of students, faculty and administrative staff. It was aimed at establishing how based on the university development strategy of the largest economic university in South-Eastern Europe recommendations could be made in terms of costs and work schedule optimisation. The optimisation is analysed with regard to the increased student attendance and engagement, enhanced faculty research and development activities, and greater effectiveness of administrative staff taking into account the change in the conventional workplace. Furthermore, another survey was carried out focused on students' views and perceptions related to the workplace of the future. Modern generations spend more of their time in the virtual reality rather than in real life and it is, therefore, reasonable to study how they see the workplace that will contribute to their full-fledged participation in knowledge acquisition and career realisation. Thus, having discussed the results and findings from both surveys, we would be able to suggest a rational model of the academic and business workplace of the future. It could be assumed that the offices of the future would have to ensure employees conditions for work in real, in-person, environment and cloud environments for distance working.

Keywords

Academic workplace, Business workplace, In-person environment, Hybrid environment, Model of workplace.

1 INTRODUCTION

Since the second part of last century, universities have been faced with a daunting challenge: society has been imposing ever increasing requirements on them while the share of the public financing of their activities has been decreasing (Conceicao, Heitor, M.V., & Oliveira, P.M., 1998, p.b 203). This encourages universities to look for new opportunities as well as to get involved in new activities such as closer relations with the business, internationalisation of academic activity in compliance with business trends, finding solutions to topical socio-economic issues, etc. The last is mostly related to the right positioning of a university in society

in terms of knowledge-based economy (KBE). In the process of searching for solutions in this area, it is noteworthy that the features of the workplaces in an academic environment would be similar to those of the organisations that manage knowledge successfully. Business workplaces, in turn, could be expected to be similar to academic ones in terms of knowledge creation and dissemination.

2 KNOWLEDGE AS THE CONTEXT OF A WORKPLACE

Over the last decades, there has been an increasing interest in knowledge seen as a factor for enhanced productivity and, hence, for sustainable long-term economic growth and development (Sundac, D. & Krmpotic, I., 2011). Authors consider it a key organisation asset and contributor to success, but view it from different perspectives: for EU policy- and decision-makers knowledge is a specific feature of human capital resulting in sustainability and welfare (De la Fuente, A. & Ciccone, A., 2002), for some scientists it is essential for research, innovation and entrepreneurship (Adams, 1990; Lederman & Maloney, 2003) while for another group of researchers it is crucial in terms of education and the acquisition of understanding, experience and skills (Hanushek & Kimko, 2000; Cohen & Soto, 2006). Knowledge with its relation to innovation and entrepreneurship as well as its impact on economic growth was recognised as early as the beginning of the 20 c. by Shumpeter (1911). For Marshall “Capital consists in a great part of knowledge and organisation... knowledge is our most powerful engine of production... organisation aids knowledge” (Marshall, 1916, p. 115). Knowledge economy and knowledge-based economy are popular concepts today with the former having its origins in the 1950s and being related to the composition of the labour force, while the latter is associated with structure and systems extending its scope to intellectual property as a form of capital. In 1959, Penrose noted the crucial importance of knowledge as an economic resource (Penrose, 1959) and decades later elaborated on it by pointing to knowledge networks and transferable knowledge (Penrose, 1995). As a concept highlighting the perspective of structure and system, knowledge-based economy is more often associated with governments (Nelson, 1982) and massive structures such as international organisations in terms of designing and implementing policies for development in the spheres of science, technology and innovation (OECD, 1964). On the other hand, Machlup (1962) tried to operationalise the concept of knowledge economy by identifying the sectors concentrating knowledge assets thus distinguishing six sectors of knowledge production with the largest share of GDP and employment potential: education, research and development, artistic creation, communications media, information services, information technologies. Other researchers (Eliasson, Fölster, Lindberg, & Pousette, 1990; Burton-Jones, 1999) as well as organisations (OECD/Eurostat, 1997) focused on the knowledge intensity of sectors and its measurement at national and regional levels. In addition, Nelson and Winter (1982) focus on technological trajectories and regimes with relation to their impact on innovation systems while Etzkowitz and Leydesdorff (1995) discuss the systems and dynamics of knowledge and develop a dynamic model - the Triple Helix model of innovation dealing with the relations and interaction between the academia, the industry and governments. Elaborating the research in the area of knowledge-based economy in the beginning of the 21st c. logically leads to the idea that being a qualitatively new phenomenon in technological and social terms, KBE will function in a qualitatively new environment. This particular environment is the modern highly technological workplace.

3 WORKPLACE WITHIN THE CONCEPT OF KNOWLEDGE-BASED ECONOMY

As the review of knowledge-based economy shows, it is a complex socio-economic phenomenon. Phenomena of this kind manifest themselves in the conditions of social division of labour. This is the only way to realise the complex interactions we are considering. On the one hand, there are a lot of autonomous actors who interact with each other and, on the other hand, there are public institutions and structures of the civil society which regulate these complex interactions. As a result, an elaborate system of rules is created, which in the conditions of democratic public relations regulate a tangled knot of conflicting interests. Establishing such complex structures, some of which of hierarchical nature and others of a network type, is based on basic structural building blocks. These are workplaces that are then organised together in groups, departments, public or private organisations pursuing business or other goals. Similarly to the field of public services, in the field of business, the division of labour presupposes a following unification in order to obtain the desired final result – a product (service) obtained through the united efforts of a number of participants in the work process and in compliance with the generally accepted and legally binding rules. The task is complicated because most often these actors represent different business organisations, public institutions and structures of the civil society. Therefore, the existence of workplaces whose specifics reflect these complex socio-economic relations is an objective necessity. This is obvious when one traces the historical development of the concept of workplace. It has been possible to speak of workplaces formed as a result of the modern view of the division of labour since the beginning of the Industrial Revolution. Until then, technology development had been a relatively slow process. This led to the fact that the specific features of the workplaces in craft workshops were rather the result of adopted traditions than of the improvement of production technologies. The situation changed with the Industrial Revolution and since then it has been possible to observe four waves in the evolution of workplaces (Szelagowski, 2019, p. 45). In this article, the workplace is considered in the context of business process management. The first wave can be called conditionally “Industrial Engineering” (Szelagowski, 2019, p. 5). It was observed in the end 19 c. and the beginning of the 20 c. Its main objective was the optimised use of time, cost reduction and increase in production volume. The focus was on the analysis and improvement of production processes. The second wave is the so-called “Value Chain Management” and it lasts until the end of the 1990s (Szelagowski, 2019, p. 6). Its maxim was that the quality of the products and services offered, and the value provided for the customers matter the most. The third wave, conditionally called “Evolutionary Adaptation to the Needs of the Clients”, aimed at organisational adaptation to consumer changing needs on a continuous, evolutionary basis. This is achieved by using modern cutting-edge technologies (Szelagowski, 2019, p. 8). This wave lasted until the first decade of the 21 c. The wave that is of importance for our study is the fourth one in the evolution of the workplace, seen through the prism of business processes. It can be called “Business Process and Knowledge Management”. It began in the first decade of the 21 c. and has been going on so far (Szelagowski, 2019, p. 42). In the contemporary world, there are two main trends that determine the specific feature of workplaces – the constant change of the socio-economic conditions established so far and the accelerating development of information and communication technologies. Our business and life are becoming more and more digital and this process is sometimes forced, as was the case with the COVID-19 pandemic. The organisation’s ability to respond to the challenges of globalisation and modern technologies is no longer a competitive advantage, but a condition for survival in a new world where traditional competitive advantages are constantly eroding. These challenges are the dissemination of information through digital social and other non-controlled networks and media, the use of big

data, the Internet of things (IoT), business process automation and robotisation, and the implementation of elements of machine learning, artificial intelligence, etc. Thus the use of modern workplaces by organisations becomes a key condition for success in KBE. Drawing the attention of the business, public institutions, educational organisations and the general public to the need to modernise workplaces will pave the way for the widespread use of KBE. The substantial contribution of knowledge to business prosperity as well as to the country, regional and global economy draws our attention to knowledge management and factors for knowledge promotion. It led to the increased interest of the World Bank because of the knowledge-welfare correlation. Thus in 1999 the World Bank Institute started the Knowledge for Development Project (K4D) aiming at making governments and politicians aware of the impact of knowledge on economic development. In this respect, the World Bank (2008) defined four elements or pillars of knowledge economy within the Knowledge Economy Framework: education – educated and skilled workforce; innovation – a well-developed innovation system including academia, scientific workers, the business and governments; information and communication technologies – an effective and modern communication infrastructure providing for the facilitation of information and knowledge dissemination and exchange; conducive economic and institutional environment – policies and incentives encouraging the expansion, dissemination and acquisition of knowledge as well as stimulating creativity and resourcefulness. According to the generally accepted classification of knowledge, it can be explicit and tacit. As Husain and Ermine define it, explicit “or documented knowledge is acquired out of formal or informal education by making use of various sources of information” (Husain & Ermine, 2021, p. 5). Tacit knowledge, in turn, is based on study, education and upbringing, and is defined by Smith as being “technical or cognitive in nature, is made up of mental models, values, beliefs, perceptions, insights, assumptions and is usually grouped according to content, context, and orientation” (Smith, 2001 as cited by Husain & Ermine, 2021, p. 5). The use of both types of knowledge by an organisation in order to benefit from it and create new knowledge is knowledge management. Knowledge management can be effective if there is an effective relationship between the people in an organisation and information and communication systems. Knowledge management can give the managerial perspective to the use and creation of knowledge as a fundamental resource, organisational capital and strategic asset. Managing knowledge involves the management of both the organisation and its personnel. Creating, accumulating and disseminating knowledge adds value to all stakeholders – people, organisations, society and ultimately leads to human progress. Therefore, social learning and knowledge promotion and sharing should be an integral part of organisational and institutional improvement along with individual performance and experience and seen as a social capital as well. With regard to knowledge management, Call (2005) suggests three characteristics of a successful organisation: efficiency, adaptability and flexibility. Furthermore, experienced and knowledgeable leaders and effective knowledge processes lead to optimised organisational performance. In addition, research revealed that in order to use the synergistic effect of process management, experience and knowledge, there should be developed knowledge management systems. Process management in this case involves the access, acquisition and networking of knowledge aimed at accomplishing organisational goals. For this purpose, various tools and techniques have been developed and implemented. In education, knowledge management is focused on building educational communities and improving learner performance through a knowledge-friendly environment of enhanced knowledge creation, knowledge sharing processes and cross-organisational learning. In modern times, this involves technology and means using information and communication technologies intensely. Thus educational and business organisations can be seen as parts of the sequence of employees’ professional preparation and

improvement, faced with the same problems and working on finding solutions to the same challenges. This similarity implies a similarity in the management of knowledge and business processes. Hence the authors assume that if educated in the same or similar way in terms of academic culture, processes, relations and work, university students will be facilitated in functioning as qualified experts for their employers in the future and with regard to living and working in a world built on knowledge as a major asset. Workplace, therefore, is of key importance and should be considered as a multi-faceted concept related to business and social effectiveness, and intertwining in itself values, expectations, behaviours, cognition, modes, motivation, perceptions – all ultimately associated with knowledge in terms of success, satisfaction, innovation and creativity, welfare. The COVID pandemic highlighted the need to adjust to the new reality and accelerated the processes that have been going on in institutions and organisations by underlying the significance of knowledge management: acquisition, exchange and processing.

4 SURVEYS ON WORKPLACES AS MODES AND CULTURES OF WORK

The first survey prepared and conducted by the authors in March 2021 after two online semesters was an online survey including the stakeholders directly involved in academic activity: faculty staff, students and administrative staff. Some 203 respondents took part, of which 51 lecturers, 139 students and 13 administrative staff from the authors' university. The survey was aimed at gathering qualitative and quantitative data, and thus studying the respondents' attitudes and perceptions related to online work, including academic and research activity. Respectively, it focused on their opinion of the new types of workplaces introduced: the remote and the hybrid ones. The survey included 26 questions based on a 5-point Likert scale. Although telework and online education have become increasingly popular since the emergence of the Internet, it was the COVID-19 pandemic that made educational institutions worldwide switch to them overnight. Stakeholders were faced with this change and it entailed adjustment and adaptation in all aspects of academic activity. The conventional academic workplace was replaced by a remote one, usually the individual's home, and later on – by a hybrid one involving remote and face-to-face work. For the methodology and results of this study, see in more detail Stefanova and Zabunov (2021). Survey results revealed that lecturers felt more stressed with regard to the adaptation and preparation of materials for online teaching; assessment objectivity; research activity including mobility, projects and events. Students were not really convinced in the disadvantages of e-assessment, but were in favour of face-to-face classes even though most of them work and study and e-education is a good option for them to attend from their offices. When asked which mode they find the most effective – the online, face-to-face or hybrid one, the lecturers were firmly in favour of the hybrid mode, while the students formed two comparable groups: one preferring face-to-face classes and one preferring the online mode. All three groups found online academic work safer with regard to COVID prevention, but more stressful with regard to physiological and psychological problems related to the mediated contact and constant work and communication on the Internet. Lecturers saw in the online and hybrid modes an opportunity to have more time for research and publication activity. The second survey was developed and carried out at the end of the winter semester of the academic 2021-2022 and included 126 respondents doing their bachelor's or master's degrees at the authors' university in Bulgaria. It was an online one designed for students and aimed at collecting quantitative and qualitative data with relation to the students' views of the ideal academic workplace and the workplace of the future. The authors wanted to find out if students see a connection between their academic workplaces and their future professional workplaces, especially after almost four online semesters. The 33 questions were divided into groups and, apart from the respondents' demographic characteristics, focused on four main

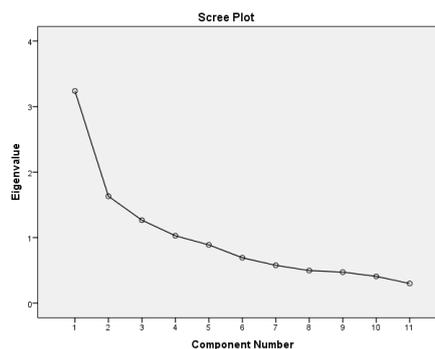
areas. Groups 1-3 were formulated with the use of a 5-point Likert scale, while Group 4 included open questions. The internal consistency of the questionnaire was checked with Cronbach's alpha. It was further applied for the first three groups of questions. For Group 3 factor analysis was applied as well. The main parameters and results of the research are presented in Table 1.

Table 1. Basic parameters and results of the research

1. Reliability statistics:			
Cronbach's Alpha -	,712	Cronbach's Alpha Based on Standardised Items -	,716
			N of Items - 24
2. Groups of questions and their content:			
Group 1 - General characteristics of educational workplaces and provision of specialised hardware and software (Likert scale)			
Group 2 - Similarities and differences between modern professional and educational workplaces (Likert scale)			
Group 3 - Formulating the characteristics of the workplaces of the future, based on respondents' expectations			
Group 4 - Respondents' ideas of the ideal workplace of the future (open questions)			
3. KMO and Bartlett's Test (for the factor analysis):			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy			,716
Bartlett's Test of Sphericity			Approx. Chi-Square
			320,021
			Df
			55
			Sig.
			,000
4. Major latent factors:			
Factor 1 – A place for creative work			
Factor 2 – A place for time balance (between work and leisure)			
Factor 3 – A hybrid place (home, an office, a hotel in the countryside, a park, etc.)			

The number of latent factors was determined using the visualisation of the relationship between the Eigenvalues and the factors. A graph of this relationship is shown in Figure 1 (Scree Plot).

Figure 1. Scree Plot



The first two groups of questions confirmed the results from the first survey to a great extent. What is noteworthy is the fact that there are differences in the answers of the students doing their bachelor's and master's degrees. The latter have a more varied life experience and the nuances in their perceptions are meaningful. For instance, unlike the former who prefer e-learning using mobile devices such as tablets and phones, they would rather use personal mobile computers like laptops. Unlike the students doing their master's degree, the students doing their bachelor's degree strongly believe that the environment is of key importance for

the educational process regardless of the mode – face-to-face or online. In addition, unlike their more experienced fellow students, they are not convinced of the similarity between the academic and the professional workplace, i.e. they make a clear distinction between them. Content analysis was applied for the last group of questions. These questions are open and provide valuable insights into students' attitudes, perceptions and ideas related to the ideal workplace of the future. The workplace of the future is approached from two aspects – part of the respondents emphasises the mode, whereas the other one puts emphasis on the relations within the team/company culture. Most respondents are in favour of a hybrid or mobile workplace, i.e. a technological one. Offices are expected to be spacious, modern and well-equipped, comfortable, with places for rest/informal communication with colleagues and providing water. Working time should be flexible and there are respondents willing to work in nature. Everyday communication with colleagues in the workplace is also seen in terms of mode and relations. The majority of the respondents are proponents of modern technologies, but for a considerable part of them direct contact is important. Relations should be meaningful and harmonious, without stress, pressure or intrigues. In terms of transportation and compared to the workplace of the present, the workplace of the future will be less time-consuming (47% of the respondents) because the infrastructure and transport network will be improved or optimised, there will be less traffic, companies will have flexible offices, but the general opinion is that the answer to the question depends on the circumstances, location, employer views, means of transportation and kind of job. Some 15% think there will be no change in the time spent in transportation and 12 % are negative because according to them employers will be renting offices on the outskirts of cities due to the lower prices. Another group finds the question irrelevant because of remote work and the hybrid mode. Since business trips account for a substantial part of a number of jobs and are a specific feature of a workplace, the questionnaire included a question about them. For 63% of the respondents the workplace of the future will involve the meetings and communication of today's trips in the online or hybrid modes, via platforms or in another digitised way. There are views that personal contact is always the best solution or that communication will be open – possible to be realised around the clock. As far as employers' costs for offices, car parks and other facilities are concerned, the workplace of the future will save money because: employees will work in a hybrid mode which is more economical, more productive and more convenient for them; productivity when working online is higher; the costs for work in the virtual space are lower; employers transfer costs to employees; staff will work from home or from any place they want (outside conventional offices). Few respondents do not find virtual workplaces cost-effective because of inflation or the need for employers to provide additional hardware/software. Asked about open-space offices (offices of over 100 m² where over 30 people of different specialties work), the respondent students were predominantly negative: "they are outdated", "I don't like them. They aren't good.", "They don't provide for the concentration one needs in order to work properly.", "People lose their identity in them.", "They are good only for people of the same specialty/of similar interests". To sum up, the ideal workplace of the future is modern and well-equipped no matter whether it is in an office or at home; teamwork characterised by straightforwardness and effective communication (whatever it means) is appreciated; places for rest and informal communication are a must; virtual communication combined with direct contact is supported. Therefore, the academic work/educational workplace must have the same characteristics, which means that universities should give the hybrid mode of work and education a serious consideration.

5 IMPLICATIONS

The comparison of the trends outlined in specialised literature and modern students' perceptions lead to interesting conclusions. First of all, students are "digital natives" (Prensky, 2001) and belong to a generation spending most of its time in the virtual space. This is a fact that should be taken into account. Furthermore, one should have in mind that the consequences of this are complex. Some of them are positive, but others are not. For the surveyed young people, the workplace is an entry point to cyberspace and overcomes the limitations of conventional reality. Such a workplace ensures a rational balance between work, education, formal communication with tutors and partners, entertainment, informal communication with friends and like-minded people from the social networks, etc. In addition, what is of special importance is the fact that there are opportunities for all this to happen simultaneously. The multi-tasking mode is a natural state for the "digital natives". Therefore, tasks requiring deeper concentration are difficult for them. Lecturers are expected to have special skills in order to be able to engage and retain their students' attention. This will be a problem for the managers who will be coordinating the work between hybrid workplaces with a considerable virtual component. The rational balance between face-to-face and remote work will be a primary challenge when designing hybrid workplaces. It can be assumed that today the computer becomes a device behind which the student can hide and escape from their personal responsibilities as a learner. In such a situation, the educational process can hardly bring up individuals ready to take the initiative, risk and fight for the righteousness and power of their ideas. They would rather expect to be given clear rules and instructions to follow while performing tasks. This is where the difference between the students doing their bachelor's and master's degrees becomes clear. The former who lack practical experience consider academic workplaces specialised places for learning. For them, professional workplaces are something different and unknown. The latter, most of whom have a practical experience of more than two years, consider academic workplaces very good universal workplaces of the future. It can be expected that just as the craft workshop has turned into the prototype of the capitalist enterprise at the dawn of the Industrial Revolution, modern universities will become the prototype of business organisations in the knowledge economy. Hence the rational model of workplaces for academic and business activity is a model of dialectical interaction between hybrid academic and business workplaces with the former having a leading role. What many of the new generation students do not realise clearly should be carefully taken into account by future managers. The situation itself is really interesting because the future managers are today's students. The workplaces of the future should have characteristics allowing managers to stimulate initiative, responsibility and leadership in remote communication to the extent of face-to-face communication. The latent factors extracted from the answers provide three key features of the workplaces of the future: a place for creative work, a place for time balance (between work and leisure), a hybrid place (home, an office, a hotel in the countryside, a park, etc.). In order to react to all these challenges, it is most appropriate to consider the workplaces of the future as components of a hybrid learning management system.

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REFERENCES

- Adams, J. D. (1990), Fundamental Stocks of Knowledge and Productivity Growth. *Journal of Political Economy*, 98(4), 673-702. Retrieved from <http://www.jstor.org/pss/2937764>
- Burton-Jones, A. (1999), *Knowledge Capitalism*. Oxford: Oxford University Press .

- Call, D. (2005), Knowledge management – not rocket science. *Journal of Knowledge Management*, 9(2), 19-30. doi:10.1108/13673270510590191
- Cohen, D., Soto, M. (2006), Growth and Human Capital: Good Data, Good Results. *Journal of Economic Growth*, 12(1), 51-76.
- Conceicao, P., Heitor, M.V., Oliveira, P.M. (1998), Expectations for the University in the Knowledge-Based Economy. *Technological Forecasting and Social Change*(58), 203–214.
- Cooke, P., Leydesdorff, L. (2006), Regional Development in the Knowledge-Based Economy: The Construction of Advantage. *The Journal of Technology Transfer*, 31(1), 5-15.
- De la Fuente, A., Ciccone, A. (2002), *Human capital in a global and knowledge-based economy*. Luxembourg: European Commission.
- Eliasson, G., Fölster, S., Lindberg, T., Pousette, T. (1990), *The Knowledge Based Information Economy*. Stockholm: The Industrial Institute for Economic & Social Research.
- Etzkowitz, H., Leydesdorff, L. (1995), The Triple Helix---University-Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development. *EASST Review*, 14, 14-19.
- Hanushek, A. E., Kimko, D. (2000), Schooling, Labor-Force Quality, and the Growth of Nations. *American Economic Review*, 90(5), 1184–1208.
- Husain, S., Ermine, J.-L. (2021), *Knowledge Management Systems: Concepts, Technologies and Practices*. Emerald Publishing.
- Lederman, D., Maloney, W. (2003), “R&D and Development”, *Policy Research Working Paper*. World Bank. Washington, DC: World Bank.
- Machlup, F. (1962), *The Production and Distribution of Knowledge in the United States*. Princeton, NJ: Princeton University Press.
- Marshall, A. (1916), *Principles of Economics*. London: Macmillan.
- Nelson, R. R. (1982), *Government and Technical Progress: A Cross-Industry Analysis*. New York: Pergamon.
- Nelson, R. R., Winter, S. (1982), *An Evolutionary Theory of Economic Change*. Cambridge, MA: Belknap Press of Harvard University Press.
- OECD (1964), *The Residual Factor and Economic Growth*. Paris: OECD.
- OECD/Eurostat (1997), *Proposed Guidelines for Collecting and Interpreting Innovation Data, ‘Oslo Manual’*. OECD/Eurostat. Paris: OECD/Eurostat.
- Penrose, E. (1959), *The Theory of the Growth of the Firm*. Oxford: Oxford University Press.
- Penrose, E. (1995), *The Theory of the Growth of the Firm* (Third ed.). Oxford: Oxford University Press.
- Prensky, M. (2001), Digital Natives, Digital Immigrants. *On the Horizon*, 9(5), 1-6.
- Schumpeter, J. (1911), *The Theory of Economic Development*. Oxford: Oxford University Press.
- Smith, E. A. (2001), The role of tacit and explicit knowledge in the workplace. *Journal of Knowledge Management*, 5(4), 311–321. doi:10.1108/13673270110411733
- Stefanova, A., Zabunov, G. (2021), Higher Education In a Pandemic: Global Implications Based on A Case Study From Bulgaria. *Strategies for Policy in Science and Education*, 29(5). doi:10.53656/str2021-5-3-pand.
- Sundac, D., Krmpotic, I. (2011), Knowledge economy factors and the development of knowledge-based economy. *Croatian Economic Survey*, 13(1), 105-141.
- Szelagowski, M. (2019), *Dynamic Business Process Management in the Knowledge Economy*. Cham, Switzerland: Springer Nature Switzerland AG. doi:10.1007/978-3-030-17141-4
- World Bank (2008), *Knowledge for Development, The World Bank Institute’s Program on Building Knowledge Economies*. Washington, DC: World Bank.

Hybrid Learning Environments in Universities – how to manage the co-creation process from design to use

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ABSTRACT

An identified need to promote hybrid practices in education puts pressure on transforming university learning environments. Current teaching and learning models and approaches include e.g. hybrid and blended learning, flexible scheduling, and attendance, and the learning environments are changing accordingly. To manage these requirements and processes, siloed practices must be overcome, and this requires the engagement of stakeholders such as faculty and facilities management as well as end-users. The goal of this paper is to understand the transformation processes of hybrid learning environments in universities. The method is cross-case analysis. 6 learning environment transformation-to-hybrid cases are analysed. The case studies are conducted in three Finnish universities in 2018-2020. The results indicate that there are three critical factors in the successful transformations towards technology enriched learning environments: 1. The participatory design process which is integrating the digital and physical architecture to serve user needs 2. The training of users to new learning environments 3. Management of support in the use phase. The research provides practical examples and process descriptions of transformation towards hybrid learning environments for the user-centric design experts, facilities managers, and education designers. The research contributes to user-centric design theories as well as learning environment research. Future studies can be conducted by gathering user experiences of hybrid learning processes in new hybrid learning environments and the challenges residing in them.

Keywords

Hybrid learning environment, Co-creation, Participatory design, University.

1 INTRODUCTION

The need to transform university learning environments (LEs) is based on an identified move towards hybrid practices in education. The places, services and facilities should revolve around the learning and teaching processes, not the other way round. Teaching and learning methods and approaches as well as support services that meet the needs of students, teachers, and staff, with their integrated use of technological tools, include e.g. blended learning, flexible scheduling, and attendance. The requirements of learning environments are changing accordingly. To manage these requirements and processes, siloed practices and push models of services should transform into pull systems, engaging stakeholders such as faculty and facilities management as well as end-users. The process should also entail a future-ready understanding

of sustainability issues from first phases of design imperatives to use and post-occupancy evaluation, in cross-sectional negotiations throughout the process (e.g. Sterner et al., 2019). The goal of this paper is to understand the need and processes of change for hybrid learning environments and embedded and emerging learning-promoting technologies in universities.

2 TOWARDS HYBRID LEARNING ENVIRONMENTS

Contemporary learning has become increasingly technology rich. Technology Enhanced Learning (TEL) research is focusing on new tools supporting learning and teaching. Bligh and Crook (2017) argue that the ones working in the field need to better understand both technology and learning as spatial phenomena and view space as an integral part of the “technology” that might mediate learning. Additionally, TEL also needs to focus on how technology might undermine spatial conventions to benefit learning. For example, they refer to the design of Multi-Display Learning Spaces, where innovative display technologies challenge established, front-facing classroom design repertoires. The display space is used to create juxtapositions of visual materials that support students’ verbal contributions in small-group teaching contexts (Bligh & Sharples, 2010). On the other hand, learning is increasingly conceptualised as ubiquitous and continuing, and different informal, even unintentional digital devices and solutions are integrally a part of learning trajectories in terms of sharing and communication, modifying and co-creating, and adapting and innovating (Lai, Khaddage & Knezek, 2013). TEL has been focusing on two-dimensional technology solutions, but the potential of virtual reality (VR) technologies and their features in education have been widely recognized, and experiments and research around them have increased rapidly (Brown et al., 2020). VR applications in higher education are most often used to teach and learn procedural-practical knowledge, declarative knowledge, analytical and problem-solving skills and communication, collaboration, and soft skills (Radianti et al., 2020). Recently, Hakkarainen and colleagues have elaborated on their initial ideas (e.g. Paavola & Hakkarainen, 2005) of inquiry-based learning and how technology can support the learning process (Paavola & Hakkarainen, 2021). Their dialogical learning model holds that technologies not only support but actively participate in the meaning negotiations taking place between the learners and between the learners and the applied technologies. The hybrid environment is an approach to merge physical and virtual spaces and technologies as well as to integrate formal and informal spaces to stress the need to overcome disciplinary and organisational boundaries. The 21st-century campus consists of a range of different general and specialised spaces such as laboratories, libraries, office areas, and lecture halls. Conceptualised and actualized hybrid environments must be rethought on the level of cross-scale space structures by integrating buildings, campuses as well as urban and outdoor spaces (Ninnemann et al., 2020). Learning space is seen as a dynamic entity that is produced by the social and material interactions taking place ‘within’ it (Law & Mol, 2001), and “the relationship between the dimensions of the environment and people is exactly what counts as the learning environment, through intelligent activities and interactions (Sandström, 2020, p. 20). When linking informal and formal as well as virtual and physical spaces, hybrid environments are emerging in completely diverse ways from the traditional bricks and mortar or clicks and bytes universities to support innovative teaching and learning processes (Ninnemann et al., 2020). Easier said than done, the key to well-functioning hybrid spaces lies in their ability to support seamless F2F interaction where remote participants can integrate their presence and where both parties have a sense of synchronous, equal participation. An unsurprising yet under-resourced factor contributing to the success – both in terms of user satisfaction and in terms of what can and will be achieved – of hybrid environments has been a secured, reliable human support resource that is available at hand (Sandström et al., 2016). In the future, the feasible solution would be for hybrid LEs to be intuitive to use and supportive

for different uses and users, irrespective of the availability of the support resource. Flipped learning (also called inverted learning) has transformed conventional in-classroom learning activities into out-of-classroom activities and vice versa (Betihavas et al., 2016; Karabulut-Ilgü, Jaramillo Chérrez & Jähren, 2018; Lo & How, 2019). Students are responsible for their learning process, and in a typical flipped learning situation they study the subject content of the lecture before class via learning materials such as videos or texts. As the in-class time is not used for lecturing, the students can be engaged in hands-on practices and in other interactive learning activities. These changes in pedagogical approaches towards active learning place a strong demand to refurbish the existing traditional classrooms and auditoriums to meet the needs of both digital and pedagogical solutions. There is a broad consensus in the research literature that learning spaces are inherently social (e.g., Matthews, Andrews & Adams, 2011). Learning spaces are historically, culturally, and socially dependent on the participants who occupy them (Bligh & Crook, 2017). Participatory design processes allow the learners and teachers to be involved in processes of place-making to develop conditions for sustained and meaningful activities, for learning and productive social interaction, this way also increasing a sense of ownership and agency in the LE and in terms of co-created services (Robertson & Simonsen, 2012a, 2012b; Kyza & Georgiou, 2014; Halskov & Brodersen Hansen, 2015; Sandström, 2020). Our approach can be seen to draw analogies to the three perspectives presented by Eyal and Gil (2022), namely *hybrid as blended*, *hybrid as a space of merging interactions, where technology adds to the space and its dynamic*, and *hybrid as fluid, as space where the boundaries between informal and formal are reconstrued and the learner is at the centre*. Our study touches upon the different perspectives to hybrid LEs by assuming co-creation as a key approach to construct hybrid LEs. The evolution in design research from a user-centred approach to co-designing is changing the landscape of design practice as well, creating new domains of collective creativity (Sanders & Stappers, 2008). Co-creation of LEs includes many stakeholders and bearers of knowledge of the digital, physical, and social aspects that need to be integrated into the process: to create hybrid environments of the future, more resources will be allocated towards ICT furnishing instead of structural features (Ninnemann et al. 2020). The emerging hybrid environments could become the first step towards sharing resources: digital and physical environments would no longer be funded from separate budgets, allowing synergies to be fully exploited. It is crucial to address the question of *managing* the process crossing siloes: understanding and promoting shared resources during the process and after occupancy. The “co” concepts like co-design to put users and communities at the heart of service design, co-production to allow users to participate in administration and delivery, co-creation to describe the involvement of customers in developing products and processes, and co-construction to describe collaboration and partnership working, are essential to recognize. Co-creative capacity can help us achieve wide-scale socio-environmental impacts including e.g. well-being (Metz et al., 2019).

3 METHODOLOGY AND CASES

The method is cross-case analysis, a research approach to analyse case studies by comparing similarities and differences in the events, activities and processes that are the units of analysis (Ragin 1997; Khan & Van Wynsberghe, 2008). Cross-case analysis focuses on the similarities and differences that may exist between different cases and gathers information from the original cases to refine and develop concepts (Ragin, 1997; 2014; 2015). Six case studies of learning environment transformations toward a hybrid mode were analysed. The case studies were selected from a pool of 12 co-creation case studies that were conducted in three Finnish universities in 2018-2020 (see Sandström & Nevgi, 2021) to represent (1) an experiment and training space for teachers and (2) a learning space for students and teachers (Table 1). The

selection criteria were the purpose of the transformation process, the driver for a need to change a space, and the variation in co-creation methods. The data were gathered by participatory workshops with users, interviews with the design team, and document analysis of e.g. spatial layouts and workshop summaries.

Table 1. Case studies

Case types	Experiment and training space			Learning space		
Case n°	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Purpose	Experimenting and developing hybrid learning and working environment	Experimenting VR-reality – research and showroom	Developing digital skills in innovative learning space	Developing a functional and comfortable learning environment	Providing flexible and easy to use digital and physical learning environment	Providing multi use digital learning environment
Driver	Activity led	Technology led	Activity led	Space led	Technology led	Space led
Size sqm	30	35	97	90	91	102
Renovation year	2019	2018	2019	2019	2018	2019
Picture						

In the case studies, different stakeholder pools participated (Table 2). The focus was arranged based on the expected main user groups, but in Case 5, the focus was more on the technical side of the ICT configurations.

Table 2. Methods used in the co-created cases

Case types	Experiment and training space			Learning space		
Case number	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Co-creation participants	Researchers, ICT-services, Facilities services	Learning services, facilities services	Facility services, ICT-services, teachers	Teachers, learning services, ICT-services, service designer, students	ICT department Learning services, facilities services	Teachers, ICT-services, students
Methods used in the co-creation						
Interviews				x		
Meetings	x					
Workshops				x		
Testing		x				
Use cases						x
Best practice			x			x

Design dialogue	x		x		x	
Walkthrough				x		
Feedback					x	

The SWOT analysis was a tool used in case studies to identify the strengths, weaknesses, opportunities, and threats of the transformation. The cross-case analysis began by reading the systematically produced reports of the case studies by individual researchers. The next step included comparing the similarities and specific features between the SWOT analysis of the case studies. The outcome was discussed in several joint researcher meetings, and the more general guidelines were elaborated.

4 RESULTS

Based on the findings, the strengths pinpointed the importance of flexibility and adjustability in terms of use of furniture and diversity in technology and technical solutions. Case 1 and 4 differed from others by highlighting the well-being and comfort of a space as a strength. Case two was specifically designed for VR and cases 3 and 6 emphasised the possibility of hybrid learning. The main weakness identified in all the case studies was that the full potential in use of devices requires systematic training of end-users. Special problems in space transformation arose due to the structure of the space and the indoor environment conditions, setting some limitations for fluent solutions as it was not easy to adjust technology to the existing classrooms (Table 3).

Table 3. Strengths and weaknesses found for the cases

Strengths	
Case 1	Flexible and adjustable furniture Comfort Scenery boards replace the lack of windows providing natural views Versatile ICT-equipment, GoPro 360 camera, Ceiling-attached fixed microphones Adjustable lightning
Case 2	Open space dedicated especially to Virtual Reality (VR) - place for experiments and demonstrations of different solutions Physical space is adjustable for the requirements of VR technology
Case 3	Modern and flexible furniture Central location on campus Diversity of audio-visual technology in limited space Ordinary lecture theatres and classrooms have similar equipment and dashboards – learning here is making using the technology easier in other locations
Case 4	Adjustable for lectures and group learning Diverse positions: standing, sitting Circadian rhythm in lighting and good acoustics with soft floor carpet increases the indoor environment comfort Two screens enable diverse presentations, the screens above the window wall support the work of the teacher
Case 5	Flexible chairs and tables, easy to move and to relocate

Case 6	Multiple options for teaching and learning Transparency through the windows to corridor Similar capacity as before the renovation Multiple screens, possibility to share screens Diverse possibilities for presentation direction Diverse use cases: discussions, poster presentations, group work, meetings, seminars
Weaknesses	
Case 1	Versatile ICT-equipment requires space Using the devices to their full potential requires skills and training Instead of digi-pedagogical training one focuses on technical training only Mere GoPro 360 from bird perspective is not usable in hybrid teaching
Case 2	Virtual Reality is a trending technology and not yet known thoroughly – requires a lot of marketing for students and teachers
Case 3	The amount of technology is also a weakness of the place – there are too many screens It is not easy to use in basic education and it is not meant for it
Case 4	The structure of the space limits the flexible arrangements of furniture The full potential of the use of devices requires training Little amount of natural daylight
Case 5	Part of the equipment and screens too advanced and non-intuitive, limited use
Case 6	The space is constantly occupied due to capacity and the use is not always for new purposes. The location on campus is not central, it is not easy to access & there is no clear ownership, and the space is not very well taken care of It is easy to forget to switch on the ceiling microphones To manage all equipment takes some time

Five case studies shared the same opportunity for organising hybrid teaching and learning by using the versatile devices and digital technologies of the space. Case study 2 differed from other case studies, as the main purpose for the space development was to create a room for effective use of Virtual Reality. All the refurbished spaces had attractiveness factors for different stakeholders. (Table 4)

Table 4. Opportunities found for the cases

Opportunities	
Case 1	Space provides multiple possibilities to train and develop digi-pedagogical skills. The space functions as a meeting room for face-to-face and hybrid and remote meetings. The space is a room for research group collaboration, and it offers potential to investigate group work and communication.
Case 2	The wow-effect of Virtual Reality can increase the interest of teachers and students in innovative technology. Modern technology advances learning and thinking and provides opportunities for new exercises.
Case 3	The development of space was based on sufficient resources. The synergy with places close by can provide resources for future development. The space can be used for other purposes too and it is easy to add innovative technologies. It is a peaceful place to test technology compared to lecture theatres. The place is a meeting place for digital mentors, and it is also a meeting place for teachers. The place can also be used for teaching purposes, and it can support all campuses of the university.

Case 4	The place is transformable into two smaller learning places by the removable wall.
Case 5	The space can be used in diverse group working situations, there can be more presentations simultaneously on many screens or only one presentation on many screens.
Case 6	It is easier to join remotely through video conferencing. The active participation of students is enhanced by sharing screens from their own laptops. Space can be used to learn digital teaching skills. The space is adjustable, and it provides enough room for diverse experiments in using digital solutions. The space can also attract external stakeholders of universities to organise events on campus.

The common threat in all six cases was the lack of support in the use of the hybrid solution. The lack of support in the use of the space leads to a situation where the potential of digital technologies is not fully taken to use. (Table 5)

Table 5. Threats found for the cases

Threats	
Case 1	Limited use because users cannot use the equipment.
Case 2	The continuity of the development is not clear, and the ownership and funding of the space are still open.
Case 3	If the space is not found by teachers to experiment and train, it is not serving its purpose. It is difficult to get teachers to use it without external guidance. Patience with the new space to new use is required – it is too easy to start to use the space differently without the full potential. Full potential and use require input and marketing.
Case 4	The potential of the space is not fully used, because the training of the use of the space was not resourced during the planning phase.
Case 5	Less communication in the scale of the learning space depending on the way the space is used.
Case 6	The skills will and time for new pedagogy in the new space – the threat is that the traditional ways to teach are still strong. There is no time to learn to use space, especially if the instructions are not clear. The space needs to be left to default settings to be ready for the next user and new settings.

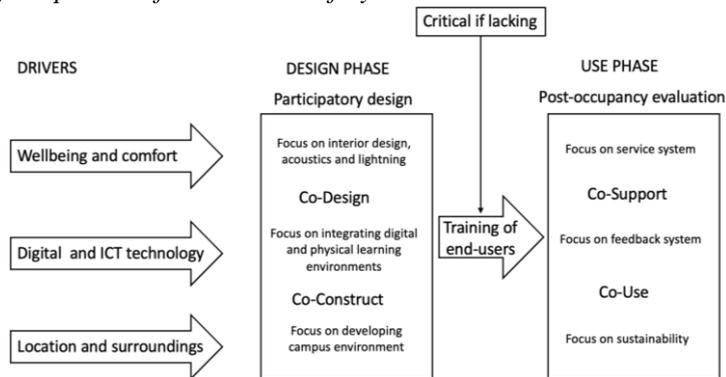
All case studies implemented co-design and co-creation in developing and refurbishing the target room to meet the requirements of the active learning environment. Cross-case analyses about user participation indicated that there was more than one method used in all but one case. The most frequent design dialogue (and meetings) seems to focus on the physical solution and co-creation on it. It is also typical to use benchmarking for best practices. There are many methods used (interviews, workshops, testing, use cases, walkthrough), but one would benefit from a more systematic framework in using them. The management of the design phase differed in the case studies. Only one of the case studies continued user involvement by gathering systematic feedback. The design drivers of the refurbishment of the space were threefold: Well-being was a driver in two case studies (case studies 1 and 4), where the selected classrooms were uncomfortable without natural light and with bad acoustics. The role of the interior architect was particularly important in managing the design phase. Case studies 2 and 5 had a driver in the integrated co-creation process to refurbish the space for the use of innovative technology (e.g. VR). The importance of the role of ICT experts in managing the design phase was identified. For case studies 3 and 6, the location of the space was the design driver. The intention was to re-design the learning environments to make them more attractive

for students and teachers. The location of these spaces was not optimal, and so in managing the design phase, the various pull factors were considered to improve the attractiveness of the space.

5 CONCLUSION

The user-centric approach is extending towards co-creativity (see Sanders; Metz). The “co” concepts co-design and co-construction require counterparts at the use-phase, namely co-support and co-use. All the cases showed that there was less emphasis on managing the user involvement at the use phase, Figure 1.

Figure 1. Managing the phases of co-creation of hybrid environments



In the present study, three different drivers for refurbishing the teaching and learning spaces were identified: well-being, new digital technology, and location of the learning environments. Depending on the driver for the transformation process, different stakeholders took part in the co-design process and influenced the outcome of the refurbishment. All the case studies highlighted that if there was no training of end-users and in the use phase no support was provided to end-users, the potential of the new learning environment was not fully utilised (See Figure 1). Managing the user involvement in this context refers to post-occupancy evaluation and user support through e.g. training to use the facilities. This kind of management is often not resourced, and there are seldom plans for post-occupancy user engagement through training and support. Furthermore, the results indicate that a participatory design process, combining digital and physical architecture to serve user needs, is essential. However, for a successful outcome, representatives of all potential end-users and experts should be identified and involved in the co-creation processes. In the use phase, integration of various service systems (such as booking system, and end-user support system) should be considered for further development of the refurbished space. The feedback is essential, and collecting it should be systematic. Like the scholars state, co-created services are important and we propose that the co-support and co-use are ensuring the potential of full use of the transformed spaces. The process can be at its best a learning process for users and stakeholders, and there should be a systematic way of collecting the learnings for future developments. This provides avenues for future studies. The selected case studies represent the growing demand to increase the diversity of modern technologies integrated to and supported in learning environments, although the number of cases is limited. The case studies were realised before the push to all-online studies, and they were the forerunner hybrid spaces to be used and scaled further. The user-centric design among experts, facilities managers, and education designers as well as users played a different role in the cases but provided a rich insight to different methods for co-creation. The continuity of theories from design phase to use phase bring new insights both to design science and workplace management research.

REFERENCES

- Betihavas, V., Bridgman, H., Kornhaber, R., Cross, M. (2016), The evidence for ‘flipping out’: A systematic review of the flipped classroom in nursing education *Nurse Education Today*, 38, 15-21. [DOI:10.1016/j.nedt.2015.12.010](https://doi.org/10.1016/j.nedt.2015.12.010)
- Bligh, B., Crook, C. (2017), Learning spaces. In E. Duval, M. Sharples, & R. Sutherland (Eds.), *Technology enhanced learning: Research themes* (69–87). Cham, Switzerland: Springer International Publishing. DOI:10.1007/978-3-319-02600-8_7
- Bligh, B., Sharples, M. (2010), Affordances of presentations in multi-display learning spaces for supporting small group discussion. In M. Wolpers, P. A. Kirschner, M. Scheffell, S. Lindstaedt, & V. Dimitrova (Eds.), *Sustaining TEL: From innovation to learning and practice: Proceedings of 5th European Conference on Technology Enhanced Learning* (464–469). Berlin: Springer-Verlag.
- Brown, M., McCormack, M., Reeves, J., Brooks, D. C., Grajek, S., Alexander, B., Bali, M., Bulger, S., Dark, S., Engelbert, N., Gannon, K., Gauthier, A., Gibson, D., Gibson, R., Lundin, B., Veletsianos, G., Weber, N. (2020), *2020 EDUCAUSE 58 Horizon Report, Teaching and Learning Edition*. EDUCAUSE. Retrieved January 3, 2022, from <https://www.educause.edu/horizon-report-2020>
- Eyal, L., Gil, E. (2022), Hybrid Learning Spaces - A Three-Fold Evolving Perspective. In: Gil, E., Mor, Y., Dimitriadis, Y., Köppe, C. (Eds.), *Hybrid Learning Spaces. Understanding Teaching-Learning Practice*. Springer, Cham. [DOI:10.1007/978-3-030-88520-5_2](https://doi.org/10.1007/978-3-030-88520-5_2)
- Halskov, K., Brodersen Hansen, N. B. (2015), The diversity of participatory design research practice at PDC 2002–2012. *International Journal of Human-Computer Studies*, 74, 81–92. DOI:10.1016/j.ijhcs.2014.09.003
- Karabulut-Ilgu, A., Jaramillo Cherez, N., Jähren, C.T. (2018), A systematic review of research on the flipped learning method in engineering education. *British Journal of Educational Technologies*, 49, 398–411. DOI:10.1111/bjet.12548
- Khan, S., Van Wynsberghe, R. (2008), Cultivating the under-mined: Cross-case analysis as knowledge mobilisation. In *Forum: Qualitative Social Research* (Vol. 9, No. 1, p. 34). Institut für Qualitative Forschung.
- Kyza, E. A., Georgiou, Y. (2014), Developing in-service science teachers’ ownership of the PROFILES pedagogical framework through a technology-supported participatory design approach to professional development. *Science Education International*, 25(2), 186–206.
- Lai, K. W., Khaddage, F., Knezek, G. (2013), Blending student technology experiences in formal and informal learning. *Journal of computer assisted learning*, 29(5), 414–425. DOI: 10.17169/fqs-9.1.334
- Matthews, K.E., Andrews, V., Adams, P. (2011), Social learning spaces and student engagement. *Higher Education Research and Development*, 30(2), 105–120. DOI:10.1080/07294360.2010.512629
- Metz, A., Boaz, A., Robert, G. (2019), Co-creative approaches to knowledge production: What next for bridging the research to practice gap. *Evidence & Policy: A Journal of Research, Debate and Practice*, 15(3), 331–337. DOI:10.1332/174426419X15623193264226
- Ninnemann, K., Liedtke, B., den Heijer, A., Gothe, K., Loidl-Reisch, C., Nenonen, S., Nestler, J., Tieva, Å., Wallenborg, C. (2020), *Hybrid environments for universities. A shared commitment to campus innovation and sustainability*. Münster; New York: Waxmann. DOI: 10.31244/9783830991793
- Paavola, S., Hakkarainen, K. (2021), Trialogical Learning and Object-Oriented Collaboration. In: Cress, U., Rosé, C., Wise, A.F., Oshima, J. (Eds.), *International Handbook of Computer-Supported Collaborative Learning*. Computer-Supported Collaborative Learning Series, vol 19. Springer, Cham, pp. 241-259. [DOI:10.1007/978-3-030-65291-3_13](https://doi.org/10.1007/978-3-030-65291-3_13)

- Radianti, J., Majchrzak, T. A., Fromm, J., Wohlgenannt, I. (2020), A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778. DOI:10.1016/j.compedu.2019.103778
- Ragin, C. C. (1997), Turning the tables: How case-oriented research challenges variable-oriented research. *Comparative Social Research*, 16, 27-42. DOI:10.4135/9781473915480
- Ragin, C. C. (2014), Turning the tables: how case-oriented research challenges variable-oriented research. In M. Tight (Ed.), *Case studies* (Vol. 4, pp. 303-303). SAGE Publications Ltd, DOI:10.4135/9781473915480.n15
- Ragin, C. C. (2015), Case-Oriented Research, in James D. Wright (Ed.) *International Encyclopaedia of the Social & Behavioural Sciences* (Second Edition), Elsevier, pp. 187-193, DOI:10.1016/B978-0-08-097086-8.44004-3
- Robertson, T., Simonsen, J. (2012a), Challenges and opportunities in contemporary participatory design. *Design Issues*, 28(3), 3-9. DOI:10.1162/DESIa00157
- Robertson, T., Simonsen, J. (2012b), Participatory design. *Routledge international handbook of participatory design*, 1.
- Sanders, E., Stappers, P. (2008), Co-creation and the New Landscapes of Design. *CoDesign*. 4. 5-18. DOI:10.1080/1571088070187506
- Sandström, N., Eriksson, R., Lonka, K., Nenonen, S. (2016), Usability and affordances for inquiry-based learning in a blended learning environment. *Facilities* 34(7/8), 433-449. DOI:10.1108/F-12-2014-0097
- Sandström, N. (2020), *From Needs to Deeds: User experience informing pedagogical and sustainable campus development*. Helsinki Studies in Education 82. Doctoral dissertation. Helsinki, Finland: Unigrafia.
- Sandström, N., Nevgi, A. (Eds.) (2021), *Digirikastetut oppimismaisemat – opas kampusten oppimisympäristöjen uudistamiseen*. (Digirich learning landscapes – the guide to renovating campus learning environments) Caledonia Hub Publications 001. Tampereen yliopisto – Tampere University. Electronic version in Finnish available at: <https://digirikastetut.fi/>
- Sterner, T., Barbier, E.B., Bateman, I., van den Bijgaart, I., Crépin, A.S., Edenhofer, O., Fischer, C., Habla, W., Hassler, J., Johansson-Stenman, O., Lange, A. (2019), Policy design for the Anthropocene. *Nature Sustainability*, 2(1), 14-21. DOI:10.1038/s41893-018-0194-x

University hubs: an emerging phenomenon between campus, work, and social spaces

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ABSTRACT

In recent years – especially in the wake of the COVID-19 pandemic – work and learning have radically changed to support community-focused, inter-professional, and inter-disciplinary engagements. In response, companies and public administrations have been developing networked and dispersed workspaces to grant people access to a variety of places tailored to their needs. University campuses have been evolving in the same direction. Aiming to expand into the whole city, universities have been activating off-campus facilities that enact the university mission of sustainable development, integration, and social inclusion. However, the phenomenon is still poorly developed even though evidence exists that students and young researchers (a) do not have access to enough supply of both on-campus and off-campus spaces due to the high demand; (b) suffer from relative isolation from other social groups; and (c) experience a disconnection between their studies and the world of work. For these reasons, they are in severe need of space for studying, working, and engaging with the broader community and society. This study analyses the phenomenon of University Hubs by distinguishing it from other similar phenomena and by discussing it in the context of hybridization of spaces for study and work. By analysing a preliminary case study the paper reflects on the opportunities that University Hubs present for students and young researchers to pursue knowledge creation and sharing with diverse communities outside the campus boundaries while enhancing the university visibility in different places.

Keywords

University, Hubs, Off-campus, Hybridization, Campus.

1 INTRODUCTION AND BACKGROUND: UNDERSTANDING UNIVERSITY HUBS AS HYBRID SPACES

Recent literature showed that, thanks to the spread of Information and Communication Technologies (ICT), the traditional university-centric location model gradually evolved into a spatially distributed model that involves on-campus and off-campus locations (Kuntz, 2012). Hence, besides university campuses, a variety of alternative “third spaces” (Oldenburg &

Brisset, 1982) constitute the modern university. This phenomenon increased due to the COVID-19 pandemic, which accelerated the spread of university activities among different locations. Thus, universities are progressively including “**hybrid**” facilities, made of both on-campus and off-campus spaces. Temple (2009) was the first to argue that the physical relevance of a university can be linked to institutional effectiveness, through the role of space in assisting community formation. Traditionally, university education and research were unequivocally associated with the idea of a precise physical environment. The architecture of a university campus was the means to communicate the identity, ideals, and values of the university community (Temple, 2009). While universities are changing their models of education and research, their campuses are required to be increasingly flexible. “**Hybridization**” meaning the co-presence and co-existence of multiple functions, users, and building types (Migliore et al., 2021) is a trend that is generating original types of spaces also in the university context. Hybridization is happening in multiple realms of the real estate and design industry. The retail sector, for example, is integrating healthcare services and workspaces into its traditional commercial function (Cardinali, 2018). The hotel sector is offering ‘mobile offices’ (Vuokko, Kojo and Nenonen, 2015) and rooms for work-related activities (Scullica et al., 2019). Universities have gradually recognized that knowledge acquisition and production is not only restricted to formal teaching and research, but it is a more collaborative process. Therefore, they have **opened the campus** towards the city through **on-campus sites that welcome the community** at large and – more recently – even through **off-campus sites**. This paper aims at exploring this emergent phenomenon by recognizing University Hubs as off-campus sites that host multiple functions and activities and are open to the academic community as well as to externals. Jane Knight (2014), for instance, conceptualises education hubs as “reputed centres for higher education, training and research” within and extending beyond a geographic region, which build a “critical mass of local and foreign actors – including students, education institutions, training companies, knowledge industries and science and technology centres (Knight, 2014).” Den Heijer (2008, p.2) claims that “managing the university campus has gradually changed from monitoring the technical condition of campus buildings and reducing costs to effectively supporting education and research processes and adding value to university goals”. Specifically, university goals may span from facilitating closer collaboration with industry and the territory at large to attracting new students in other areas which are not close to the main site of the campus. Therefore, campuses are changing both in its physical and in its symbolic presence across multiple locations **on-** and **off-campus**. These locations are *hybrid* since they allow different groups to share a place with fluid boundaries and functions (Star, 2010) and they configure as emerging designs and building practices characterised by *in-betweenness* and *indeterminacy* (Simões Aelbrecht, 2016). On one hand, some **on-campus sites** have gradually been opened to external users. For instance, Bouncken (2018) reports that some universities (*e.g.*, Harvard University, Lakeview University, Tübingen University, Aalto University, Berlin Technical University) operate coworking spaces either only for their members or for externals. These types of spaces are likely to foster entrepreneurship both for students and researchers, and, unlike universities’ libraries, provide additional “non-silent” areas to give opportunities for teamwork. Moreover, Watson (2007) mentions the striking development in new university buildings of “*third places*” as physical and/or virtual areas that are not predominantly identified with either social or work/study perspectives but transcend both. On the other hand, universities open **off-campus hubs** with diverse aims. The literature shows that universities are becoming increasingly linked to the presence of non-academic spaces (Chapman, 2006; den Heijer, 2011; Haugen & Aasen, 2016). For instance, to assure knowledge transfer, stimulating innovation and increasing sustainability, which are typical strategic goals for universities, it is common that campuses are now partnering with **learning**

and working incubators for entrepreneurs (Wissema, 2009). Moreover, den Heijer and Curvelo Magdaniel (2018) report that coffee bars and sport facilities are functional resources of the city that serve as crucial facilities for a dynamic university campus while public libraries are transitory spaces chosen temporarily for specific purposes (Di Marino & Lapintie, 2015). Among these recent practices, we refer to University Hubs as diverse spaces to study, work or socialise that are not within the normal boundaries of the main campus but that are mostly off-campus. Namely, anecdotal evidence shows that they can be located in other cities or even countries far from the main site of the university campus. For instance, the recent project of GTatrium promoted by Georgia Tech University is a case in point. GTatria are scalable gathering places and portals to real and virtual services for Georgia Tech University to achieve a distributed global presence and to provide - through co-working and co-learning spaces - education, career development, advising, enrichment, and specialised learning experiences to not only current Georgia Tech students, but also to alumni, prospective learners of all ages, and the community at large. The project is still under development, and it is planned to open in several places around the world where the distance learners and alumni community of Georgia Tech university concentrates (*e.g.*, Monterrey, Colombia, South America; Morocco, Africa; Taipei, Taiwan, as well as several locations in the United States). Alternatively, University Hubs can be hosted in existing spaces for temporary use. For instance, during COVID-19 pandemic, NYU Shanghai has leased and converted nearly 7,000 square metres of WeWork office space within walking and commuting distance of the campus into classrooms, lecture halls, and other academic facilities for students (NYU Shanghai³) and the same happened in Columbia University where they offered access to Columbia students and academics in 80+ cities to use at any WeWork location in their city. Apart from this anecdotal evidence, literature on these practices is still scarce and fragmented. To fill this gap, this research aims at understanding what university hubs are and why they are emerging internationally (*e.g.*, which other facilities they add to the campus). Our analysis starts from the assumption that university hubs appear as a category of hybrid spaces, by referring to the framework of ‘hybridization level’ proposed by Migliore et al. (2021). This paper aims at acknowledging the distinguishing features of university hubs which are not only related to their location outside the campus boundaries, but unfold on various levels: in terms of spatial forms, activities, user diversity, accessibility, management and openness to the public (Migliore et al., 2021). Starting from a preliminary case study analysis, we extrapolate the characteristic features of off-campus university hubs that could inform further studies on this topic, as they are shaping a trajectory for the evolution of learning spaces.

2 METHODOLOGY AND CASE SELECTION

Since the phenomenon of university hubs is still preliminary and poorly investigated, this research follows the approach of a phenomenon-based research (Von Krogh, Rossi-Lamastra & Haefliger, 2012), with the aim of capture, describe and document as well as conceptualise the phenomenon. Von Krogh, Rossi-Lamastra & Haefliger (2012) confirm that hypothesis-testing strategies may fail to create new knowledge about novel phenomena while a mix of research methods is often required for such work. According to Von Krogh, Rossi-Lamastra & Haefliger (2012), every stage of maturity of a phenomenon requires its strategies of research (*distinguish, explore, design, theorise, synthesise*). As university hubs are a novel phenomenon, still in an *embryonic stage* of maturity, this paper aims at *distinguishing* the phenomenon of university hubs from other similar phenomena which fall under the umbrella of hybrid spaces in university context. The *distinguish* phase of the phenomenon-based research has the goal to

³ <https://shanghai.nyu.edu/news/nyu-shanghai-host-students-nyu-and-nyu-abu-dhabi-shanghai-fall>

(1) bracket peculiarities encountered against the existing body of knowledge; (2) describe context in broad cultural terms; (3) identify inadequacy of given body of theory and knowledge in the field; and (4) identify relevant concepts for study (Von Krogh, Rossi-Lamastra & Haefliger, 2012). Specifically, this research aims at *distinguishing* University Hubs from three categories of university on-campus and off-campus facilities. First, from on-campus spaces (both workspaces and learning spaces) which configure among the traditional campus boundaries. Second, from university accelerators/incubators and new working spaces which universities open within their campus boundaries for specific purposes (Hynes & Hynes, 2018; Moultrie et al., 2007). Finally, from independent accelerators/incubators and new working spaces which recently universities are exploiting to distance learning for their students as well as for researchers and staff (Bouncken, 2018)). The aim of this research justifies the adoption of a case-study analysis methodology following Yin (2008) and Benbasat et al. (1987). Benbasat et al. (1987) argue that a case study strategy is well suited for problems in the very early stages of theoretical development and especially those dealing with situated action that can only be studied in context. This paper reports the analysis of a **preliminary case study**, located in Italy. The case study under analysis is *MilanoLuissHub*⁴, a space located in the city-center of Milano in Italy. The space opened in 2018 from an idea of the LUISS University (*Libera università internazionale degli studi sociali Guido Carli*)⁵. The LUISS University is one of the most important Italian universities in the field of economics, law and social sciences. It is located in Rome and attracts students from all over the world for bachelor, master and post-university degrees. The *MilanoLuissHub* was conceived by LUISS as the first off-campus location of the university and was purposely founded in the business district of Milano, the most prominent Italian city for entrepreneurial and business activities. The case study was documented through multiple data sources, the main being interviews. The authors conducted a semi-structured interview (which lasted one hour) with the professor from the LUISS University who ideated the concept of the space (interviewee 1) and who is the contact person for the education activities of the space. Secondly, we conducted a site visit and observation of the space which allowed us to collect visual and ethnographic materials. During the visit a second one-hour interview was conducted with the local project manager of the space (interviewee 2) who is the contact person for the day-by-day organisation and management of the activities taking place in the hub. Other sources of secondary data include formal and informal documents and websites.

Table 1 summarises the data collected for the analysis of the case.

Table 1: Summary information of the selected case study and sources of data.

District/area	Porta Nuova/Garibaldi (Milano)
Year of foundation	2018
Type of building	Former garage and a goods depot (quasi totally rebuilt)
Interviewees	<ul style="list-style-type: none"> ● Interviewee 1: Director of the space and originator – Professor of Luiss University (1h duration) ● Interviewee 2: Local project manager of the space – Staff of Luiss University (1h duration)
Other sources of data	<ul style="list-style-type: none"> ● Photos of the space/Visual Data ● Websites ● Formal Documents (i.e., brochure and reports of the <i>MilanoLuissHub</i> collected during the visit)

⁴ <https://milanoluissHub.it/>

⁵ <https://www.luiss.it/>

Data analysis followed a qualitative approach aimed at disentangling the peculiar characteristics which distinguish off-campus University Hubs from other types of hybrid spaces in the university context. They are not learning spaces nor workspaces nor university incubators while neither independent new working spaces, instead they are undetermined and multifunctional spaces which transcend the education and research goals of universities.

Figure 1: Interior of the MilanoLuissHub. Photo of the authors.



3 PRELIMINARY RESULTS AND DISCUSSION

From both the interviews, *MilanoLuissHub* comes across as a highly diverse and multi-faced space. It was created by the shared initiative of the LUISS University with *Brodolini* Foundation and *ItaliaCamp* united into a newly established temporary association of enterprises (ATI, in Italian), with the support of the Milano Municipality that gave the space in concession. In the words of interviewer 2 this association is described as “*a hybrid of different entities that work as a graft, with the objective to create a space with its own identity where each partner would bring in its own capacities*”. On the website, this is presented as an urban regeneration project brought to life by a public-private partnership. Also, the website reads: “[MilanoLuissHub] is a multidisciplinary agora of the knowledge economy dedicated to learning, sharing and integrating traditional and innovative entrepreneurial skills. The goal is to increase the creative potential of the territories for a more equitable and inclusive development of society and the economy.”

Table 2 summarises the results of the preliminary analysis. We present the results according to an interpretative scheme (Figure 2). University Hubs have distinguishing features compared to other University facilities according to two dimensions. The first dimension (the horizontal axis) is ‘distance from the campus’ since we started from the assumption that University Hubs are a novel phenomenon as they are located relatively far from their originator university. Therefore, we distinguished off-campus university hubs from the other types of hybrid spaces in the university context based on the physical distance that these have from the main campus location. The second dimension (vertical axis) is ‘hybridization intensity’ which we interpreted according to 7 layers of hybridization of space from Migliore et al. (2021).

Concerning *distance from the campus* (*x* axis), we classified the four spaces on a gradient from on-campus spaces (teaching and working spaces which are located within the campus boundaries) to off-campus spaces which are located far from the campus (they locate mostly in other cities or even in other countries from the central site of the campus). For instance, the *MilanoLuissHub* is located in Milano whereas the LUISS University is in Rome. According to interviewees 1 the idea was not to do Milano what the LUISS University does in Rome, “but to do in Milano activities that LUISS University does not do in Rome” Conversely, both university-related and independent new working spaces/accelerators/incubators are usually located semi-close to the campus (*i.e.*, they are in the same city or in the surroundings where

most students and staff live): the former benefit from the service exchange with the university, the latter, instead, need to be convenient in terms of commuting in order to be accessed by students and researchers of universities. Concerning *hybridization intensity* (y axis), we recognized off-campus university hubs as spaces that alternatively share with or strongly differ from on-campus spaces, university new working spaces/accelerators/incubators and independent new working spaces/accelerators/incubators. First, at the level of *spatiality*, intended as the “indeterminacy of spatial forms in terms of flexible furniture; complexity of the layout among multiple spatial combinations; historical overlapping of architectural characteristics and of relationships with the neighbourhood”, *MilanoLuissHub* demonstrates to involve a superfetation of spatial arrangements over time and to host a variety of flexible spaces. An ex-parking garage was refurbished to host: 3 rooms that can function both as classrooms for learners taking courses from master’s to professional refresher, as meeting rooms and as a large conference room (the walls can be opened to create a common room); One large learning space for interactive workshops, exhibitions, and shows; One coworking space that rents out workstations to start-ups both participating or not in the university’s incubation and acceleration program; two enclosed offices for non-profit associations; and a maker-space. In total the space is 1500 sqm. Second, at the level of *temporal ‘in-betweenness’* intended as “planned events or uses for temporary duration or unplanned uses and interactions in between the planned activities”, off-campus university hubs are similar to university as well as independent new working spaces/accelerators/incubators since they host planned and unplanned activities, where multiple events, work, research and laboratorial activities overlap at the same time. In the case of *MilanoLuissHub*, the space hosts on different days a digitalization school with digital manufacturing classes, a group called H-ability that creates prototypes of new tools for supporting daily activities of impaired people, Creative Mornings – an initiative that welcomes all interested people to share opinions on a variety of themes including politics, a neuroscience lab which uses the space of their experiments on human-environment interactions, a number of exhibitions (also in collaboration with the European Parliament), the training classes of the accelerator program. Third, at the level of *users’ diversity*, off-campus university hubs have the highest level of hybridization since they sum users’ categories of the university on-campus spaces (*i.e.*, academics, staff and students) and of new working spaces/accelerators/incubators (*i.e.*, companies, start-ups, freelancer, researchers). *MilanoLuissHub* welcomes regularly the people enrolled in the incubation/acceleration program, startups that have concluded the program and are renting out their workstations in the same space, attendees all the abovementioned courses, Alumni who participate in different events, the citizenship at large in the occasion of exhibits and other public events, high-school students who participate in a program called “school-work alternation”. In the words of the interviewees, the *MilanoLuissHub* target particularly what comes before and after regular university learning (*i.e.*, attraction of high school students and courses for young workers and executive persons). In addition, they target citizens as a whole, being a place of social regeneration of an urban area. Fourth, at the level of *occasionality of presence* intended as the “accessibility in relation to different needs of use (e.g., monthly, quarterly, annual subscription; single access)”, the off-campus university hubs just like independent new working spaces/accelerators/incubators are open to different membership policies and to rental possibilities to the externals, while on-campus spaces and university incubators or coworking are open mainly to members and affiliated professionals. In the case under examination, startups members mainly have access to spaces according to their memberships’ subscriptions, while for students and for the citizens community requirements are less strict and the space is spaces, students have free access related to their and the community have open and free entrance for public events. Moreover, there are also non-

standard opening hours (at night and during weekends) which may be easily asked to the management of the space assuring the highest occupancy. Fifth, at the level of *activities and functions*, university hubs are truly flexible spaces, since they are multi-functional spaces mixing activities which are typically hosted in university – such as workspaces, research spaces and learning spaces – and those which are typically hosted in both university and independent new working spaces – such as maker spaces, coworking spaces etc. For instance, the *MilanoLuissHub* offers a digital manufacturing laboratory capable of bringing together, in a synergic and multifunctional way, school-to-work activities and advanced managerial training initiatives, emerging startups and events open to the territory. Specifically, what the first interviewee argued was the *MilanoLuissHub* does the things that the promoter university does not do. Sixth, at the level of *managerial structure* intended as “management structure of the space, stakeholders involved, control of the space to different extents (top-down/bottom-up)”, university hubs are hybrid in the sense that they mix a nearly bottom-up approach according to which members can propose and autonomously propose their initiatives while they are managed by multiple stakeholders. For instance, our case study was initiated by the LUISS University together with the Municipality of Milan⁶, Fondazione Brodolini⁷ and ItaliaCamp⁸. This hybrid managerial structure allows the LUISS university to maximise its social and inclusive mission by sharing the university life with local communities. Indeed, university hubs often have a business model which is independent of the main University, including a separate board of directors, partnerships with other entities such as public and private institutions in charge of activities related to education or social impact activities. Finally, at the level of *publicness/openness* intended as the “accessibility by non-official members to the space”, off-campus university hubs such as university campus and university and independent new working spaces/accelerators/incubators are less open to non-official members (if not for events open to the public). None of these spaces are configured as public spaces, even if exceptions may exist. However, what is relevant about University Hubs and in particular about the case under analysis is that University Hubs, being off-campus, represent a tool to increase university “**brand reputation**”. As interviewee 1 argue “if they [University Hubs] are not removed from the territorial context but are linked to the territorial context they are a mean of creating a brand reputation that then leads local students to enrol in our university, which, as I repeat, does not have an economic effect but it does have an effect of greater internationalisation of our university. For example, what if you want to have more students from a specific country? Opening a University Hub is one of the many possible ways to have more students from that country and is quite less challenging and expensive than opening your own university there”. This is why the openness of the space is central for University Hubs. In the case under examination, particularly, the conference space has glass walls directly visible from the street because the University and its two partners want that “whatever happens in there is transparent to the citizens” [Interviewee 1].

⁶ <https://www.comune.milano.it/>

⁷ <https://www.fondazionebrodolini.it/>

⁸ <https://italiacamp.com/it/>

Figure 2: Interpretative scheme for distinguishing off-campus spaces from other spaces.

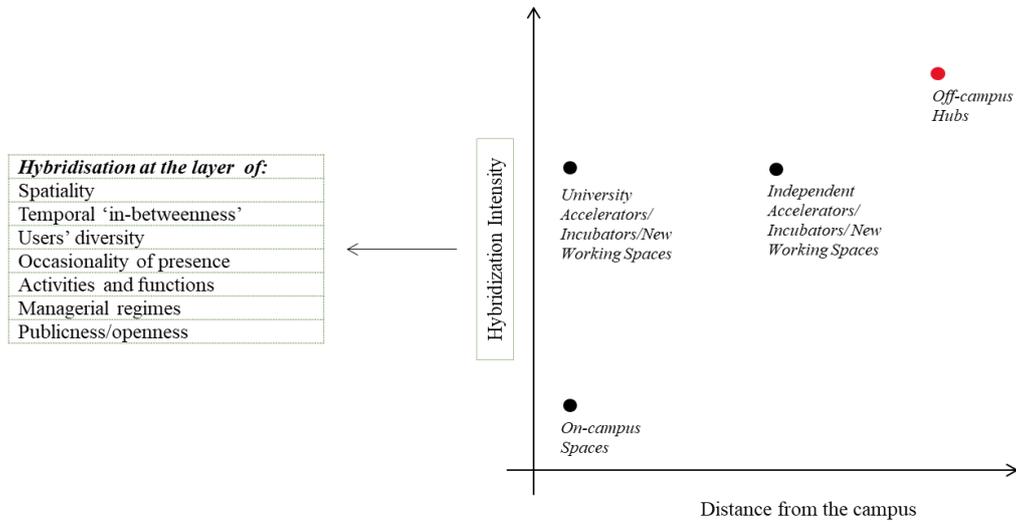


Table 2: Distinguishing features of the Off-campus University Hubs phenomenon.

		Distance from the campus			
		On-campus	Close to the campus	Semi-close to the campus	Far from the campus
		On-campus spaces (Workspaces & Teaching Spaces)	University Accelerators/Incubators/New Working Spaces	Independent Accelerators/Incubators/ New Working Spaces	Off-campus hubs
Hybridisation at the layer of:	Spatiality	Very recognisable and compact spaces (especially in Italy). Image of the university identity. Layout: typically, standard workplace part and classroom part	Very recognisable and compact spaces More varied layout because they house different kinds of functions (informal spaces, maker space)	Very recognisable and compact spaces More varied layout because they house different kinds of functions (informal spaces, maker space)	Less recognisable. Often housed in more recently converted spaces in terms of function of use (e.g., ex industrial spaces). More varied layout because they house different kinds of functions (informal spaces, maker space)
	Hybridization intensity	**	***	***	*****
	Temporal 'in-betweenness'	High predictability in the use of space (standard lessons and working hours)	Activities are often planned. There are more overlaps between a higher variety of activities.	Activities are less planned. There are more overlaps between a higher variety of activities and temporary events. The quality of "independence" provides more flexibility for temporary use.	Activities are less planned. There are more overlaps between a higher variety of activities and temporary events.
	Hybridization intensity	**	***	***	***
Users' diversity		Users are very well defined. They are almost exclusively	Users are defined and selected (they are	Users are selected according to different	Accessibility to different

		three types: academics, staff and students.	mostly academics, students, alumni, companies affiliated to the institution).	criteria (ensuring a high range of diversity) but generally these spaces do not target academics and students.	professional categories, but also to different demographic categories. Students, researchers, alumni, enterprises, occasional users, etc. Users' diversity is the highest because it sums those of the prior spaces.
	<i>Hybridization intensity</i>	**	***	****	*****
	<i>Occasionality of presence (e.g., need of subscription)</i>	Need to be affiliated to the university in order to use all its spaces. Generally, not open to third parties for rental purposes.	Strict membership policies (medium-long term) Generally, not open to third parties for rental purposes.	Medium-short term membership. Open to rental possibilities.	Medium-short term membership. Open to rental possibilities.
	<i>Hybridization intensity</i>	*	***	****	****
	<i>Activities and functions</i>	Teaching Research Work Laboratories Eat Study Sport	Innovative learning Innovative Research, Laboratories (maker), Research Eat Study Sport	Innovative learning Innovative Research Laboratories (maker), Research, Eat Events	Innovative learning Innovative Research Laboratories (maker) Teaching Research Eat Study Sport Work Events
	<i>Hybridization intensity</i>	**	***	***	****
	<i>Managerial structure</i>	Top-down and centralised (one main stakeholder: university)	In-between/nearly top-down (one main stakeholder: university)	Nearly bottom-up/Totally bottom-up (high number of stakeholders, mostly private actors)	Nearly bottom-up (high number of stakeholders, both public and private)
	<i>Hybridization intensity</i>	*	**	***	****
	<i>Publicness/openness</i>	Low. Externals cannot benefit from on-campus spaces continuously and not for rental purposes)	Low. Only for public events.	Low. Only for public events.	Low. Only for public events.
	<i>Hybridization intensity</i>	***	***	***	***

4 CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This paper approached the emerging phenomenon of university hubs as the configuration of off-campus spaces that are distinct from any other university-related form of hybrid space. Even if this research relies on preliminary results only, this analysis opens avenues for future research on the emerging phenomenon of off-campus university hubs. The university hubs are configured as off-campus locations of academic campuses which are hybrid in terms of spaces, activities, users, functions, and managerial structure more than on-campus spaces and of university-related and independent accelerators/incubators/new working spaces. Indeed, off-campus university hubs mix the features of the three former categories of spaces, generating a hybrid that is still in its embryonic phase of development. Through its strong physical presence and their hybridity (Migliore et al., 2021), University Hubs configure as attractors of students, workers, research companies and industries from other regions and countries beyond the main

location of the campus. Their impact could be national, regional and/or global in scope (Knight, 2014) as they represent one of those non-academic spaces which complement campus spaces (Haugen & Aasen, 2016). The interpretative framework proposed to organise and understand the features of university hubs provides a basis for future studies. The preliminary analysis will be further complemented with additional cases in different geographical locations in order to validate these results and provide a more nuanced picture of off-campus university hubs. We call for more research on the topic, such as the direct and indirect effects of these spaces on, respectively, the individuals who use them and the neighbourhood/cities where they operate. For instance, at the moment they seem to be an urban phenomenon taking advantage of geographical proximity to complementary activities and services. Nevertheless, they have the potential to be used as a tool for not only urban regeneration, but rural regeneration where the University Hubs mission of social innovation could be maximised.

REFERENCES

- Beckers, R., Van der Voordt T., Dewulf G. (2015), "A Conceptual Framework to Identify Spatial Implications of New Ways of Learning in Higher Education." *Facilities*, 33 (1/2): 2-19.
- Benbasat, I., Goldstein, D. K., Mead, M. (1987), "The Case Research Strategy in Studies of Information-Systems". *MIS Quarterly*, 11(3): 369-386.
- Bouncken, R. B. (2018), "University coworking-spaces: mechanisms, examples, and suggestions for entrepreneurial universities", *International Journal of Technology Management*, 77 (1/2/3).
- Cardinali, M. G. (2018), *Retail ibrido*, Milano, Italy: Egea Publishing.
- Chapman, M. (2006), *American Places: In Search of the Twenty-First Century Campus*, Westport, CT: American Council on Education/Praeger.
- Den Heijer, A.C., Curvelo Magdaniel, F.T.J. (2018), *Campus-City Relations: Past, Present, and Future*. In: Meusburger P, Heffernan M, Suarsana L, editors. *Geographies of the University. Knowledge and Space*. Springer, Cham; p.439-459.
- Den Heijer, A. (2011), *Managing the University Campus: Information to Support Real Estate Decisions*, Kindle Edition.
- Den Heijer, A. (2008), "Managing the University Campus in an Urban Perspective: Theory, Challenges and Lessons from Dutch Practice", in *Corporations and Cities: Envisioning Corporate Real Estate in the Urban Future*, conference proceedings, Brussels, 26-28 May.
- Di Marino, M., Lapintie, K. (2015), "Libraries as transitory workspaces and spatial incubators", *Library & Information Science Research*, 37(2): 118-129.
- Hampton, K.N., Gupta, N. (2008), "Community and Social Interaction in the Wireless City: Wi-Fi Use in Public and Semi-public Spaces", *New Media & Society*, 10(6):831-850.
- Haugen, T.I., Aasen, T.M. (2016), "Campus alive: Transformation and integration of university work and campus space". In *Proceedings of CFM's second nordic conference: Facilities Management Research and Practice. Does FM contribute to happiness in the Nordic Countries*, 8-15.
- Hynes, M. M., Hynes, W. J. (2018), "If you build it, will they come? Student preferences for Makerspace environments in higher education" *International Journal of Technology Design Education*, 28(3), 867-883.
- Knight, J. (2014), "International Education Hubs: Student, Talent, Knowledge-Innovation Models", retrieved from <https://www.springer.com/gp/book/9789400770249>.
- Kuntz, A. M. (2012), "Reconsidering the workplace: faculty perceptions of their work and working environments" *Studies in Higher Education*, 37:7, 769-782.

- Lewis, J. M., Ross, S., Holden, T. (2012), "The how and why of Academic Collaboration: Disciplinary Differences and Policy Implications." *Higher Education* 64(5): 693-708.
- Migliore, A., Ceinar, I.M., Tagliaro, C. (2021), Beyond Coworking: From Flexible to Hybrid Spaces. In: Orel, M., Dvouletý, O., Ratten, V. (eds) *The Flexible Workplace. Human Resource Management*. Springer, Cham.
- Moultrie, J., Nilsson, M., Dissel, M., Haner, U. E., Janssen, S., Van der Lugt, R. (2007), "Innovation spaces: towards a framework for understanding the role of the physical environment in innovation" *Creativity and Innovation Management*, 16(1), 53-65.
- Oldenburg, R., Brissett, D. (1982), "The third place", *Qualitative Sociology*, 5, 265-284.
- Scullica, F., Elgani, E. (2009), *Living, Working and Travelling. New Processes of Hybridization for the Spaces of Hospitality and Work*. Milano, Italy: Franco Angeli Editore.
- Simões Aelbrecht, P. (2016), "'Fourth places': the contemporary public settings for informal social interaction among strangers", *Journal of Urban Design*, 21(1), 124-152.
- Star, S. L. (2010), "This is not a boundary object: Reflections on the origin of a concept". *Science, Technology & Human Values*, 35(5), 601-617.
- Temple, P. (2009), "From Space to Place: University Performance and its Built Environment". *Higher Education Policy* 22(2), 209-223.
- Von Krogh, G., Rossi-Lamastra, C., Haefliger, S. (2012), "Phenomenon-based Research in Management and Organisation Science: When is it Rigorous and Does it Matter?" *Long Range Planning*, 45, 277-298.
- Vuokko, I., Kojo, I., Nenonen, S. (2015), "Places for multi-locational work - opportunities for facilities management", *Facilities*, 33 (2), 20-37.
- Watson, L. (2007), "Building the future of learning", *European Journal of Education*, 42(2).
- Yin, R. K. (2008), *Case Study Research: Design and Methods* (4th ed.) Thousand Oaks, CA: Sage Publications Inc.

Hybrid Student Accommodation: the role of workplaces in the transition to a new functional identity

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ABSTRACT

The development of hybrid constructions, intended as a combination of different functions into the same building, is an increasing phenomenon in contemporary architecture. The evolution of more flexible and adaptable buildings designed for modern needs, users, and activities represent one of the most compelling challenges of the 21st Century that the field needs to address. In the last decade, the student accommodation market has been involved in significant functional, spatial, and usage transformations due to university internationalisation, increased student mobility, and the digitalization of learning and working activities across the world. As a result, new typological solutions become necessary to meet the "live, learn, work, and connect" needs of a growing community of students, young professionals, digital nomads, and travellers. New hybrid buildings, which include options like coliving, coworking, start-up incubators, and community network organisation, offer a precious platform to experiment these concepts contributing to the improvement of innovative student housing models. This essay investigates the potential of hybrid student accommodation including coworking spaces through an international case studies analysis and a literature review and explores its innovative functions, spaces, and activities. The analysis also identifies potential project categories to guide the future development of workplaces inside these structures. The paper contributes to investigate this new architectural trend which is still a low-investigated topic in the literature. In the light of the ongoing demographic and social changes, especially in university cities, it aims to identify and highlight the slow but meaningful transformations of student hospitality into more inclusive, articulate, and connected places. Finally, some key factors to reflect about the progress of these facilities to help build well-connected communities are discussed to address potential actions and opportunities for the city and university community.

Keywords

Hybrid student accommodation, Off-campus spaces and activities, University cities, Coworking spaces, Well-connected communities.

1 INTRODUCTION

Contemporary cities are historically considered the core of our society driving social, cultural, technological, and economic evolution. In this context, university cities, thanks to the presence of Higher Education Institutions (HIEs), research centres, business incubators, and start-ups, attract a massive additional population of students, researchers, intellectuals, and innovators. This powerful *blend* defines new needs, habits, and behaviours and influences human progress and the urban building environment evolution. The hybridization solution seems one of the most appropriate opportunities to lead a renewed demographic and connected society. Creativity and flexibility are strategic factors in the working sector, while social heterogeneity,

(such as cultural and religious), become distinctive and characterise paradigms (Bricocoli 2011). *Hybrid building* implicates the combination and the “relation” between different shared spaces, places, users, and social aspects within a single structure. Multiple patterns of emerging opportunities transcend the functional dimension of a living ecosystem where spaces and people are completely involved. An opposed concept is that of *Mixed Building* which contains a plurality of distinct functions, are not integrated but juxtaposed. Features that have nothing in common and do not define sharing spaces but are exclusive to residents. In other words, the sum of the details in the hybrid building leads to a better result than the functional spaces understood separately (Gringhuis and Wiesner 2014). The Hybrid Building is based on the mixture of functions and facilities essential to generate relationships, meetings, and transformations, as the “celebration of complexity, diversity, and variety of programmes, (...) a mixture of different interdependent activities”. It is a search for “unexpected, unpredictable, intimate relationships, encourages coexistence and is conscious that unprogrammed situations are the keys to its future”, (Per et al. 2011). While the hybridization of the private-residential context and university environments are topics explored by the literature (Ahrentzen 1991; Besimi and Jakupi 2019; Khymytsia 2018; Ninnemann et al. 2020), few research studies the evolution of hybrid student accommodation. This study investigates the potential innovations and opportunities offered by the hybridization of student accommodation models hosting coworking spaces beneficial for developing university cities and campuses aiming at becoming attractive places for society. Three main research questions drive the essay: 1) How can hybrid student accommodation evolve into an informal social and learning place thanks to the presence of the workplace? 2) Which changes in terms of spaces, functions, activities, can be identified? 3) Can the presence of the workplace in hybrid student accommodation contribute to creating *well-connected communities* (Gilchrist 2019)? These questions are investigated through literature review and an international case studies analysis. The final aim of the paper is to outline the first picture of this phenomenon and highlight the key features of hybrid student hospitality.

2 THE NATURE AND ROLE OF HYBRID STUDENT ACCOMMODATION

In the last two decades, universities have been involved in a complex process of institutional and operational change (Gullace 2020). As a result, HEIs support spaces and infrastructures experienced significant transformations. These factors were firstly impacted by the evolution of student behaviours, expectations, and needs (Prensky 2001, Beckers and Van der Voordt 2013, McLaughlin and Faulkner 2012), the advancements in information technology (Johnson et al. 2013), learning approaches (Marais 2011), learning communities (McLaughlin and Mills 2008) and policies concerning internationalisation and education quality. Moreover, recent changes, accelerated and encouraged by the current pandemic, have also affected university student housing and generated a newborn of informal spaces and services supporting users’ socialisation and well-being (Bellini and Mocchi 2021, Bellini et al. 2022). Student accommodations seek to rediscover their nature and role in this evolving context. Therefore, they can be translated not only for academic-related functions but also as additional university entrepreneurial spaces scattered throughout the city, like start-ups incubators, fab-lab, etc., or retail and leisure spaces like cafeterias and sports facilities. In this way, student housing became an informal learning place (Bilandzic and Foth 2013; Colopardi and Nurra 2019). Furthermore, among these new adaptations, coworking places are recently becoming an option that can strengthen the atmosphere of collaboration among students and other people: workers, city users, globetrotters, etc. (Spreitzer et al. 2015). Based on these assumptions, the hybridization of student accommodation is here defined and organised by the authors under three different levels:

1. *User hybridization*. One of the first peculiarities of hybrid building concerns the plurality of users involved. While traditional student accommodation focuses only on the academic population, hybrid student houses accommodate additional users from the business, tourism, and creativity sectors, such as young professionals, scholars, tourists, globetrotters, digital nomads, city-users, etc.
2. *Functional hybridization*. The functional hybridization links to the users' activities inside the building. It is conceived to address the different needs related to the stay's duration (live, learn, work, meet, etc.) and the consequent living formula offered. It is also associated with the typology of dwell and common facilities requested. More specifically, hospitality is essentially organised in the following accommodation solutions:
 - a) Short stay guests, such as tourists or travellers who seek the formula *hotel or hostel*.
 - b) Non-resident or visiting students who need to stay about a semester or longer through the formula *student accommodation*.
 - c) The young professionals, digital nomads, etc., who need to stay for the duration of a first or occasional job contract pursuing the formula of *coliving*.
3. *Spatial hybridization*. Spatial Hybridization results from the organisation of private, semi-private and common spaces. The indispensable bedrooms are divided in different types and models (single or double rooms, studios, apartments etc.), a series of support services areas (study rooms, gyms, and yoga rooms with fitness equipment laundries) are available in addition to outdoor event spaces, gardens, sport courts, workouts areas, etc. These spaces integrate with coworking and food & beverage services and are also open to non-resident guests who need flexible, temporary working or relaxing spaces.

The implementation of services, facilities, and spaces available within university off-campus places and the definition of new approaches to conceive living and workplace contribute to the development of new social communities, besides increasing universities attractiveness.

3 “THE STUDENT HOTEL”: THE FIRST PILOT EXPERIENCE

The most advanced example of hybrid student accommodation, including coworking spaces, is in Europe. The Student Hotel (TSH) was founded in 2006 in the Netherlands and opened its first building in Rotterdam in 2012. The buildings are currently located in 15 European university cities like Amsterdam, Barcelona, Berlin, Vienna, Paris, Florence, and Bologna, holding more than 11000 rooms (Forbes 2021). In this case study the innovative concept of hybrid hospitality offers the maximum flexibility and variety enabling to accommodate users with different needs and lifestyles through the contemporary presence of physical, digital, and creative spaces. TSH proposes a student accommodation model which supplements conventional residential student spaces and facilities with a modern and flexible coworking concept. TSH accommodates places that no longer require traditional “desks” but are open to multifunctional spaces connecting different activities for contemporary users such as innovators, young professionals, entrepreneurs, and city users. Three case studies are analysed according to the three hybridization levels identified in the previous section 2 (user, functional and spatial hybridization). Table 1, compares three recent TSH projects, selected for their significant size, variety, and completeness of spaces, services, and activities.

Table 1. TSH Case studies comparison (©TSH)

City	Vienna (AT)	Florence Lavagnini (IT)	Maastricht (NL)
Building size	+38.000 m ²	+20.000 m ²	+16.000 m ²
Users	Students, families, tourists, travelers, young professionals, workers, city users, freelancers, start uppers, musicians	Students, tourists, travelers, young professionals, workers, city users, freelancers, start uppers, musicians	Students, tourists, travelers, young professionals, workers, city users, freelancers, start uppers, musicians
Functions	<i>Stay and live</i> Hotel 4*, Student accommodation and Co-living <i>Work, meet, and share</i> Workplace and meetings <i>Learn, connect, and relax</i> business, cultural, and social events	<i>Stay and live</i> Hotel, Student accommodation and Co-living <i>Work, meet, and share</i> Workplace and meetings <i>Learn, connect, and relax</i> Indoor and outdoor business, cultural, and social events, shops	<i>Stay and live</i> Hotel, Student accommodation and Co-living <i>Work, meet, and share</i> Workplace and meetings <i>Learn, connect, and relax</i> Business, cultural, and social events
Spaces	<i>Dwells</i> 819 rooms (single, double, suites, studios, family room) <i>Common facilities</i> Shared kitchen, restaurant, snack-bar, study zones, children's play area, games area, laundry, lobby, gym, rock me room, retro' room events, auditorium, coworking, offices, meeting rooms, shop, parking	<i>Dwells</i> 390 rooms (single, double, suites, studios) <i>Common facilities</i> Shared kitchen, restaurant, study zones, playrooms, laundry, panoramic gym, lobby, rooftop pool and sky bar, concept stores, music bands rehearsal room, auditorium, coworking, classrooms, offices and meeting rooms, courtyard multifunctional space	<i>Dwells</i> 378 rooms (single, double, studios) <i>Common facilities</i> Coffee-corner, bar-restaurant, bar and DJ set, rooftop sky bar, study zone, study-work rooms, lounge areas, games areas, laundry, lobby, gym, auditorium, meeting rooms, classrooms, coworking,
Services, activities, and events	<i>TSH Bike sharing</i> <i>TSH Collab</i> Coworking Hub <i>TSH Bed Talks</i> events, workshops, and freethinking festival	<i>TSH Bike sharing</i> <i>TSH Collab</i> Coworking Hub <i>TSH Bed Talks</i> events, workshops, and freethinking festival	<i>TSH Bike sharing</i> <i>TSH Collab</i> Coworking Hub

In this type of hybridization, the shared areas are typically organised in flexible, open, or transparent spaces. “Common facilities” such as study rooms, playrooms, or relaxation areas are fluid places where it is possible to exchange several privacy needs without physical or spatial limitations. Moreover, in addition to the traditional functions, activities such as “stay” and “live” are here integrated spaces for users who also need “work”, “meet”, “learn”, and “connect” by enriching the dialogue between people and places (Fig.1).

Figure 1. TSH Florence Lavagnini coworking spaces (©TSH)



The TSH coworking spaces, named *Collab*, are conceived to offer unconventional areas for hosting intimate or large-scale meetings, start-ups incubator, digital talks, community networks and events to promote connections and creativity. Facilities are designed with transparent separations, open space lounges, sofa and round table areas, original phone cabins useful for long calls, private offices, and several typologies of desks (Fig. 1 and Tab. 2). Furthermore, the broader aim of *Collab* is to build the world's largest coliving and coworking *connected community*. Their ambition is to foster and create a bridge between international students, digital nomads, and the entrepreneur's world. For this purpose, all the *Collab* in Europe are digitally connected and offer a shared calendar of interviews, events, workshops, roundtables, parties, and a free-thinking festival (Donati 2017). This hybrid format also offers initiatives such as *Bed Talks*, a platform to facilitate the connection and exchange of projects to support new friendships and tighten new collaborations, including professional ones. Since 2016 *Bed Talks* has hosted over 75 talks, 100 speakers (artists, educators, entrepreneurs, activists, etc.), 1.500 visitors and 20 workshops (Bed Talks 2022).

Table 2. TSH Collab coworking operational scheme (TSH Florence Lavagnini, 2500 m², awarded with MIPIM “Best mixed-use Development Award, 2019” Cannes)

Coworking spaces and services	Description
Desks	<ul style="list-style-type: none"> • Flexible space (multifunctional space with sofa area, informal desk area, round table area and personal lockers, open 24/7) • Dedicated space (dedicated desk with ergonomic chairs, corkboards, and personal lockers, open 24/7)
Offices	<ul style="list-style-type: none"> • Private (equipped offices for teamwork 6-8 pp open 24/7) • Digital (operational headquarters address, post and parcel services, reception, and concierge services)
Meeting spaces	<ul style="list-style-type: none"> • Phone cabins (isolated space equipped with seats and phone up to 2 pp) • Meeting rooms (events up to 35 pp) • Auditorium (presentations and conferences, up to 90 pp)
Additional spaces	<ul style="list-style-type: none"> • Break Out Zone (open space for events up to 20 pp) • Bed Talks Room (events up to 20 pp) • Rooftop and Sky Bar (indoor/outdoor events) • Courtyard (open court for big outdoor events) • Gym (multifunctional and panoramic gym) • Game room and open lobby
Services and activities	<ul style="list-style-type: none"> • Bike sharing • Restaurant and Catering (coffee break, light lunch) • Collab and Bed talks events, workshops and freethinking festival

This hybridization of student accommodation represents a remarkable structural metamorphosis of the topic. A new research combination of functional innovation, high quality of spaces and facilities, interactivity, digitalization, and connection, integrated with multiple customer-oriented strategies, innovative services, and a dynamic and engaging coworking system that can offer a responsive approach to our society's emerging needs. Moreover, it constitutes a concrete and potential support in building simultaneously *interconnected communities* in different cities between the heterogeneous social, cultural, and technological backgrounds plus an increasing opportunity for university cities' attractiveness. The TSH also represents a significant expanding phenomenon. Indeed, while TSH is planning 12 new openings in Europe and expansion in the US, Canada, and Asia, other corporations (Campus X, Combo, etc.) are starting to invest, develop, and implement this model. Finally, under the architectural technology perspective, the analysis of the case studies provided three main project categories for devising coworking spaces into hybrid student accommodation. The following section discusses the main insights identified in Table 1 and 2.

4 DEVELOPING WORKPLACES IN STUDENT ACCOMODATION. THREE PROJECT CATEGORIES: DESIGN, SOCIAL AND LIVING ENVIRONMENT

A coworking environment can help improve individual productivity, community, and trust (Bouncken and Reuschl 2016), equally as the positive academic and social effects of living in college or university residence halls (Pascarella and Terenzini 1991). Moreover, as research and knowledge on the workplace are currently expanding, the standard features of these spaces should be frequently revised (Sankari and Peltokorpi 2018). In order to conceive coworking in Hybrid student accommodation for groups of academics and workers can be strategic to using a "bottom-up" approach. Putting this unusual community at the heart of the design process is crucial in producing the most effective and sustainable solutions for shared space (Seo et al. 2017). A practical way to maintain a productive dialogue with the space's future occupants is

to create a multidisciplinary Design Team, providing periodical collaborative workshops and co-designing the project process. Creating a workgroup of academics, workers, and other users' representatives, with architects, interior designers, and sociologists, may be helpful to innovate and better manage the building and the amenities hosted within to optimise opportunity and eliminate the risk of conflicts. The interior aspect of a hybrid student residence equipped with a workplace can be read as its most intimate interface. The place where users are most intensely involved can also highlight critical factors in used shared space. Interior design should drive decisions concerning the performance of a structure, starting with emotional, cultural, and practical considerations. Consequently, *academic learning spaces* will increasingly function as a platform for interest-driven informal social learning and training experiences. Further research could also focus on the needs of the *off-campus academic communities* and related good practices. In addition, the spatial, technological, social, and service-related elements that constitute student guild spaces' positive atmosphere could also be investigated as a good practice. Hence, in support of further improvements, this research, based on the review of the TSH case study and literature, proposes a guide thinking based on three project categories: *design, social, and living environment*.

4.1 Design

Workplace functions, spaces, and services. Workplaces in student accommodation, thanks to the business, research, and collaboration activities among young and different users, offer the opportunity to create new ideas, projects, and inventions. Furthermore, they can also promote the popularisation of scientific culture and knowledge by encouraging initiatives for the training of the national and international university community, enhancing students' talents during their academic life and in the completion of personal, cultural, and professional training. To achieve these goals, it is essential to:

1. Organise and manage training and specialisation courses, seminars, tutoring activities, and similar initiatives, collaborating with HEIs, public and private entities.
2. Promote forms of integration between university and experimental technologies and encourage the development of the crucial "green economy" themes in places of innovation to foster an efficient and eco-sustainable development.
3. Promote activities and initiatives, building an integrated interdisciplinary level of scientific and technical knowledge to represent an avant-garde example in constructing an efficient "smart community".
4. Collaborate with national and foreign bodies with similar purposes and international cultural organisations.

To achieve these goals, workplaces in hybrid student accommodation should provide:

1. Private offices with flexible private workspaces to suit small groups demands.
2. Shared offices with flexible spaces including digital amenities supporting the access to the online community.
3. Flex drop-in, flexible, safe, and affordable solutions to boost productivity, avoid distractions and spark innovation in safe and inspiring offices with advanced IT services.
4. Virtual offices to establish a legal presence in other countries, integrate ecosystems, and enjoy the added benefits of meeting rooms and mail handling services.
5. Fully equipped meeting rooms ready to provide maximum comfort and connections.
6. Event spaces, to be at the heart of the tech ecosystem, near metro and bus stations and airports.

In the student accommodation, these workplaces should also offer services to help the development and the efficiency of businesses such as: a) expert consulting services to grow and create fertile environment for create and support teams, research and development centres, and start-ups; c) specialists services, to provide or to help to find the right senior talent and

streamline human resources processes; d) facility management team, to transform quickly and with no disruption to business operations; e) finance and legal services, to help workers resolve complex issues and identify opportunities. *Space flexibility and adaptability.* Providing open-plan, and multipurpose workplaces where users may choose desks best suited to their current activities are indispensable. Walls and surfaces should alternate opaque and transparent materials favouring space depth and colours and be movable. The furniture and places can become more ambiguous; varying comfort levels and privacy help to signpost different functional possibilities. For example, high-back seating can create exclusion, while curved seating helps to facilitate face-to-face conversation and encourage interaction between users. Ergonomics can be integrated into office furniture, meaning spaces designed for relaxation can have laptop use. Space can be highly flexible when several furniture typologies can be stored, folding and stacking elements come into play. Interesting solutions are adapting castor wheels to furniture or other elements or making objects purposely lightweight so they're easy to lift (Bilandzic and Foth 2017). *Digital Tools and services.* Digital platforms and applications for managing the booking process like the check-in, stay, check-out phases and online activities and events are vital. In addition, the diffusion of environmental sensors in the building to monitor the use of light, temperature, and space are helpful also to collect data to understand potential users' preferences, such as the use of space, preferred desk location, and related stay duration. Specific services through which users gain access to an adequate physical and social environment for a contingent period. Finally, promoting web channels and social media activities is a supportive and powerful tool to enhance brand visibility and marketing.

4.2 Social

Atmosphere. Workplaces in hybrid student accommodations must be designed to create a good mood, well-being, and serenity. The quality of interior design and the harmony of the spaces are fundamental aspects. Students and workers who feel good in the living area and workplace create more prosperous communities and work better. Several studies highlight that people react emotionally to their environment. It is a chance that provides exciting possibilities and directions, enriching people and their relationships, communities, and workplaces with new opportunities and creating a mood (Cleaver and Freason 2021). It is possible to design adequate decor, even if it is not the only way to evoke feelings of ownership and sharing (Gerdenitsch et al. 2016). *Community.* Coworking represents a condition in which young people from different backgrounds, ages, cultures, etc., come together to use the same space and services. In this space, it is helpful to provide workplaces to share working time, discuss, and learn from each other (Schopf et al. 2015). Coworking managers in student accommodation can promote meet and social interaction - such as networking, crosslinking, and contact initiation - by organising events, training, and other activities (Balakrishnan, et al. 2016). The shared space provides a chance to reinvent how people of different ages, genders, ethnicity, and backgrounds can live and work together, striking a balance between individuality and collectivism (Brown 2017). British anthropologist Robin Dunbar has identified how human beings form relationships in hierarchical layers, making good friends with up to 50 people (Dunbar 2014). Creating different common spaces, offering distinct atmospheres through finishings, lighting, floor and ceiling levels, and increasing the number of access and exit points to make each zone independent from the others may help the community's meeting process besides the "informal socialisation" (Bellini et. al 2020). *Privacy.* One of the main reasons people opt for coworking environments is to avoid loneliness, have an inspiring place to work, and favour multicultural interaction, if needed. Thus, creating multiple layers of privacy within the building is essential. Providing, for example, different isolation zones for activities like public administrative tasks, collaborative work, and isolated spaces for focused work, can better support the several users' activities. Another virtuous solution, employed in the TSH case studies, appears to be a silent

room where someone can quietly develop concentrating activities and separate small spaces for taking phone or web calls.

4.3 Living environment

Light, air, and power. In the hybrid building, flexibility, and multifunctional places, certainly require different lighting, ventilation, and power schemes. Diverse layers of illumination and adjustable light can provide solutions. The provision for rising and reducing light intensity creates different moods and suits different circumstances. Low-hanging pendant lights are great for creating an adapted mood but should be avoided where furniture is mobile. In a place where the use of electronics and devices is essential to work, power points, and USB points, need to be well distributed. In addition, natural ventilation and lighting is essential also in terms of sustainability. The provision of the consumer indicator tools may be helpful to monitor the real consumption of these resources. **Acoustic.** In workplaces, noise can be critical when defining the difference between shared and private space. Many coworking developers have tackled this by grouping 'noisy' activities, such as playrooms, social spaces, and game rooms far from desks. Materials and textures play a key role in an acoustic strategy, mainly when dealing with large workspaces. For example, upholstered walls attenuate sound and have the same effect as cork boards or pinboards. Furthermore, the impact of a long time working on the PC alienates personal well-being. A balanced harmony is addressed by providing specific leisure places in workspaces like small snack coffee-bars. **Greenery.** The value for the well-being provided by vegetation and the biophilia theories of Wilson has been long recognized by science and the world of architectural design. This dimension of the project suggests that workplaces should be in contact with nature as much as possible: a nature perceived directly or even visually. It is, therefore, useful to provide, inside and outside the workplace, a habitat rich in vegetation and nature. A joyful and green contrast with the grey concrete of the streets and buildings helps to feel better and to work with greater enthusiasm and pleasure. Indeed, another aspect is the scent. Space is a multisensory experience, and the scent is one of our most important senses. Although workplaces must emanate "clean" and be hygienically healthy, they can significantly impact our comfort level. This perception must also be targeted using light essential oils, flowers etc.).

5 CONCLUSIONS

The awareness that the future increasingly depends on the development of human and social capital is pushing many university cities to rethink the infrastructures that identify the Learning City, Learning Community, and Learning Region (Longworth 2007). Communities are characterised by the prospect of influencing their future development through research, knowledge, and innovation. Supporting tomorrow's citizens, eager to live together, it is necessary to foresee situations where human relationships and communication can be encouraged (Bouncken and Reuschl 2016). Therefore, it is essential to create proper conditions for the development of physical and digital infrastructures with dedicated services, to inspire the development of culture in society, generate social communities and have "more generations under one roof". The idea is that young people and adults, workers and managers, students and teachers live or attend the same spaces where they study, work, and relax. Places where their needs are recognized and satisfied (Sankari and Peltokorpi 2018). University hospitality for the Z Generation is slowly transforming, through hybrid solutions, thanks to the creation of digital ecosystems and future-proof approaches, where technology is placed at the centre of the customer experience and the business operating model. Technology becomes the linchpin of this transformation by creating a process that mobilises the power of the university community, favours the direct management of these infrastructures, and the seamless integration of hospitality products, operational efficiency, and scalability concerning the world around them.

Furthermore, these innovative infrastructures can become levers for urban regeneration, collaborating with the city, development agencies, academic institutions, employees, and employment agencies. The integration of workplaces within university residences, in perspective, can help promote *well-connected communities*, “focused on the maintenance and coordination of interpersonal and inter-organisational relationships within complex systems of interaction” (Gilchrist 2019). University cities can become potential core places where attracting, and enhancing talent, generating jobs, and developing opportunities for local communities. A framework requires mutual effort from public institutions, private investors, and the planning and design sector. University residences are widespread on a national, international scale, with millions of different people who stay there to have a coffee, take a course, work, or start a new company. In conclusion, the transition from hybrid student accommodation to the *well-connected community* of tomorrow, even if currently ongoing, constitutes a new challenge for the future. The key factors that must guide the design and management of these facilities to help build communities are:

Attract

- Convening people with similar or mutually reinforcing ideas, talents, and resources to align goals and strategies.
- Providing creative spaces for shared learning, knowledge, and inspiration.
- Connecting people and organisations inside the community influencing the broader local, regional, or global systems.

Facilitate

- Supporting diversity, equity, and inclusion to uncover and build on common ground.
- Helping people and groups to understand the dynamics inherent in the communities and how to manage them in respectful and productive ways.
- Providing network leadership by identifying and strategically connecting community momentum to new opportunities.
- Guiding people through processes that turn ideas and inspiration into action and results.

Share

- Sharing knowledge, information, and stories. Fostering the emergence of a shared community narrative and integrating a baseline understanding of past and present happenings in the community and in the social context.
- Understanding individual, group, and organisational aspirations and ensuring that each individual or group has access to resources, opportunities, and people, that may help them meet their goals.

The policymakers, HIEs, investors, and developers should contribute to build the optimal political, social, and educational conditions to meet the changes of a whole new generation of international students, young professionals, city users, globetrotters, and entrepreneurs who want to meet and connect with other people, explore and study new educational, economic, and entrepreneurial opportunities and simultaneously grow as a society of individuals, social and relational connected. Therefore, an in-depth debate and research appear paramount for guiding and understanding future developments.

REFERENCES

- Ahrentzen, S. (1991), “Hybrid Housing: A Contemporary Building Type for Multiple Residential & Business Use”, *Centre for Architecture and Urban Planning Research*, Books.
- Balakrishnan, B.K.P.D., Muthaly, S., Leenders, M. (2016.), “Insights from coworking spaces as unique service organisations: the role of physical and social elements”, in Petruzzellis, L., Winer, R.S. (Eds), *Proceedings of the 2015, Academy of Marketing Science (AMS)*,

- World Marketing Congress on Rediscovering the Essentiality of Marketing*, Springer International Publishing, Geneva, 837-848.
- Bellini, O.E., Mocchi, M., Arcieri, M. (2020), “Digitalizzazione e Socializzazione informale nel progetto dell’housing universitario”, in Perriccioli, M., Rigillo, M., Ermolli, S.E. and Tucci F. (Eds), *Design in the Digital Age. Technology Nature Culture*, Maggioli Editore, Santarcangelo di Romagna, 444-449.
- Bellini, O.E., Mocchi, M. (2021), “Nuovi Campi universitari - Student Housing Post-Covid 19”, *Archi Espazium*, n. 2, 10-11, <https://www.espazium.ch/it/archi-nuovi-campus-universitari>
- Bellini, O. E., Gullace, M. T., Mocchi, M. (2022), Re-Start: le policrisi dello Student Housing post-Coronavirus. *Techne*, 23, 94-103.
- Beckers, R., Van der Voordt, T. (2013), “Facilitating new ways of learning in Dutch higher education”, Proceedings of the EuroFM Research Symposium: *FM for a Sustainable Future*, 23-24 May, Prague, 25-35.
- Bed Talks from home, available at: <https://www.bedtalks.nl> (accessed 7 April 2022).
- Besimi, E., Jakupi, E. (2019), “New Models of Hybrid Housing: a case of transforming a neighbourhood in Tetovo, Macedonia”, Proceedings of the 3rd ICAUD *International Conference in Architecture and Urban Design*, Epoka University, Tirana, Albania, 24-26 October 2019, 100-107.
- Bilandzic, M., Foth, M. (2013), “Libraries as coworking spaces: understanding user motivations and perceived barriers to social learning”, *Library Hi Tech*, vol. 31, 2, 254-273.
- Bilandzic, M., Foth, M. (2017), “Designing hubs for connected learning: social, spatial and technological insights from coworking, hackerspaces and meetup groups”, in Carvalho, L., Goodyear, P., de Laat, M. (Eds), *Place-Based Spaces for Networked Learning*, Routledge, Oxon, 191-206.
- Bouncken, R.B., Reuschl, A.J. (2016), “Coworking-spaces: how a phenomenon of the sharing economy builds a novel trend for the workplace and for entrepreneurship”, *Review of Managerial Science*, vol. 12, 1, 1-18.
- Bricocoli, M. (2011), “Amburgo, pratiche e progetti di abitazione collettiva”, in Sampiero, A. (a cura), *L’abitare collettivo*, FrancoAngeli, Milano, 67-80.
- Brown, J., (2017), “Curating the ‘third place’? Coworking and the mediation of creativity”, *Geoforum*, vol. 82, 112-126.
- Cleaver, N., Frearson, A. (2021), *All Together Now. The coliving and coworking revolution*, Published by RIBA Publishing, London.
- Colopardi, E., Nurra, M.G. (Eds) - Ance (2019), *Student Housing*, Ance | Servizi EdilStampa, Roma, available at: <https://www.acerweb.it/student-housing-on-line-le-book-del-seminario-ance-2/> (accessed 20 March 2022).
- Donati, C. (2017), “The student hotel un modello alternativo alla conquista dell’Italia”, *Il Giornale dell’Architettura*, 25 April 2017, available at: <https://ilgiornaledellarchitettura.com/2017/04/25/the-student-hotel-un-modello-alternativo-alla-conquista-dellitalia/> (accessed 22 March 2022).
- Dunbar, R. (2014), *Human Evolution*, Pelican Books, London.
- Forbes Staff (2021), “The student hotel raccoglie 300 milioni di euro per continuare l’espansione in Europa”, 5 May 2021, available at: <https://forbes.it/2021/10/05/the-student-hotel-300-milioni-azionisti-crescere-europa/> (accessed 15 March 2022).
- Gerdenitsch, C., Scheel, T., Andorfer, J., Korunka, C. (2016), “Coworking spaces: a source of social support for independent professionals”, *Frontiers in Psychology*, vol. 7, n. 581, 1-12.
- Gilchrist, A. (2019), *The Well-Connected Community 3E: A Networking Approach to Community Development*, Policy Press, 3rd New edition, Bristol.

- Gringhuis, R., Wiesner, T. (2014), *An exploration into the qualities of a true hybrid building*, Master Thesis, University of Delft available at: https://dc.uwm.edu/caupr_mono/40 (accessed 10 March 2022).
- Gullace, M.T. (2020), “Residenze universitarie: quali prospettive per il futuro?”, in Bellini O.E., Gambaro M. (Eds), *Vivere e abitare l’Università. Bilancio nazionale sulla residenzialità universitaria*, Maggioli Editore, Santarcangelo di Romagna, 159-166.
- Johnson, L., Smith, R., Willis, H., Levine, A., Haywood, K. (2013), “NMC Horizon Report: 2013 Higher Education Edition”, The New Media Consortium, Austin, TX.
- Khymytsia, O. (2018), “Analysis of trends in the development of hybrid housing: European experience of the 21st century”, Paper for 8th International Youth Science Forum “*Litteris et Artibus*”. Lviv 2018, 61–66, available at: <https://openreviewhub.org/lea/paper/analysis-trends-development-hybrid-housing-european-experience-21st-century>
- Longworth, N. (2007), *Learning Cities, Learning Regions, Learning Communities: Lifelong Learning and Local Government*, Taylor and Francis, UK.
- Marais, N. (2011), “Connectivism as learning theory: the force behind changed teaching practice in higher education”, Vol. 4, 3: Meeting the Challenges of Diversity, E-Learning and Competences, 173-182, <https://www.tandfonline.com/doi/full/10.1080/17496896.2010.556478?scroll=top&needAccess=true>
- McLaughlin, P., Faulkner, J. (2012), “Flexible spaces... what students expect from university facilities”, *Journal of Facilities Management*, vol. 10, 2, 140-149.
- McLaughlin, P., Mills, A. (2008), “Where shall the future student learn? Student expectations of university facilities for teaching and learning”, *Proceedings of the 17th Annual Teaching Learning Forum: Preparing for the Graduate of 2015*, 30-31 January, Curtin University of Technology, Perth, 1-9.
- Ninnemann, K., Liedtke, B., Den Heijer, A., Gothe, K., Loidl-Reisch, C., Nenonen, S., Nestler, J., Tieva, Å. Wallenborg, C. (2020), *Hybrid environments for universities*, WaxmannVerlag., *Facilities*, vol. 32, 1/2, 27-45.
- Pascarella, E.T., Terenzini, P.T. (1991), *How college affects students: Findings and insights from twenty years of research San Francisco*, CA, Jossey-Bass, San Francisco.
- Per F., Mozas A., Arpa, J. (2011), *This is Hybrid*, a+t publishers, Barcelona.
- Prensky, M. (2001), *Teaching Digital Natives*, Sage Publications, London.
- Sankari I., Peltokorpi A. (2018), “A call for coworking – users’ expectations regarding learning spaces in higher education”, *Journal of Corporate Real Estate*, vol. 20, 2, 117-137.
- Schopf, J., Roche, J., Hubert, G. (2015), “Coworking and innovation: new concepts for academic libraries and learning centres”, *New Library World*, vol. 116, 1/2, 67-78.
- Seo, J., Lysiankova, L., Ock, Y.-S., Chun, D. (2017), “Priorities of coworking space operation based on comparison of the hosts and users’ perspectives”, *Sustainability*, vol. 9, 8, 1494-1504.
- Spreitzer, G., Bacevice, P., Garrett, L. (2015), “Why people thrive in coworking spaces”, *Harvard Business Review*, vol. 93, 7, 28-30.
- Uyttebrouck C., Van Bueren E., Teller J. (2020), “Shared housing for students and young professionals: evolution of a market in need of regulation”, *Journal of Housing and the Built Environment*, vol. 35, 1017-1035, <https://link.springer.com/article/10.1007/s10901-020-09778-w>

SESSION 2B: NEW WORKING SPACES AND COMMUNITIES

Working the boundaries to transform public workspaces into caring communities

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ABSTRACT

In the present research we aim to investigate ‘boundary work’ (Langley et al., 2019) within what Ivaldi et. al (2018) described as “welfare coworking” (WCW). Adopting a Work and Organizational Psychology (WOP) perspective we consider managers as relational, ethical and relational authors (Cunliffe, 2014) contributing together with others in the construction of these organizational realities and in defining their social purposes. Recent literature has shown that WCW is quite rare and challenging to develop (Spinuzzi et al., 2019). Therefore, further research is required to describe in more detail their distinctive organisational dynamics (Ivaldi et al., 2018). For this purpose, we propose an exploratory qualitative multiple case study within 3 Italian WCW spaces. Our research questions are the following: What’s the role of boundary work within WCW? What distinctive strategies do their managers implement to address WCW goals?

Keywords

Coworking, Third sector, Management, Reflexivity, Boundary work.

1 INTRODUCTION

According to Ivaldi et al. (2018) the objectives of ‘welfare coworking’ (WCW) are to “address cultural or social issues that affect society or local communities and to which both the public and private sectors fail to respond”. Its distinguishing features compared to other coworking spaces are: the presence of agreements with local governments for the use of real estate owned by municipalities, free or reduced prices for coworking desks, and a declared commitment to contribute to a social cause at the local level through one or more activities carried out by coworkers, who devote part of their time to this end. Welfare coworking managers face several challenges including: nurturing networks among the coworkers and with local partners, mobilising and governing community-based projects and ensuring their continuity and sustainability. In order to address these issues, we decided to use the theoretical framework of ‘boundary work’. (Langley et al., 2019). The synthesis through the concept of boundary work seems particularly fruitful for exploring coworking since they are ‘open organisations’ whose

boundaries are shaped and reshaped for enhancing inter-professional and inter-organizational collaboration or, even, solidarity.

2 THEORETICAL FRAMEWORK

Contemporary discourses on management have shifted the focus from the application of standardised procedures, in which the manager is conceived as a rational decision maker, to a more complex view of the profile of the manager as an actor (Goffman, 1978) and storyteller (Weick, 1995) in constant social interaction, or as an ethical and relational author (Cunliffe, 2014) who contributes with others to the construction of organisational realities through his or her own reflexivity on the actions he or she performs. Consistent with this onto-epistemological positioning, which is interpretive and socio-constructivist, management is to be considered as a relational process, whose nature and effects are crafted not exclusively by managers, but also by the other organisational actors – see coworkers and other stakeholders if we look at coworking organisations. Their perspectives are entangled and it is precisely through dialogical relationships that coworking realities are constructed. The notion of “boundary work” is coherent with this framework. Boundary working means shaping or renewing social, symbolic, material or temporal boundaries, affecting groups, occupations and organisations for different purposes: separating competing groups, aligning differences and enabling collaboration, creating new spaces of inclusion and transforming the domains of competition or cooperation (Lamont & Molnár, 2002; Phillips & Lawrence, 2012). The notions of “boundary work” and boundary “objects/subjects” can help us shed light on the management of welfare coworkings, for several reasons. First, CW spaces are open organisations whose boundaries are shaped and reshaped for enhancing new forms of collaboration and solidarity. Second, we agree with Langley and collaborators (2019) in stating that “boundary work is significantly over-intellectualized” and studied mostly from a structural perspective, while we know very little about how this is experienced by managers and coworkers, how emotions are mobilised and which challenges are faced in working around/at/through specific boundary objects/subjects. Coworking managers’ activity, aimed to foster inter-professional collaboration and community caring, is challenged by the need to set, negotiate, influence boundaries among individuals, groups, even organisations attending or partnering with the collaborative spaces (Langley et al., 2019). Performing their managerial roles and subjectively experiencing their mediational function, coworking managers make sense of their intermediary positions through the enactment of boundary work. At the same time, the “others” (coworkers, stakeholders) play an active role in legitimating management mediational function and in working the boundaries. We agree with Langley and collaborators (2019) in stating that “boundary work is significantly over-intellectualized” and studied mostly from a structural perspective, while we know very little about how this is experienced and co-created by managers and coworkers, and which challenges are faced in working around/at/through specific boundaries. The study of how boundary work is experienced in welfare coworkings is therefore quite interesting, since it can help shed light on its specific features and challenges, and also distinguish more finely between the rhetoric and the practice (often more contradictory) of managing such boundaryless places.

3 CASE STUDIES

In the paper we rely on an exploratory qualitative multiple case study within 3 Italian Welfare Coworking, with the aim to: explore managerial boundary work in WCs, identify its specific functions and peculiar challenges. Here a brief description of the 3 cases:

- **P** is a network of collaborative workspaces founded in 2014 and managed by a steering group composed of two social enterprises, a coworker, a civic association and two labour trade unions. The scope of the network is to develop a “solidarity-oriented” model of

coworking, aiming at revitalising peripheral centres by prompting local economies and community-building practices. The network counts 4 spaces including a fablab and counts about 30 coworkers. 2 spaces are located in the Province city centre the other two are in peripheral urban areas (5-10.000 inhabitants).

- **C** defines itself as a network of rural coworking spaces. It is based in a province in north-eastern Italy that has 200.000 inhabitants, counts 50 municipalities and a population density of only 200 inhabitants/km². It consists of three spaces that can be categorised as: a coworking space, a maker space and a coliving space. Coworkers have founded an association on their own, in which space managers also participate in the form of consultants and partners.
- **S** was born as a private coworking space with a strong emphasis on women and work-life balance. More recently it became a civic coworking space in a small town in north Italy that counts around 20.000 inhabitants. Coworkers are also members of the coworking space's association of which the board is also a part, which engages them in planning and executing social projects where funds are obtained through public calls for proposals.

The first case study (P) has been recruited in dec. 2018. A great deal of data was collected in this context during the first two years of research, inclusive of the pre-Covid period. Regular meetings were held with the network's steering committee, as well as interviews with coworkers, stakeholders and ethnographic observations of the spaces. The second (C) and third (S) case studies were instead recruited in a second phase, between sept. 2021 and jan. 2021 and were explored through semi-structured qualitative interviews, followed by a group debriefing. The rationale for the interviews included an in-depth investigation of the following thematic areas:

- Image/meanings/representations of the coworking space.
- Image/meanings/representations of the value produced by the space.
- Significant others and relationships within/outside the coworking space.
- Daily experiences and practices within the coworking space.

The number of interviews differed greatly from context to context (see table 1). These differences depend partly on the size of the Coworking space (which have fewer desks than traditional Coworking) and partly on factors that cannot be controlled. Engaging organisational contexts in research processes takes a long time and each research relationship has different speeds, stalling times and moments of acceleration. The research relationship is still in existence with all three contexts. Among the three S and P are the contexts that were most saturated by the research, we interviewed the entirety of managers and more than two-thirds of coworkers and stakeholders (identified with managers as most significant). While in C the entirety of managers interviewed was reached, but there is a minor representation of coworkers and the stakeholder perspective is missing. However, it was chosen to keep case C, while considering the limitations, because it was judged to have generative diversity with respect to the research objectives.

Table 1. Interviewee (january 2022 - june 2022)

	Managers	Coworkers	Stakeholders
P	9	10	8
S	8	20	4
C	3	6	0

Total	20	36	12
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All the interviews were recorded and transcribed. After reading several times all the texts, a thematic analysis was conducted (Brown and Clarke, 2006), following six steps: familiarising with data; generating initial codes; searching for themes; reviewing themes; defining and naming themes; producing the synthesis. In the analysis, several themes emerged. In the present study, however, we decided to focus on some meanings and purposes related to boundary work, and WCW specific challenges.

4 RESULTS

4.1 The need for an “holding” environment (keywords: separating, blurring, positioning)

A first type of boundary work was related to the creation and maintenance of what Petriglieri et al. describe as ‘holding environment’ (2019). The space is a mean for coworkers to experiment and express their identities within a safe space where they can redraw the boundaries of their personal and professional spheres enabling both to separate and to connect part of them. The most noticeable separation was between the professional and the domestic sphere. This was crucial in psychological terms, as coworkers in distancing themselves from home could cope with loneliness, cultivate a sense of belonging, having social relationships, engage in routines and moreover they could experiment themselves in new viable professional, personal and social identities. These aspects were particularly relevant during the Pandemic. The possibility to access different contexts generates the chance for the individual to approach different systems of meaning, in which they have the possibility to experiment new rules and different roles, offering them new identifications that can be complementary or in competition with each other (Knights & McCabe, 2003). The existence of an alternative is very important for women, for example, in the period following parental leave. As professionals may ask to see both their professional and family roles recognized without giving up one or the other. The need for a working mother might be both to demarcate a clearer boundary or instead blur the demarcation between personal and professional, being allowed “to be both a great mom and a great worker” (study case S). In describing the experience of these spaces, coworkers and managers often refer to a ‘before’ or an ‘elsewhere’ (home, office, other experienced coworking spaces) with respect to which the current workspace has distinctive characteristics. At the same time, WCW was recognized as the opportunity for coworkers to position themselves within a public and collective domain. Being part of the coworking life and its social initiatives allowed them to re-discover their relation with their territory and territorial identity, and be part of a process of revitalization of territories that for geographic-economic reasons had seen workers migrate towards richer areas or where they are naturally dispersed (Case C). A specific dimension highlighted by coworkers and managers was the feeling of ‘being rooted to their territory’. A sense of *being* or *returning* local was important for coworkers. The local community serves therefore as an ideal recipient of various forms of prosocial actions (see next paragraph) and as a positive identification for coworkers.

4.2 “Provisional boundary objects” (keywords: enacting, connecting, rooting)

Coworking managers are concerned with generating ‘temporary circuits’ that allow coworkers to experience and learn, in an organisational climate that is free of obligations and pressures and ensures a playful and free experience. What’s characteristic of WCW is that in these forms of collaborations the dimensions of ‘social entrepreneurship’ or ‘social activism’ and ‘local roots’ are heightened. These are some of the boundary objects used by the managers to open the coworking spaces to the local community. One is the partnership with key stakeholders

(municipality, schools, universities, other third sector associations, companies) the other is through boundary objects that involve actively the coworkers that enable them to connect to the territory and enact their contribution. Some examples we observed: *Open coworking events and training*; *Social intervention project*; and the *practice of 'Restitution'*. The first consists in creating 'open days' (case P, S, C), in which it's possible to access training activities based on the competencies of the coworkers. If in traditional CW spaces these events are targeted to other professionals or for professional networking purposes, more often in WCW the access to these training is free, they are targeted to young people and for institutional purposes. The topics are similar: digital skills, communication, entrepreneurship. A second boundary object we observed were social intervention projects. The projects are financed thanks to public calls and the coworkers can be involved by the management (case S) or organise on their own (case C). Another example is that of P, in which a contract is stipulated as a commitment to give a return to the territory. In this case, the coworker signs a contract in which he/she commits to donating part of his/her time or work to repay the space through activities or collaborations that benefit the local community. In the case of P the manager has a supervisor function, meeting regularly with the coworkers to finalise with them the terms and modalities of restitution. In participating to these 'provisional commitments' coworkers put themselves at service, in a position of caring for others, they engage in prosocial behaviours which are facilitated by an identification with another - similar to me - and ultimately further reinforcing their common belonging to a space, to a shared cultural context and also to a local territory.

4.3 Resistance and social critique (keywords: deconstructing, coherence)

The third aspect emerged in the interviews was the idea that belonging to coworking had a transformative role with regard to the social, ethical and political aspects of coworkers' lives. The spaces were strongly characterised as places of innovation, exchange and self-experimentation, but also as places of 'social critique' and 'resistance'. The 'new', human, caring, solidaristic value proposition of coworking was seen as a political alternative to the 'conventional', consumeristic and individualistic approach to work and life. Such storytelling seemed aimed to highlight the subversive nature of the WCW, presented as laboratories of alternative values. The specific risk perceived by the managers of these initiatives at this level, is that when they give up their authorship in the creation of the projects in favour of a greater openness to the market, they'll lose their identity and the transgressive value of their actions. The way in which the observed WCW managers strived to maintain their identity anchorage was implemented through a continuous exercise of storytelling and reflexivity on the coherence between their mission, what was communicated, what was acted inside the coworking space and the actions that the coworking community carried out on the territory, when new calls for projects were proposed and discussed, when new collaborators were hired, or when new partners were to be chosen.

5 DISCUSSION

The use of the concept of boundary work to read the coworking phenomenon and to focus on some distinctive features of WCW and its management seems fertile. Boundary work allows firstly to the construction of a 'holding' space (Petriglieri, 2019) This characteristic seems to us to be distinctive not only of WCW, but of all coworking spaces that have over time made their fortunes thanks to this ability to create new belonging, break the isolation of freelance workers, ensure new inclusion for fragile categories, and at the same time support professional networking and self experimentation. However within WCW boundary work is also expressed on other more specific levels. A first level concerns the relationship between the space and territory, which enables new collaborations and the construction for coworkers of a new sense of "rootedness" and belonging to a local community. This shifts the focus from a view of

coworkers as single professionals and self-entrepreneurs, focussed to their employability and self development for being appreciated by the market, to a view of coworkers as local citizens and political activists, who rediscover the social and ethical nature of their work and fight to be part of a social innovation process. This also requires new management actions: from simply facilitating coworkers' self-development and socialisation, to helping coworkers read their social context and create new partnerships with public administrations, relevant social actors and other fellow citizens in order to nurture transformative actions. A second level is related to the subversive and socially critical stance in WCW. This was an instance that could be found also in the experiences of the first coworking in the United States (2005) and in England (2006), which presented themselves as generators of social change, able to narrate an alternative work and economic model. Its political stance can be found in the choices that management makes in terms of communication, the choice of their partners, and the projects proposed and developed within the space. However in the absence of a collective strategy through which these subcategories of coworking spaces can communicate the innovative value of what they propose at the social level (crossing the boundaries of their network), much of the political action of these spaces remains local. Lastly, managing these types of spaces is complex, and not surprisingly, many of the managers of the welfare coworking spaces we interviewed face (to some degree) some sustainability issues, such as: imbalance between network expansion and their ability to meet stakeholder expectations; uncertainty of scenarios; inability to measure or account for results. In most spaces, managers are delegated the selection of coworkers; the choice of which coworkers to include or exclude from projects; they are entrusted with supporting and facilitating interactions; they are also perceived as "transitional figures" who offer support and reassurance, especially to the most "fragile" coworkers. The result can be excessive manager fatigue: always needed and feeling empowered and energised, but always required and feeling busy and overwhelmed. Committed to generating social innovation, but also asked to deal with cultural tensions, such as Individualism vs. Collectivism one; the need of being in a market logic vs. the ambition to promote a new approach based on caring.

REFERENCES

- Azambuja, R., Islam, G. (2019), Working at the boundaries: Middle managerial work as a source of emancipation and alienation. *Human Relations*, 72(3), 534-564.
- Braun, V., Clarke, V. (2006), Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Akhavan, M., Mariotti, I. (2018), "The Effects of Coworking Spaces on Local Communities in the Italian Context", *Territorio*, 87, pp. 85–92, <https://doi.org/10.3280/TR2018-087014>
- Cunliffe, A. L. (2014), "A very short, fairly interesting and reasonably cheap book about management", Sage, London, <http://dx.doi.org/10.4135/9781446280317>
- Cunliffe, A. L. (2008), "Orientations to Social Constructionism: relationally responsive Social Constructionism and its implications for knowledge and learning", *Management Learning*, 39, 2, pp. 123-139, <https://doi.org/10.1177%2F1350507607087578>
- Engeström, Y. (2009), "The future of activity theory: A rough draft", Sannino, A. Daniels, H., K. Gutierrez (Eds.), *Learning and expanding with activity theory* (pp. 303–328). New York: Cambridge University Press, <http://lchc.ucsd.edu/mca/Paper/ISCARkeyEngestrom.pdf>
- Fotaki, M. Islam, G., Antoni, A. (Eds.) (2019), *Business Ethics and Care in Organizations* (1st ed.), Routledge, London, <https://doi.org/10.4324/9780429029943>
- Farias, C. (2017), Money is the Root of All Evil—Or Is It? Recreating Culture through Everyday.

- Neutralising Practices. *Organisation Studies*, 38(6), 775-793.
- Gandini, A., Cossu, A. (2021), "The third wave of coworking: 'Neo-corporate' model versus 'resilient' practice", *European Journal of Cultural Studies*, 24(2), pp. 430-447, <https://doi.org/10.1177%2F1367549419886060>
- Ivaldi, S. Pais, I. Scaratti, G. (2018), "Coworking(s) in the Plural: Coworking Spaces and New Ways of Managing.", Taylor, S. Luckman, S. (eds), *The New Normal of Working Lives, Dynamics of Virtual Work*, Palgrave Macmillan, Cham.
- Yagi, N., Kleinberg, J. (2011), Boundary work: An interpretive ethnographic perspective on negotiating and leveraging cross-cultural identity. *Journal of International Business Studies*, 42(5), 629-653.
- Langley et al. (2019), "Boundary work among Groups, Occupations and Organisations: from Cartography to Process", *Academy of Management Annals*, vol 13, 2, pp. 1-88.
- Oldenburg, R. Brissett, D. (1982) "The third place", *Qual Sociol*, 5, pp. 265–284, <https://doi.org/10.1007/BF00986754>
- Spinuzzi, C. (2012), "Working alone together: coworking as emergent collaborative activity". *Journal of Business and Technical Communication*, 26(4), pp. 399–441, <https://doi.org/10.1177%2F1050651912444070>
- Petriglieri, G., Ashford, S. J., Wrzesniewski, A. (2019), "Agony and ecstasy in the gig economy: Cultivating holding environments for precarious and personalised work identities". *Administrative Science Quarterly*, 64(1), 124-170.
- Waters-Lynch, J. Potts, J. Butcher, T. Dodson, J., Hurley, J. (2016), "Coworking, a transdisciplinary overview", working paper, SSRN, <https://dx.doi.org/10.2139/ssrn.2712217>

Community-driven workspaces and local social infrastructure

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ABSTRACT

In May 2020, the Mayor of London publicly declared that ‘*social infrastructure is key to supporting inclusive and thriving neighbourhoods*’. Several scholars define the concept of social infrastructure as a way to research and value some spaces with a collective public character, which is the key dimension of a good city (Latham & Layton, 2019). Klinenberg (2018) defined community organisations as social infrastructures when they have an established physical space where people can assemble and mix with others with whom they share their neighbourhoods. In developing the term social infrastructure, Ray Oldenburg's work on ‘Third Place’ diverts the focus on “inclusively sociable” spaces like cafes, hair salons, and community spaces to build trust and new workspaces (Oldenburg, 1989). Social infrastructure links with the concept of new workspaces, especially with those that emerged with the intent to benefit the local area and are deeply entangled with the neighbourhood. Many of them pair with charities, local associations, or cooperatives – often economically funded by local authorities, even if privately owned – aiming at supporting the local community. Beside the increasing of entrepreneur-led workspaces, some scholars argue that those community-centred should be considered mutual survival platforms of precarious employment and community development, managing social relationships and playing a broader social role in the local area (Avdikos & Merkel, 2020). The study aims to define community-driven coworking spaces as places of social infrastructure acting for the ‘community good’ (Avdikos & Merkel, 2020) by assessing the users’ degree of interaction, perception, and integration with the neighbourhood. A pilot study was carried out for three months in 2021 in the Work Heights coworking space in Crown Heights North (Brooklyn, NY), applying the Perception Questionnaire to ethnographic methodology.

Keywords

Neighbourhood, New workspaces, Community-driven coworking, Social infrastructure.

1 INTRODUCTION

1.1 Coworking: a concept in evolution

The rise of coworking is related to several interlinked conditions (Waters-Lynch et al., 2016). However, it is possible to trace three main tendencies: firstly, the rise of the so-called “creative economy” (Florida 2002). Secondly, the digitisation of the economy (Moriset and Malecki, 2008), ‘*which drive profound changes in the production and consumption of space and places dedicated to creative work*’ (Moriset, 2013:2). Thirdly, ‘*the financial crisis of 2007/2008 and subsequent global recession*’ (Merkel, 2015:121). The three causalities have brought to light the emergence of ‘*urban start-ups and “lone eagles” – self-employed knowledge workers – who seek to find “third places” to break the loneliness and to maximise serendipity and potential interaction with their peers*’ (Moriset, 2013:2). The need to find a “third place” to work from highlights a new possible way of working developed as a ‘*halfway combination between the classic work life, in a defined, traditional space as a traditional community environment, and the freelancer independent work life*’ (Iulia Constantinescu & Devisch,

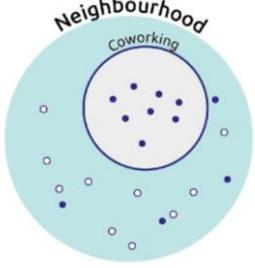
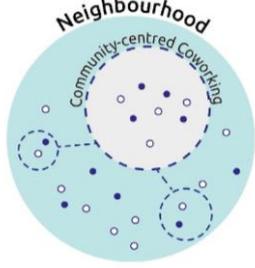
2018:1265). This new method of work was named after coworking. Among incubators, accelerators, artists' studios, and maker spaces, coworking spaces (from now CSs) can be considered one typology of flexible and '*open workspaces*' (Roberts, 2016:9). The coworking model has been gaining strength worldwide since the mid-2000s as an alternative collaborative solution to standard office and traditional working hours. The concept of coworking is an evolving concept. Due to its complexity and the lack of a clear definition, the concept did not follow a linear development path. Instead, its birth and evolution have been affected by the succession of economic/political scenarios, as well as cultural factors, which have boosted the emergence of certain spaces with similar characteristics during specific time frames in history: the so-called waves of CSs (Johns & Gratton, 2013; Gandini, 2015; Gandini & Cossu, 2019). Based on the existing literature, is it possible to recognise three primary waves that emerged in the mid-2000, around 2010 and a recent wave that arose before the COVID-19 pandemic twisted the work culture worldwide. Considering the last recognised wave that appeared before the COVID-19 pandemic, the CSs emerged are defined as resilient CSs, driven by the purpose to benefit the local context. Gandini and Cossu (2019:5). Therefore, different typologies of CSs act on the territory in different ways, with different intensities, having '*different impacts on local economic development and urban regeneration*' (Fiorentino, 2019: 1769). That is the case of community-centred coworking which have been defined as bottom-up initiatives (Avdikos & Iliopoulou, 2020), deeply rooted in the neighbourhood and embedded with the local community. But, what a resilient or C-centred CSs is?

1.2 Defining Community-centred Coworking Spaces (C-centred CSs)

Gandini and Cossu (2019) define the concept of resilient coworking with a tradition in urban and cultural studies that conceives of resilience as a concept that '*enables adaptation and thriving*'. (Pratt, 2015: 62). Resilient CSs '*embrace the evolution of work toward flexibility and independence*' (Gandini & Cossu, 2019:6) while striving for innovation and change to adapt to the specific context where they are located (Virani et al., 2016). A key element of resilient CSs is the quality of social relations to develop '*communal interactions*' (Gandini & Cossu, 2019:6). Before 2019, the term 'resilient' related to the coworking economy has only been used in terms of recommendations, mainly for local authorities, to develop, for instance, '*alternative resilient approaches*' (Di Marino & Lapintie, 2017:7) or to promote '*a stronger and more resilient innovation environment*' (Mariotti et al., 2017:62). Recently, the term has gained more and more value, especially with the change and transformation of ways of working brought about by the COVID-19 pandemic. In fact, since 2020, the COVID-19 pandemic has opened a perspective on a new wave of CSs, which accelerated the resilient trends already in place before: community-centred coworking (from now C-centred CSs). Existing literature revealed that '*independent and C-centred CSs have been mostly affected by the COVID-19 pandemic due to their bottom-up nature and less stable economic sources of funding*' (Manzini Ceinar et al., 2020:150). However, those C-centred CSs have more potential in the long term for providing spatial alternatives to accommodate the partial displacement of people who want or need to work locally, as well as for companies relocating their employees (Mariotti & Di Matteo, 2020; Mariotti et al., 2020; Manzini Ceinar et al., 2020). Today, C-centred CSs are described as those emerging small-scale, independent and (often) not-for-profit CSs typically founded and run by local entrepreneurs to support the local community of the surrounding area (Avdikos & Iliopoulou, 2019; Arnoldi et al., 2021): '*They [C-centred CSs] correspond to the more grassroots experiences [...] Those spaces are more locally embedded, they show a deeper engagement with the issues of urban regeneration of the surrounding, usually decaying and socially deprived neighbourhood.*' (Fiorentino, 2019:1779). To distinguish C-centred CSs from CSs more, in general, is a key to understanding the diversity of shared workspaces which is critical to evaluating their potential entrepreneurial growth, innovation agendas and local

development (Avdikos & Merkel, 2020). Table 1 conceptualises how the two typologies differ, even if they do not replace one another but, on the contrary, overlap, generating increasingly complex spaces and dynamics. In general terms, C-centred CSs adopt more spread dynamics, are more inclusive with the local community and are more embedded in the neighbourhood where they are located. The use of the C-centred CSs is generally ‘open’ to locals, and the ‘use’ of the neighbourhood (businesses, public spaces etc.) is more frequented by coworkers. Therefore, the means of funding those spaces are diverse and come from different sources, such as donations, public funds, and community events that subsidise rent and equipment costs.

Table 1. Differences between CSs in general and C-centred CSs

		
	Coworking in general	Community-centred coworking
	Clustered dynamics	Spread dynamics
Use of the coworking	Coworkers mainly	Coworkers + locals
Use of the neighbourhood	Locals mainly	Locals + coworkers
Users' interaction	One way: ● *Coworkers to neighbourhood	Double way: ● *Coworkers to neighbourhood ● *Locals to coworking
Services	Business-based	Support-based
Funding	Members' memberships	Subsidised by both community and private events, donations, public grants, etc.

The C-centred CSs are places where synergies and interactions are double-way between the coworkers and the local community, which recognises coworking as part of the social infrastructure ecosystem. In fact, of relevance for this study, C-centred CSs link with the concept of social infrastructure and all the ethos and relationships behind it. Scholars define the concept of social infrastructure as ‘*the way to research and value some spaces with a collective public character*’ (Lathan & Layton, 2019), including tangible and intangible aspects. In fact, alongside tangible services and social spaces, intangible networks and community support play an essential role. Oldenburg’s work on Third Place (Oldenburg, 1989) combines those aspects in the concept of ‘inclusively sociable’ spaces like cafes, community spaces and workspaces, such as C-centred CSs. Moreover, many of C-centred CSs pair with charities and cooperatives, often economically funded by local authorities, even if privately owned – representing a ‘*state of liminality between public and private blurred boundaries*’ (Zukin, 1991).

1.3 Aim and Objectives

The research has been guided by the general question: *What is community-centred coworking?* This question focuses on the values, infrastructures and spatial strategies associated with the community-centred model. It defines strategies and elements that link coworking, the local area and the community in relation, mainly focussing on the degree of involvement of the coworkers

in the local community. Therefore, the research uses the specific case study of Work Heights Prospect to test initial hypothesis with the aims to:

1. Analyse the level of interaction between the coworkers of Work Heights Prospect and the surrounding area of Prospect Heights Prospect.
2. Explore the neighbourhood perception of coworkers in terms of safety, vibrancy, and what local businesses offer.
3. Examine the degree of integration of the coworkers with the local community and its dynamics.

To address these objectives and aims, the paper has the following structure: After presenting an overview of the existing literature on the emerging trend of C-centred CSs, the paper explains the methodology grounded on an ethnographic approach that has been used to collect data, along with describing how the case study analysed could be considered a C-centred CSs. Then, it develops an analytical framework for assessing the degree of interaction, perception, and integration of coworkers presented in the results. Lastly, the paper outlines the key conceptual conclusions and reflects on how the empirical findings can contribute to theory and practice.

2 METHODS AND MATERIALS

The purpose of this paper is to expand on the relationship between CSs and their surrounding community by collecting and analysing qualitative data in the single case study of Work Heights Prospect, selected according to the criterion of *purposing sampling* (Etikan et al., 2016), during three months in 2021.

2.1 Methodology

The methodology is based on data gathered by sixteen Perception Questionnaires (Chuah, 2016) – composed of 29 choice questions and 3 open questions – filled by coworkers to evaluate their perception of the surrounding neighbourhood and gauge their participation in community events, and one in-depth interview with the founder of the CS. The methods used have been anticipated by an initial screen of quantitative data useful to frame the context of Prospect Heights, where the space is in Brooklyn. Table 2 shows information about the space and the area, including social and spatial characteristics. Data on location was gathered from Neighbourhood Tabulation Area (NTA) – New York City Census. Data on amenities and services provided by Work Heights Prospect, such as facilities, amenities, services etc., are extracted from CoWorker.com and during the interview with the owner of the space. After this screening, an in-depth analysis based on desk research was performed. The results are shown in the following sections.

Table 2. Characteristics of Work Heights Prospect

Work Heights Prospect, 184 Underhill Avenue, Prospect Heights, Brooklyn	
Year of foundation	2017
(4) Branches	<ul style="list-style-type: none"> ● Work Heights Prospect, 184 Underhill Avenue, Prospect Heights, Brooklyn ● Work Heights Machine, 1037 Dean Street, Crown Heights, Brooklyn ● Work Heights Electric, 650 Franklin Avenue, Crown Heights, Brooklyn ● Work Heights Kinetic, Clinton Hill, Brooklyn
Area	Crown Heights North NTA (Brooklyn Borough)
Location and social aspects of the area	Crown Heights North and Prospect Heights have been recognised as an area with a significant poverty gap Index (8.0), and one of the higher Poverty Rates (21.4%), compared to the citywide Poverty Rate 5-Year

	Average = 20.3%, and the Poverty Gap Index = 7.0. (New York City Government Poverty Measure 2005-2016).
Services:	
Classic basics	High-speed WiFi open to local users
Gathering space	Outdoor spaces
Equipment	Recording studio open to local artists
Community support and urban strategies	Event space open to the local community
	Open access workshops
	Training opportunities
	Incubator for community-based initiatives
	Supply of services upon request
	Partnership with local associations

2.2 Works Heights Prospect as a case study

In New York, the total number of CSs surveyed in September 2020 amounts to 262 CSs, registering the highest coworking growth after London in the United Kingdom. This paper has a particular focus on the single case study of Work Heights Prospect in Brooklyn, New York (Figure 1). From the accessibility point of view, it is only 6 minutes walking away from Grand Army Plaza underground station. However, the space is in a highly fragmented and diverse context, with one of the highest concentrations of ethnic minority residents in the city of New York. In fact, it is recognised as a “super-diverse” neighbourhood meaning the migration has become more complex: residents vary by religion, ethnicity, legal and employment status, sexuality, and class. The relative proximity to the city centre, together with the social disadvantage character and gentrification dynamics, contribute to creating pockets, just streets apart, which vary from being among the 2% most deprived in the country to the 50% least deprived, in part due to the diversity of housing provision. This represents the current discrepancy between the residents of the neighbourhoods and the coworking members aligned to the ethos of the tech sector, described by Lloyd as ‘*neo bohemians*’ (Lloyd, 2010:55) working in the flat white economy (McWilliams, 2015). Work Heights is a coworking provider with four locations opened, all in the same area: Brooklyn. Among the branches, Work Heights Prospect is relatively new. It opened in 2017 nearby the Blue Marble Ice Cream Shop, with which it shares the outdoor dehors. The space offers weekly workshops, networking events (i.e., comedy nights and poetry readings), as well as training opportunities for the local people living in the area. In fact, the space is promoting itself as a ‘local coworking space’ or ‘your neighbourhood coworking company’. This is aligned with the ethos of the company, which sponsored via its website the idea of hyper-localism without commuting: ‘*Why commute when you can walk to Work Heights? We understand a dynamic work style boosts creativity. That’s why we built a network of 4 convenient locations our members can enjoy at any time. No subway needed.*’ All the Work Heights CSs are relatively small-sized and are managed by an active team of employees, many of whom were already based in the space as coworkers or living nearby – the founder himself lives upstairs from the Work Heights Machine branch, and the flat is accessible from the back garden of the coworking.

Figure 1. Work Heights Prospect, 184 Underhill Avenue



3 RESULTS

The data collected are based on sixteen anonymised questionnaires filled by coworkers of Work Heights and one in-depth interview with the owner and founder of the space.

3.1 Neighbourhood perception

Based on the data collected, half of the participants rely on the affordance of the space for choosing to work from Work Heights, while around 40% of the reason is the environment. However, approx. 20% of the participants justified their choice in relation to the proximity to their home: *'Wanting to get away from working at home due to COVID-19'* or *'Needing additional space to work out of, tired of home office'* and *'My office is closed, and I am not productive working from home'*. In fact, one of the big issues in cities like New York and London is that the dimension of residential homes is limited. Especially young entrepreneurs and freelancers, who are mostly flat sharing, do not have space enough to work or store their equipment – 25% of participants work in the art and entertainment sector, and 31.25% declared to be self-employed. The importance of the proximity between Work Heights and the coworkers' homes is also reflected in the fact that the majority of the coworkers walk (nearly half) or cycle (around one-fourth) every day to the CS. Furthermore, commuting time is the main reason for choosing the Work Heights Prospect location (about one-fourth of the responses), while affordability and familiarity with the area are other key factors for choosing the location – *'It's proximity to public transportation, parks, and my favourite restaurants.'* Most of the coworkers have been working in the space for a maximum of 6 months and aim to continue working from there for another six months-1 years, which is a timeframe relatively long for being located in a CS. This is partly because coworkers perceive the neighbourhood 'safe enough' (more than 50% of respondents)– *'It is affordable but not dangerous'*. Moreover, coworkers feel that there are a lot of eating out options, with around 30% of them usually going out in the surrounding cafés and restaurants – *'I like the abundance of cafés and restaurants [...] and that it's easy to commute to Manhattan.'*

3.2 Neighbourhood interaction

Despite 11 out of 16 participants enjoying going out for a break during the week, most of the respondents said that the amount of green space in the area is very poor, and this affects their use of the public areas: nobody uses the area for sports activities. However, 25% of the participants spend their free time in the neighbourhood, and nearly 30% of them are engaged in social events, and interacting with the local community, even if only a few of them are involved in any community organisation or voluntary activities in the neighbourhood – *'I have been volunteering as part of a community composting effort with Work Heights.'*

3.3 Neighbourhood integration

In sum, more than half of the participants said that they know the area ‘extremely well’ and they felt ‘enough’ integrated into the neighbourhood community, with 44% of them satisfied with the neighbourhood – ‘*I live in the neighbourhood and do many activities nearby (shopping, kids’ school, dining out)*’. However, someone mentioned that even if the area is ‘*lively and diverse*’, there is a *lack of African American-owned businesses and community-based social events to promote African American culture*. This is partly because, as mentioned at the beginning of this paper, the typology of coworking space users is not representative of the local population in terms of background and ethnic composition.

4 CONCLUSIONS

In the analysed case study, there is a mismatch between the CS’s community and the larger community of the neighbourhood. Moreover, there is little follow-up in policy to support the integration of the CS in the local area. As a result, the CS adopts bottom-up logics and informal approaches (Simonelli, et al., 2018) to make the local community engaged with coworkers, and the other way around—like what Weishaguna, et al. (2021) found in their study on Bandung city. Also, coworkers are content with their embedment in the local community, (contrary to the study of Chuah, 2016), however generally dissatisfied with the neighbourhood number and quality of amenities. Then, it is worth mentioning that the specific time we are living is questioning a lot of new ways of work, well-being and life-work balance. During the pandemic especially, the standard place of work – the office – has been overtaken by new flexible ways of working from home or from the so-called ‘third-places’, with new forms of flexible work, such as remote working, smart working, south working etc. However, Work Heights worked as a neighbourhood backup, giving the space for free to the local community during specific times of the day to organise cultural events. This was successful on the one hand for the space to get to know local people better while fostering a reputation as a socially-minded organisation, on the other to thrive during 2020. During the interview, the owner mentioned: ‘[During 2020], *the coworking space has been kind of good. We were shut down until late June, and then we reopened as part of the Phase II reopening. It was a little slow, and then October was our best month ever in six-year of business.*’ This demonstrates the significant role of Work Heights Prospect during the COVID-19 pandemic for both the coworkers, who have been supported by their ‘coworking community’, as well as the locals, becoming a resilient place of local infrastructure.

ORIGINALITY AND VALUE

There are several contextual factors that establish the timeliness of this study, including the impact of the COVID-19 pandemic that challenges the way we work, increasing recognition of the importance of third spaces, and emerging awareness of the social structure in the local dimension. These present new challenges to which stakeholders and local authorities are required to respond. Although this study does not presume to make recommendations in terms of policy, it could potentially serve as a case study in order to:

1. Provide CSs with an overview of diverse governance and management to meet the local community’s needs – renting at an affordable market rate the space for private events can potentially subsidise cheaper or free space to community groups who need it.
2. Inform local authorities about the changing role of the social dynamics at the neighbourhood level. This can therefore provide them with the tools to proactively intervene by connecting actors and meeting the community's needs.

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REFERENCES

- Arnoldi, E., Bosua, R. (2021), Contemporary dynamics of the future of work, the platform economy and transient work pre-and post-COVID-19: a research agenda. *Transitions: Journal of Transient Migration*, 5(1), 3-10.
- Avdikos, V., Iliopoulou, E. (2019), Community-led coworking spaces: From co-location to collaboration and collectivization. In *Creative hubs in question*, 111-129. Palgrave Macmillan, Cham.
- Avdikos, V., Merkel, J. (2020), Supporting open, shared and collaborative workspaces and hubs: recent transformations and policy implications. *Urban Research & Practice*, 13(3), 348-357.
- Chuah, V. (2016), *Beyond the core: The role of co-working spaces in local economic development* (Doctoral dissertation, Columbia University).
- Di Marino, M., Lapintie, K. (2017), Emerging workplaces in post-functionalist cities. *Journal of urban technology*, 24(3), 5-25.
- Etikan, I., Musa, S. A., Alkassim, R. S. (2016), Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, 5(1), 1-4.
- Florentino, S. (2019), Different typologies of ‘co-working spaces’ and the contemporary dynamics of local economic development in Rome. *European Planning Studies*, 27(9), 1768-1790
- Florida, R. (2002), *The Rise of the Creative Class: And How It’s Transforming Work, Leisure, Community and Everyday Life*. Routledge.
- Gandini, A. (2015), The rise of coworking spaces: a literature review. *Ephemera* 15(1), 193–205.
- Gandini, A., Cossu, A. (2021), The third wave of coworking: ‘Neo-corporate’ model versus ‘resilient’ practice. *European Journal of Cultural Studies*, 24(2), 430-447.
- Hammersley, M. (2010), *Methodology: Who needs it?*. Sage.
- Iulia Constantinescu, T., Devisch, O. (2018), Portraits of work: Mapping emerging coworking dynamics. *Information, Communication & Society*, 21(9), 1263-1278.
- Klinenberg, E. (2018), *Palaces for the people: How social infrastructure can help fight inequality, polarisation, and the decline of civic life*. Penguin.
- Johns, T., Gratton, L. (2013), The third wave of virtual work. *Harvard business review*, 91(1), 66-73.
- Latham, A., Layton, J. (2019), Social infrastructure and the public life of cities: Studying urban sociality and public spaces. *Geography Compass*, 13(7), e12444.
- Lloyd, R. (2010). *Neo-bohemia: Art and commerce in the postindustrial city*. Routledge.
- Manzini Ceinar, I., Pacchi, C., Mariotti, I. (2020), Emerging work patterns and different territorial contexts: Trends for the coworking sector in pandemic recovery. *Professionalità studi*, 2020(4), 134-159.
- Manzini Ceinar, I., Mariotti, I. (2021), The effects of COVID-19 on coworking spaces: Patterns and future trends. In *New Workplaces—Location Patterns, Urban Effects and Development Trajectories* (pp. 277-297). Springer, Cham.
- Mariotti, I., Pacchi, C., Di Vita, S. (2017), Co-working spaces in Milan: Location patterns and urban effects. *Journal of Urban Technology*, 24(3), 47-66.

- Mariotti, I., Di Matteo, D. (2020), Coworking in emergenza COVID-19: quali effetti per le aree periferiche. *Volume 10-Numero 2-Marzo 2020*, 55.
- Mayor of London (2020), “Good Growth by Design, 2020”. Available at https://www.london.gov.uk/sites/default/files/good_growth_web.pdf (accessed 17 March 2022)
- McWilliams, D. (2015), *The Flat White Economy: How the digital economy is transforming London and other cities of the future*. Gerald Duckworth & Co.
- Merkel, J. (2015), Coworking in the city. *Ephemera*, 15(2), 121-139.
- Moriset, B., Malecki, E. J. (2009), Organisation versus space: The paradoxical geographies of the digital economy. *Geography Compass*, 3(1), 256-274.
- Moriset, B. (2013), Building new places of the creative economy. The rise of coworking spaces. HAL Open Science online Journal. Available at <https://halshs.archives-ouvertes.fr/halshs-00914075/document> (accessed 18 January 2022)
- Oldenburg, R. (1989), *The great good place: Cafés, coffee shops, community centres, beauty parlours, general stores, bars, hangouts, and how they get you through the day*. Paragon House Publishers.
- Pratt AC (2015), Resilience, locality and the cultural economy. *City, Culture and Society* 6(3): 61–67.
- Roberts, C. (2016), Start me up: The value of workspaces for small business, entrepreneurs and artists in London. Available at <https://www.ippr.org/publications/start-me-up-the-value-of-open-workspaces> (accessed 29 March 2022)
- Simonelli, G., Scullica, F., Elgani, E., Monna, V. (2018), Can coworking spaces be built bottom-up?. In *ServDes2018. Service Design Proof of Concept, Proceedings of the ServDes. 2018 Conference*, 18-20 June, Milano, Italy (No. 150, pp. 761-771). Linköping University Electronic Press.
- Virani, T., Dovey, J., Pratt, A., Lansdowne, J., Moreton, S., Merkel, J. (2016), *Creative Hubs: Understanding the New Economy*. British Council. Available at <https://creativeconomy.britishcouncil.org/resources/creative-hubs-understanding-new-economy> (accessed 29 March 2022)
- Waters-Lynch, J., Potts, J., Butcher, T., Dodson, J., Hurley, J. (2016), “Coworking: A transdisciplinary overview. Available at <https://ssrn.com/abstract=2712217> (accessed 29 March 2022)
- Weishaguna, W., Damayanti, V., Rahmawati, S. D., Almakhi, M. L., Hindersah, H., Pradifta, F. S., Darmaputra, P. A. (2022), Rethinking Coworking Space Design as a Self-Supporting and COVID-19 Resilient Community Centre in Indonesia. In 4th Social and Humanities Research Symposium (SoRes 2021) (pp. 70-76). Atlantis Press.
- Zukin, S. (1991), *Landscapes of Power: From Detroit to Disney World*. University of California Press

Collaboration in Co-working Space in Johannesburg

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ABSTRACT

Co-working space is a growing phenomenon gaining popularity amongst managers of companies, digital and independent workers. These co-working spaces are designed to encourage collaboration and knowledge sharing among independent workers who are usually a part of the growing knowledge economy. Although this information is well documented from developing countries, there is still limited research on the effectiveness of co-working spaces in encouraging collaboration among independent workers in South Africa. This has hindered co-working space from being explored as a viable alternative to traditional office space. The target population in this study is employees within the built environment profession, such as architects, property developers, construction professionals and town planners. These professionals work in a co-working space in Johannesburg, South Africa. Out of the six participants, one used a traditional office most of the time and only used a co-working space sometimes. Semi-structured interviews were conducted to elicit information on collaboration and knowledge sharing. The purposive sampling technique was used to identify and select six built environment professionals. The findings of this paper show that co-working space encourages collaboration between co-workers, which leads to the establishment of professional relationships. The findings also revealed how idea-sharing and productivity increased because of effective collaboration in co-working spaces. The built environment professionals working in co-working spaces are happy with the outcome of being in a co-working space because of the many benefits that come with it. This study is one of the few studies exploring co-working spaces in South Africa. It is a valuable study that will hopefully spike discussions and more research in this area, especially now when most companies are trying to cut costs on office space. Due to COVID-19, many employees are working from home and coming to the office a few days a week, and co-working space can be something that companies can explore.

Keywords

Co-working space, Collaboration, Knowledge sharing, Built environment professionals, Workspace design.

1 INTRODUCTION

Co-working space is a growing phenomenon that is growing in popularity. Modern shared workspaces, also known as co-working spaces, were designed to encourage collaboration and knowledge sharing among independent workers who are usually a part of the growing knowledge economy (Orel and Almeida, 2019). As such, co-working spaces are seen as centres of innovation, creativity and areas of concentrated human talent (Kubátová, 2016). Co-working spaces are not only growing in popularity among digital and independent workers; others are interested in this kind of office design too. These include managers of companies looking at spotting talent among the users of co-working spaces to enhance communication and quicken the process of transferring knowledge and improve the level of interaction to ignite the process of innovation between co-workers. Collaboration in co-working spaces gives digital workers access to human and social capital and the available knowledge bases (Orel and Almeida, 2019). It also allows co-workers to establish networks with each other and transfer knowledge and experience (Yang, Bisson, and Sanborn, 2019). This transfer of knowledge and experience between co-workers may generate new sources of information and new financial sources. With co-working spaces growing in popularity among independent workers, more research is needed to assess if co-working spaces encourage collaboration and knowledge sharing amongst independent professionals. This research is necessary as encouraging collaboration and sharing knowledge and resources among independent users is one of the main goals of co-working spaces (Spinuzzi, 2012; Rus and Orel, 2015; Bianchi et al., 2018). The limited amount of research on the effectiveness of co-working spaces in encouraging collaboration among independent workers in South Africa has hindered co-working spaces from being explored as a viable alternative to traditional office spaces. After the introduction, the paper reviewed related literature. This was followed by methods used in the study. After this, the results were presented and discussed. The last section concludes the paper.

2 LITERATURE REVIEW

Co-working spaces of different kinds have been established as economic and social mediators in urban economic growth (Fiorentino, 2019). Fiorentino (2019) identified three main kinds of co-working spaces. The first kind is a co-working space known to host social activities, and they have an educational role and may even have ties to local public authorities. The second kind of co-working space is for aspiring entrepreneurs as it provides economic and technical support to those starting businesses. This type of co-working space is like the business telecentres that Kojo and Nenonen (2019) mention, as they are geared toward generating economic and financial profit. The third kind of co-working space is a space that exists as a commercial product, such as a type of office space provided in an office block. These three typologies form the umbrella terms for the co-working space models that exist today. Apart from the three typologies given by Fiorentino (2019), there are other types of co-working spaces. Each type has different uses, determining the nature and level of collaboration in those co-working space types. These are the revenue (Ivaldi, 2019; Kojo and Nenonen, 2019; Yang, Bisson, and Sanborn, 2019), synergistic (Fiorentino, 2019; Ivaldi, 2019; Sanborn, 2015; Yang, Bisson and Sanborn, 2019), customer contact (Fiorentino, 2019; Ivaldi, 2019; Yang, Bisson, and Sanborn, 2019), Fab Lab (Capdevila, 2019; Scailerez and Tremblay, 2017; Scattoni et al., 2019), Living Lab (Capdevila, 2019; Scailerez and Tremblay, 2017), social innovation (Capdevila, 2019; Fiorentino, 2019), telecenters (Kojo and Nenonen, 2019) and hackerspace co-working space models (Capdevila, 2019). Of the different co-working space models listed above, the model that offers maximum collaboration, which, in turn, maximises productivity and innovation, is the synergistic and Fab Labs co-working space model. These models not only add value for the owners of the co-working spaces, but they also create the most

appropriate environment for effective collaboration (Scaillerez and Tremblay, 2017). The synergistic co-working space model is limited to certain types of users with similar or specific disciplines depending on which types of services are offered in that type of co-working space (Yang, Bisson, and Sanborn, 2019). Fab Lab co-working space offers services to a specific field of research which encourages collaboration and networking among the users (Capdevila, 2019). They encourage effective collaboration because they succeed in creating spaces aligned to the goals of the users of the space (Kojo and Nenonen, 2019). These two co-working spaces also offer the necessary resources and amenities for the users. These resources can be maintained more quickly because of the restrictions concerning the type of independent users permitted to use the space (Scaillerez and Tremblay, 2017). The restriction to these two types of co-working space models will also increase user satisfaction which can enhance the efficiency of the co-workers and may positively affect the level of effective collaboration. When it comes to collaboration, one needs to note that it can be interpreted differently depending on the types of users or organisations. Castilho and Quandt (2017) listed different collaboration approaches in co-working spaces. Some of the collaboration approaches are cost-based collaboration, resource-based collaboration, and relational collaboration. The cost-based collaboration approach aims to reduce operational costs or transaction costs incurred in office spaces. Changes in a knowledge-based economy drive a Resource-based collaboration approach, and it aims to amalgamate resources from coworking users to develop new projects and services. The focus is mainly on the integration and coordination of resources among co-workers. The relational collaboration approach is about building community and exploring collaboration instead of focusing on gaining knowledge or untapped resources. The critical elements of this approach are specialisation, transmitting a vision and strengthening the community (Ivaldi, Galuppo, Calvanese and Scaratti, 2020). The relational collaboration approach is one of the best approaches because it builds community and explores collaboration instead of minimising operational costs or gaining knowledge. In addition, it offers specialisation and encourages high collaboration in co-working spaces, which is the most common reason people join co-working spaces (Ivaldi, Galuppo, Calvanese and Scaratti, 2020). Research conducted in different countries indicated many changes that have taken place wherein many countries witnessed a drop in number of coworkers because of COVID-19 lockdown restrictions (Akhavan, 2022). The impact that the COVID-19 pandemic had on office occupancy is being felt worldwide due to the shift in work modality. Employees no longer work in the office five days a week. Therefore, it does not make sense to maintain individual offices' traditional, pre-pandemic layout. When employees go hybrid, spaces become vacant multiple days in the week. So, to avoid having drastically underutilised office space, companies should rethink their workspace and enter co-working space (Wonnink, 2022).

3 METHODOLOGY

The target population in this study is employees within the built environment profession, such as architects, property developers, construction professionals and town planners. These professionals work in a co-working space in Johannesburg, South Africa. Johannesburg is one of the major cities located in the smallest Province out of the nine provinces in South Africa. However, it is the most significant contributor to the national economic product. Semi-structured interviews were conducted to elicit information on collaboration and knowledge sharing. Interviews were conducted during COVID-19 and conducted online because of lockdown regulations. However, during the time of interviews, some employees were back in offices. The participants use co-working space a few days a week while they work from home or other places for the other days. Purposive sampling technique was used to identify and select

six built environment professionals. Thematic analysis was used to identify common themes from the interviews.

4 RESULTS

4.1 Participants' knowledge of co-working space

Participants of the study have a different understanding of co-working space. Below is a list of what was gained from participants: P1 understood co-working space as an open-plan type of office space that fast-growing companies mainly use at a low cost. For P2, co-working spaces are beneficial among start-up ventures, and affordable office spaces are available for sharing with other workers. P3 believed that co-working spaces are only for businesses looking to cut costs by entering into shorter-term leases and sharing facilities. P4 stipulated that a co-working space is a working ecosystem that promotes shared resources, flexibility and a community-like work environment. P5 and P6 thought that co-working spaces present the best possible working environments where professionals from different organisations work in one place. Altogether, co-working spaces are seen by participants as affordable office spaces available to businesses for sharing resources. Consequently, many positives come with the utilisation of co-working spaces. Only one participant, that is, P3 did not utilise a co-working space because it would cost the company much money to convert the traditional office space into a co-working space, especially with the considerable number of tenants already occupying the building. All the other five participants embrace co-working. P1 specified that it makes financial sense to use co-working space, which has short-term leases: "The use of co-working space may not work for larger corporations who are more established. Large corporations may use co-working space for smaller projects with a finite life span and use conventional office space for most of their operations". P2 said that: "the company that I work for has embarked on co-working schemes with business partners in Botswana. We have been co-working for projects and have experienced co-working space for a long time". P4, P5 and P6 agreed that sharing office space has afforded them space to grow professionally and more time for engagement with other co-workers. All these activities have benefited their businesses in several ways. The following information was given about how often the participants use co-working spaces. As a broker, P1 utilises co-working space monthly when operating with clients. P2 utilises a co-working space weekly. While P4 goes to work three days per week, P5 and P6's office space utilisation depends on the workload and projects. It appears P3 prefers privacy in a smaller enclosed environment. Despite the company's operation from a traditional office space, the participant desires to experience the co-working space environment shortly. In addition, the participant felt that co-working space is innovative and effective in collaborative environments.

4.2 Collaboration amongst co-workers in co-working spaces

Several questions were asked in order to source information on collaboration. Often, participants find themselves collaborating with self-employed built environment consultants, self-employed professionals, small business owners, architects, quantity surveyors, project managers and real estate agents. Except for P3, who uses breakout rooms and boardrooms to collaborate with other co-workers, the rest of the participants revealed that they collaborate with co-workers every working day through constant interaction, knowledge sharing meetings, client referrals, industry workshops and group activities. Whereas P1 thought that collaboration between co-workers depends on the company culture, the consensus is that co-working spaces foster collaboration that builds strong professional communities and encourages synergies, adding more excellent value to everyone who utilises them. P1 thought that "good synergy between professionals can be established internationally through co-working space". P4 thought that "it is the intended purpose, and so far, I believe collaboration is being achieved to a very high standard compared to a normal office space setting". While P5 thought co-working

spaces enabled strong business relations, P6 said that co-working spaces build strong professional relationships through knowledge sharing. P1 further gave an impression that the leadership style provides co-workers with knowledge-sharing opportunities. Thus, idea-sharing is not necessarily dependent on the type of office space provided. P2's opinion was that co-working spaces could aid companies that need their workers to be near each other while working to collaborate more effectively. Sharing office space is considered an effective alternative to working from home. P4 acknowledged that "there is always a lot of industry information circulating, which enhances the opportunity and chances to get more clients through business referrals from people we share the co-working spaces with". In some cases, companies have also expanded their client base ever since they moved to co-working spaces (P5). In other cases, co-working spaces have allowed corporations to create relationships with other businesses (P6). Other benefits derived from collaboration with other professionals in a co-working space include business expansion (P4).

4.3 Influence of collaboration in co-working spaces

In terms of the influence of collaboration, participants were asked related questions, and the following information was revealed:

- It depends on the project and the company goals (P1),
- Utilises a goal-setting exercise to get the co-workers excited about the task. This requires that they decide what the most challenging task they want to achieve in a day and what is the most exciting thing to achieve in a day. This daily goal-setting increases productivity (P2),
- We draw inspiration from other co-workers; this keeps us on our toes, motivated and dedicated. We are always learning from and sharing ideas with other professionals with the same goals as ours (P4),
- The spaces host many people working on different projects, which gives us exposure (P5), and
- It broadens your perspective as you learn from other co-workers (P6).

In addition, co-working spaces appear to affect the level of interaction among co-workers positively (P4, P5). There is much positive interaction, mainly because "we are in the same field, so our work is closely related, which makes it easier to interact and reach out should one need any professional assistance" (P6). However, there are mixed results on whether co-working spaces increase productivity compared to traditional office spaces. On a positive note, P1 mentioned, "Co-working space offers improved space usage, adopts modern facilities and is more efficient, unlike boardrooms which are not used regularly and are monopolised". P3 added that "Maybe harder to foster an idea-sharing environment in conventional office space than in co-working space. Tedious to walk to another office cubicle to talk with co-workers whereas, in a co-working space, people are closer to each other because they share a space". P4 and P5 agreed that being in the same space with people from different organisations with different work ethics and approaches to delivering projects encourages them to become a lot more productive than they would have been in a typical traditional office. P6 admitted that a lot has since improved. On the negative side, P1 believed that everything depends on the type of generation of people sharing co-working space. As an older generation (50+ years), P1 does not enjoy using co-working space and does not perform better in a co-working environment compared to traditional office space. It appears co-working spaces are ideal for younger generations because they are more social and interactive. Thus, they perform better in co-working spaces than in conventional office spaces. It also depends on the personalities of the employees. So, those who prefer privacy to do their work may not perform well in a co-working space. P3 thought that adaptation to a co-working space might improve individual performance because it is possible to collaborate efficiently. However, the participant cautioned that co-

working space does not always work if business deals are kept secret or if company information is supposed to be kept confidential. So, if a deal or project is not too important, then a co-working space could benefit collaboration. In well-established companies that have mastered their relationships with other companies, P3 understood that there is no need to adapt to co-working spaces for collaboration purposes.

4.4 Preference for co-working space over traditional office space

Participants appeared to have favoured co-working spaces over traditional office spaces. P4 exclusively thought that open space “has definitely been a great experience and has improved my professionalism tremendously”. Nevertheless, P1 stated that big corporations that have considerable investments in office space would continue utilising that space. However, they could be re-imagining their working space due to the emergence of the COVID-19 pandemic which has affected the way we use offices (Akhavan, 2022; Wonnink, 2022). P3 argued that co-working space makes sense for small businesses with fewer workers because the company's number of employees is essential in deciding to have a traditional office space or co-working space. The level of interaction in a co-working space also brings more open and creative spaces that foster more significant interaction between co-workers (P2). P3 said in co-working spaces, “we are a pool of different individuals from different organisations, so our skill sets are different, the projects we are working on are different, the clients we have are also different, which makes it a lot easier to collaborate and share all these aspects”. P5: “the eagerness to understand/gain knowledge in what other industry professionals are working on has improved collaboration in co-working space”.

4.5 Challenges that hinder the ability to collaborate in a co-working environment with co-workers

In general, not much hinders participants' ability to collaborate with their co-workers in a co-working environment. P4 “Well, there are not many obstacles hindering collaboration” P5 “I cannot think of any at the moment” P6 “There have not been any inconveniences so far”. Some challenges raised include clashes between co-workers due to different cultural backgrounds and personalities, ill-mannered behaviour, struggling to establish boundaries among co-workers (P1; P2; P3), and clients struggling with rental payments for using that space's facilities (P1).

5 DISCUSSION

The study results indicate that participants are well aware of co-working spaces. Although one participant did not use a co-working space, the participant knew of a co-working space. However, their employer only uses traditional office space units, breakout rooms and boardrooms since the employer is a big corporate company. The participant reasons that co-working space is most suitable for small and fast-growing companies. However, in their company, the kind of co-working space provided is the boardroom and break out rooms are the spaces for collaboration. There are many reasons these built environment professionals use co-working spaces. The reason given is similar to the findings from other studies that co-working space is an affordable office space for a start-up business, it enables them to cut rental cost, it allows them to share resources, knowledge sharing happens within this space, foster engagement and give room for co-workers to grow professionally (Babatunde and Khalighi, 2018; Bueno, Rodriguez-Baltanás and Gallego, 2018; Castilho & Quandt, 2017; Kojo and Nenonen, 2017; Orel and Almeida, 2019; Yang, Bisson, and Sanborn, 2019). This indicates that the findings amongst built environment professionals in Johannesburg are similar to the findings from previous studies as indicated by different scholars above. Participants of this study wanted their businesses to grow, and they saw co-working space as a suitable working space to facilitate their growth. The level of collaboration within the co-working space is

phenomenal, and it is one of the main reasons for creating or working in a co-working space (Orel and Almeida, 2019). Participants reported constant interaction that increases knowledge sharing, and it is from this interaction that they can do client referrals amongst each other, thereby expanding each other's business. As part of collaboration practices within this co-working space, they formulate and encourage synergies. Most of the participants have said that their performance in co-working space has improved compared to standard office space. The reasons given were that the motivation to work is higher in a co-working space. At the same time, another participant said that they have more excellent proximity to the co-workers that they need to partner within a co-working space. Co-working space is an area of concentrated human talent (Kubátová, 2016), and it is no surprise that co-workers are motivated and are in an environment that facilitates partnership formation. When participants are reporting on motivation, it might be due to the increased level of interaction that ignites the process of innovation (Laing and Bacevice, 2013; Hills and Levy, 2014), making co-workers more competitive. However, just like office space, there are challenges with using co-working space and have to do with different individual preferences.

6 CONCLUSION

This study was conducted to explore whether collaboration occurs in co-working spaces in South Africa among built environment professionals. Based on the literature review, there is limited knowledge about collaboration within co-working spaces in South Africa. The literature in this study explores the different types of co-working space working models and the different approaches to collaboration within the different co-working spaces. The literature also sheds light on co-working space models that primarily encourage collaboration, namely synergistic and Fab lab co-working space models, and which collaboration approaches the best suit these models. The findings of this study are that co-working space encourages collaboration between co-workers, which leads to the establishment of professional relationships. These findings also revealed how idea-sharing increased because of effective collaboration in co-working spaces. Although the literature review focused on professionals within the creative industry, their findings were somewhat similar to built environment professionals in South Africa. However, more studies are necessary to understand the co-working space for the different industries in South Africa. In addition, data on the number of co-working spaces is scattered and research that can synthesise this information will be helpful. COVID-19 has affected the office space and research on this area is important in a developing country like South Africa. Moreover, researchers should explore co-working and co-living hybrid spaces in South Africa for further study.

REFERENCES

- Akhavan, M., Holzel, M., Leducq, D. (2022), "The geography of new working spaces and impact on the periphery CA18214, Working paper, April 2022.
- Babatunde, A., Khalighi, P. (2018), "Bumblebees, Fireflies & Ants at Coworking Spaces: Inter-organizational Collaboration Patterns within Coworking Space", Masters Thesis, Malmo University.
- Bianchi, F., Casnici, N., Squazzoni, F. (2018), "Solidarity as a byproduct of professional collaboration: social support and trust in a coworking space", *Social Networks*, Vol. 54, pp. 61-72.
- Bueno, S., Rodriguez-Baltanas, G., Gallego, M.D. (2018), "Coworking spaces: a new way of achieving productivity", *Journal of Facilities Management*, Vol. 16 No. 4, pp. 452-466.
- Capdevila, I. (2019), "Joining a Collaborative Space: Is It Really a Better Place to Work?", *Journal of Business Strategy*, Vol. 40, No. 2, pp.14-21.

- Castilho, M.F., Quandt, C.O. (2017), "Collaboration Capability in Coworking Space Convenience Sharing or Community Building", *Technology Innovation Management Review*, Vol. 7, No. 12, pp. 32 - 43.
- Fiorentino, S. (2019), "Different typologies of 'co-working spaces' and the contemporary dynamics of local economic development in Rome", *European Planning Studies*, Vol. 27, No. 9, pp. 1768-1790.
- Ivaldi, S., Galuppo, L., Calvanese, E., Scaratti, G. (2020), "Coworking space as a practised place between welfare working and managerial challenges", *Journal of Workplace Learning*, Vol. 33, No. 1, pp. 26-44.
- Ivaldi, S., Scaratti, G. (2019), "Coworking hybrid activities between plural objects and sharing thickness", *TPM: Testing, Psychometrics, Methodology in Applied Psychology*, Vol. 26 No. 1, pp. 121-147.
- Kojo, I., Nenonen, S. (2017), "Evolution of Co-working Places: Drivers and Possibilities", *Intelligent Buildings International*, 9, 3, 164 – 175.
- Kubátová, J. (2016), "Work-related attitudes of Czech generation Z: International comparison", *Central European Business Review*, Vol. 5, No. 4, pp. 61-70.
- Orel, M., Almeida, M.D.M.A (2019), "The Ambience of Collaboration in Coworking Environments", *Journal of Corporate Real Estate*, Vol. 21, No. 4, pp. 273-289.
- Rus, A., Orel, M. (2015), "Coworking: a community of work", *Teorija in Praksa*, Vol. 52 No. 6, pp. 1017-1038.
- Scaillez, A., Tremblay, D.G., 2017. Coworking, fab labs et living labs. État des connaissances sur les tiers lieux. *Territoire en mouvement Revue de géographie et aménagement. Territory in movement Journal of geography and planning*, (34).
- Scaillez, A., Tremblay, D. G. (2017), "Coworking, Fab Labs and Living Labs: State of Knowledge on Third Places", *Territory in movement Journal of geography and planning*, Vol. 34.
- Scattoni, P., Lombardi, M., Pini, M., Turi, R. (2019), "Innovative startup localization determinants and origin: A Rome city case study", *Italian Journal of Planning Practice*, Vol. 9, No. 1, pp.24-48.
- Spinuzzi, C. (2012), "Working alone together: coworking as emergent collaborative activity", *Journal of Business and Technical Communication*, Vol. 26 No. 4, pp. 399-441.
- Yang, E., Bisson, C., Sanborn, B. E. (2017), "Coworking space as the third-fourth place: changing models of a hybrid space in corporate real estate", *Journal of Corporate real estate*, Vol. 21, No. 4, pp. 324-345.

Impact of coworking spaces on the local urban milieu. Case study of Poland

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ABSTRACT

Coworking spaces are often defined as local anchors for global knowledge communities and places which link and enhance a local buzz through global pipelines. They enable the integration of local societies and users into innovation processes, however, their impact on the intra-urban environment as well as the urban effects they induce have not been fully investigated. The paper aims to determine the impact of coworking spaces on the spatial, socioeconomic environment and identify the effect of coworking spaces on the creation of inner communities. This study uses an up-to-date database of coworking spaces in Poland and an extensive questionnaire. The analysis is based on results of Computer Assisted Telephone Interviewing (CATI) of representatives (mainly owners and managers) of coworking spaces in Poland. Such a study involving this group allowed for a correlation analysis and an estimation of the scale and scope of the impact of coworking spaces on the local urban milieu. Furthermore, the research is enhanced by an analysis of the in-depth interviews with representatives of coworking spaces in Warsaw, allowing also for the comparison of the social activity of the coworking spaces before and during the COVID-19 pandemic. Results of the study reveal a presence of urban transformation in the proximity of coworking spaces. Processes affected by the prevalence of the analysed spaces include the improvement of the surrounding public space, which can be described as micro-scale physical transitions. The research results reveal a limited level of collaboration between coworking spaces and the local communities that resulted in joint cultural events. Entrepreneurial collaboration (e.g. joint projects and ventures) among space users has also been identified; however, the contribution of coworking spaces to the creation of inner communities is insignificant.

Keywords

Coworking spaces, Collaborative spaces, Urban transformation.

1 INTRODUCTION

The phenomenon of coworking spaces (hereinafter CSs) has been observed globally since the first space was created in 2005, in San Francisco. A dynamic growth not only in the number of CSs but also in the number of users of such spaces has been observed since then (from 2015 to 2019 about 400% user growth has been reported) (2019 Coworking Forecast, 2019). These innovative workspaces received such widespread attention due to global phenomena, which include the process of globalisation and the Information and Communication Technology (ICT) that have contributed to changing user working patterns. Development of the Internet and online platforms has enabled people to achieve greater freedom in selecting the place and time of work, primarily due to less dependence on distance, time and space (Mariotti et al., 2017). Besides these factors, the emergence of the “sharing economy” has significantly contributed to the popularisation of CSs due to its major impact on transforming the labour market. Moreover, collective spaces, which can be used by an array of employees through sharing spaces, being an alternative to traditional organisational workplaces has resulted in a greater interest in coworking spaces (Parrino, 2015).

Definition of coworking spaces indicates that they provide a place for collaboration and connection between users who often work in different industries, mainly related to the field of knowledge, thus providing them with opportunities for social relations across their own professional networks (Gandini, 2015). CSs are regarded as “serendipity accelerators”, designed to host creative people and entrepreneurs, which, due to the capability of numerous individuals to work in the same location, allow for a reduced feeling of isolation while supporting the development of collaboration amongst users (Moriset, 2014). In addition, CSs enable increased business opportunities and knowledge sharing (Spinuzzi, 2012), as well as enhanced interactions and community building (Kojo, Nenonen, 2016). Coworking spaces located in Poland are dominated by corporate-type CSs – large, professionally managed, for-profit affiliated regional networks (e.g. WeWork, Regus) (Smętkowski et al. 2019). They differ from traditional coworking spaces, characterised by the idea of a community with an informal atmosphere, in the type of users and the location of CSs. Traditional CSs users consist mainly of people living close to each other and close to the coworking space, who value collaboration opportunities. Corporate coworking spaces function differently, offering services often based on professional profiles or economic models of companies, attracting e.g. employees of foreign branches of companies. They are situated in office districts and business districts and develop the most dynamically. Traditional spaces (also called classical spaces) are more dispersed in the city area with a focus on central districts, often also created in old buildings or areas with a unique aesthetic, with a homely atmosphere that contrasts with the office environment. This paper concentrates on coworking spaces functioning in Poland and how they influence the local spatial and economic environment. A growing number of CS is being noticed in various metropolitan areas in Poland, while the first CSs were founded in Warsaw in 2008, whereas the most significant expansion of these spaces occurred during the beginning of the second decade of the 21st century (Smętkowski et al., 2019). Moreover, due to the existing differences in the location of CSs in Poland, the article also discusses the impact of coworking spaces on the social environment along with their ability to create connections within the space. An analysis of the types of impacts was conducted based on the differences that were noted by respondents in their space and environment during and before the COVID-19 pandemic.

2 LITERATURE REVIEW

Coworking spaces came to be conceptualized as a spatial phenomenon but more importantly as a site of social relationships (Waters-Lynch, et al., 2016). Literature has referred to CSs as “third places”, allowing for a wider and more creative interaction between communities (Mariotti et al., 2021), understood as places where knowledge transfer and informal exchange takes place, along with various forms of a horizontal interaction between members and users of the space (Mariotti, 2017). Cooperative learning opportunities positively enhance the dissemination and sharing of information, which CSs owe largely to face-to-face interactions (Lorenzen, Foss, 2002). Research relating to the transformations which CSs can bring in relation to their local environment notes the impact of CSs on some urban effects, such as improving the surrounding public space, which can be established as a “micro-scale physical transformation” (Mariotti et al., 2017). Other impacts of CSs related to the broader revitalization of the urban area, in economic and spatial terms, including micro-scale physical transformations, have also been noted (Akhavan, 2018). Regarding the spatial impact of CSs, a contribution is noticeable that these spaces make to the transformation of public space, which is linked to the creation of new equipment for leisure and entertainment, new urban equipment, and new cultural installations (Mariotti, et al., 2017). Moreover, literature notes the impact of CSs on the economic sector and the creation of innovative services in their neighbourhoods, which can be understood as the economic regeneration of surroundings (Akhavan, 2018). Due

to the ability of CS to impact its environments, the author seeks to answer the question **whether coworking spaces located in Poland affect their spatial and economic environment (RQ1)**. These new forms of spaces, designed for multiple participants with various domains and focuses, are raising the question of the influence of such spaces on the local community, in particular on the forms of integration between CSs and the inhabitants of their surroundings. Comprehensive research outlines the inclusion of CSs in fostering community ties at the district level (Mariotti, et al., 2017). Additionally, the occurrence of a cooperation between CSs users and community users may contribute to diffusion of contacts, increase in the number of meetings, and develop a sense of belonging to the community, which may allow for the emergence of new neighbourhood initiatives. At the same time, CS spaces provide opportunities to collaborate with residents and to demonstrate their collaboration with the inhabitants by organising accessible events and engaging in local initiatives, such as SoSts - “Social Street”, which are growing dynamically for example in Italy (Akhavan, 2018). However, the number of events and social initiatives has been substantially reduced during the COVID-19 pandemic (Micek et al., 2022). This article addresses the question **how Polish CSs affect the local social environment and the intensity of cooperation (RQ2)**.

Today’s transformation of the workplace in which CSs are idealised places more attention on the cooperative nature of co-working spaces, not only in the spatial and functional form but also in the social form (Kojo, Nenonen, 2016). Due to the possibility of “working alone, together” (Spinuzzi, 2012), co-workers can benefit from the advantages of communities e.g. through the cooperation with other participants often working in another industry, while being free from hierarchies that commonly predominate in established communities (Jones et al. 2009). Numerous authors have emphasised the community relevance of CSs, including Capdevila (2014), who noted the focus of CSs on “community and its knowledge sharing dynamics”, others have noted that the social aspect of CSs is demonstrated in the openness of members “to help each other within their expertise” (Holienska, Racek, 2015). Additionally, Kojo and Nenonen (2017) indicate the increasing importance of CSs and their acknowledgment as places that prioritise people over the space and place itself. Considering the above mentioned, in this article the **author questions whether in examined CSs located in Poland, internal communities are established among CS users (RQ3)**.

With the massive impact of the COVID-19 pandemic on the daily lives of co-workers, which involved either temporarily closing the space or closing it altogether, there have been changes that have affected the coworking community as a whole. Particularly, the changes have affected social ties, which may have been disrupted given the need to maintain social distance. In addition, it is important to note the reduction in demand for services offered by CSs, or the inhibition of the dynamics of space development (Manzini Ceinar, Mariotti, 2021). Reflecting on the changes affecting CSs, the author considers **how the Covid19 pandemic has impacted the spatial, economic and social milieu of Polish CSs (RQ4)**.

3 DATA AND METHODOLOGY

During the first stage of work on the publication, the database of coworking spaces in Poland was updated according to the analysis of the main websites (coworker.com, spacing.pl, sharespace.work) and web inventories of CSs. Subsequently, an interview questionnaire was constructed, based on literature, and addressed to managers, owners or representatives of coworking spaces. The questionnaire consisted of 20 questions divided into 4 categories, of which the first category referred to questions related to the impact of coworking spaces on the spatial and service environment. Further categories related to the effects of CSs on the socio-economic environment, and the impact of CSs on the creation of internal community along with the inclusion of general question categories about the users of the space. The research was

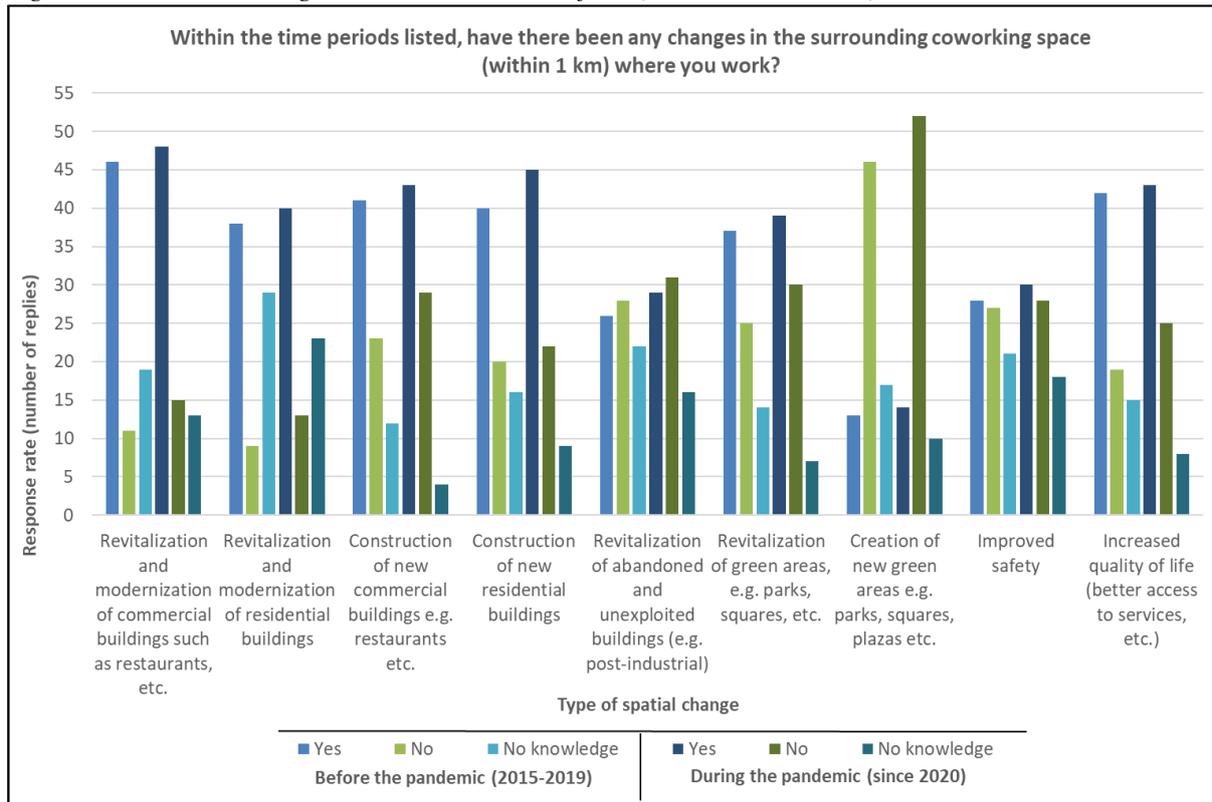
conducted with the use of a Computer Assisted Telephone Interviewing (CATI) technique and resulted in 76 responses. Additionally, the analysis was supplemented with in-depth interviews conducted in February-March 2021 with representatives of coworking spaces located in Warsaw, allowing for a comparison of data with respect to changes that occurred under the impact of the COVID-19 pandemic. Most respondents were representatives of coworking spaces situated in large metropolitan cities, such as Warsaw (39.5%), Krakow (17.1%) and Poznan (10.5%), whose CSs are located in major parts of the city. The vast majority of CSs studied were profit-oriented organisations (n=71) and of private type (n=68 responses). Answers provided by respondents relating to the location and space type, follow the general sample of all CSs located in Poland, which examples indicate a stronger tendency for CSs to locate in large metropolitan cities that represent private coworking spaces. Spaces were predominantly of a small size with the highest number in the 10-49 user range (42%). The vast majority of respondents indicated that the main type of users of their coworking space are entrepreneurs - a person who owns a business or is self-employed working as a mobile employee (e.g., a salesman, IT specialist) who uses the space for work and business meetings (n=75)

4 RESULTS

4.1 Impact of CSs on the spatial and economic environment

The answers of the survey respondents most often indicated changes to the CSs neighbourhood before the pandemic (2015 to 2019) associated with the revitalization and modernization of commercial buildings (e.g. restaurants) – up to 60.5% of positive responses (Figure 1). Significant changes noticed in the pre-pandemic period also highlighted: increased quality of life (better access to services etc.), construction of new commercial buildings e.g. restaurants etc. (53.9% of positive responses), construction of new residential buildings (52.6% of positive responses) and revitalization and modernization of residential buildings (50% of positive responses). In contrast, respondents in the vicinity of their CSs did not observe the creation of new green areas e.g. parks, squares, plazas, etc. (60.5% of negative responses), while indicating a revitalization of these areas (48.7% of positive responses). Comparing spatial changes between the pre-pandemic period (2015 to 2019) and the pandemic period (from 2020), the absence of initiatives involving creation of new green areas e.g. parks, squares, plazas, etc. was strongly emphasised (68.4% of negative responses). Moreover, the respondents' answers indicated an increase in activities in the area of CSs operation, including construction of new residential buildings (increase by 6.6 percentage points) and revitalization of abandoned and unexploited buildings (e.g. post-industrial) (increase by 4 percentage points).

Figure 1. Observed changes in the local milieu of CS (within 1 km radius)



Regarding changes in the public spaces, the majority of respondents did not notice an expansion of the parking area/an increase in the number of parking spaces in the vicinity of CSs whether before or during the pandemic (Table 1). Meanwhile, the significantly noticeable changes associated with the installation of new bicycle racks/bicycle shelters and the planting of trees and flowers were particularly highlighted and noted during both study periods. The low interest in putting up new art installations (40.8% of negative responses in the period before the pandemic and 47.4% of negative responses during the pandemic) along with putting up new trash cans or improving sidewalks, is also worth noting. Changes that were noticed by the respondents were mainly related to the development of relaxation, rest and transport zones (excluding car transport).

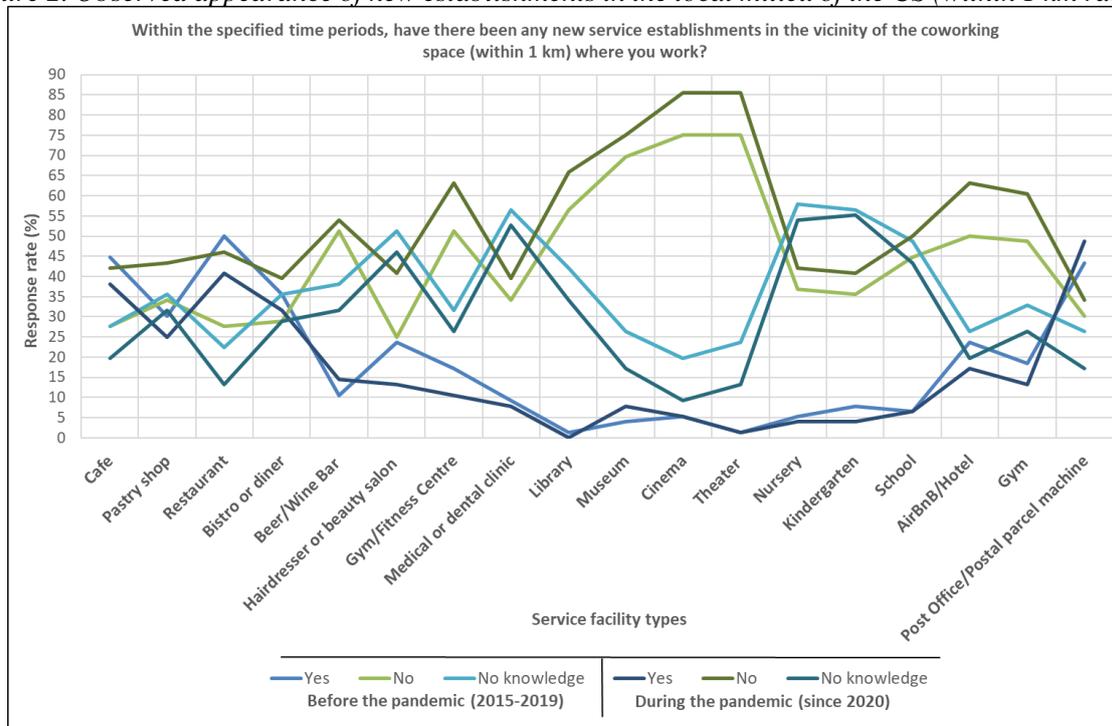
Table 1. Percentage distribution of respondents' answers to the question "Within the specified time periods, have you noticed any changes in the public space in the vicinity of the coworking space (within 1 km)"

Type of spatial transformation	Before the pandemic (2015 to 2019)			During the pandemic (from 2020)		
	Yes	No	No knowledge	Yes	No	No knowledge
Expansion of the parking area/ increase in the number of parking spaces	17.1	68.4	14.5	18.4	77.6	3.9
Installation of new bicycle racks/bicycle shelters	60.5	22.4	17.1	65.8	26.3	7.9
New places to sit, e.g. benches	40.8	31.6	27.6	43.4	38.2	18.4
New art installations	35.5	40.8	23.7	36.8	47.4	15.8

Putting up new trash cans	27.6	30.3	42.1	30.3	34.2	35.5
Creating new places for rest and relaxation	40.8	35.5	23.7	43.4	38.2	18.4
Improving the quality of sidewalks	44.7	34.2	21.1	50.0	40.8	9.2
Planting trees and flowers	64.5	21.1	14.5	69.7	25.0	5.3

Respondents' answers associated with the emergence of new service establishments in the CSs environment during both the pre-pandemic and pandemic periods indicate enterprises with a negligible appearance (Figure 2). Within the milieu of CSs, there were no reports of an appearance of libraries, museums, cinemas and theatres. Similarly, the creation of new gyms and fitness clubs with bars was not observed. However, there was an increase in the number of new restaurants, both before and during the pandemic, but their development was significantly reduced due to the outbreak of the COVID-19 pandemic. Additionally, there is a significant process of locating new postal outlets, including parcel machines, in the area where CSs occur, the development of which has been observed in Poland over the last years.

Figure 2. Observed appearance of new establishments in the local milieu of the CS (within 1 km radius)



4.2 Impact of CSs on the social environment and developing cooperation

Cooperation between coworking spaces and local institutions is scarce, CSs mainly establish cooperation with enterprises offering catering services. In addition, collaboration with educational, cultural and community institutions is negligible or almost non-existent (Table 2).

Table 2. Percentage distribution of respondents' answers to the question "Has the coworking space you work in cooperated with local institutions or companies during listed time periods? (within 1 km)"

Types of local institutions	Before the pandemic (2015 to 2019)			During the pandemic (from 2020)		
	Yes	No	No knowledge	Yes	No	No knowledge

Municipality/City Office	14.5	61.8	23.7	10.5	76.3	13.2
Educational institution such as a school	5.3	80.3	14.5	2.6	93.4	3.9
University/college/research centre	13.2	71.1	15.8	11.8	82.9	5.3
Cultural centre/Library	3.9	82.9	13.2	2.6	94.7	2.6
Foundation	30.3	55.3	14.5	30.3	65.8	3.9
Local Activity Centre	5.3	80.3	14.5	5.3	90.8	3.9
Catering company	53.9	30.3	15.8	46.1	48.7	5.3
Cleaning company	32.9	48.7	18.4	38.2	53.9	7.9
Accountancy and bookkeeping services company	25.0	59.2	15.8	27.6	67.1	5.3
Equipment service company	27.6	59.2	13.2	26.3	71.1	2.6
IT company	31.6	53.9	14.5	31.6	64.5	3.9

The low interest of CSs in event organisation, especially sports activities, is noticeable (up to 72.37% of respondents indicated that they did not organise such events before the pandemic) (Figure 3). Although only a small number of CSs chose to host training activities prior to the pandemic (31.6%), the overall trend shows that CSs are avoiding hosting events designed for community residents (Figure 4). An escalation of these trends occurred in 2020, when CSs involvement in creating activities for the local community declined even further, and in the case of sports, recreation and arts events, over 90% of spaces responded saying they have not hosted these events either. With the COVID-19 pandemic, the majority of CSs avoided holding events in the space due to general prohibitions on gatherings of people. Thus, this resulted in the necessity to transfer certain events to the online realm. Additionally, some CSs stopped holding events for non-members, despite the fact that prior to the pandemic they often held open meetings for outsiders. It should also be noted that some users had dropped out of CSs during the pandemic, causing CSs to experience large declines in total users during wave 1 of the pandemic in particular. However, there are cases of CSs that are eager to contribute to both the local society (cooperation with start-ups), for example by supporting charity events for children. Moreover, they have contributed to things like a collection of dog food, Noble Gift or a collection of kitchen equipment for the people. It should be emphasised here that all these actions were organised by co-workers, and not directly by the space.

Figure 3. Observed events hosted by CSs by event type – before the pandemic

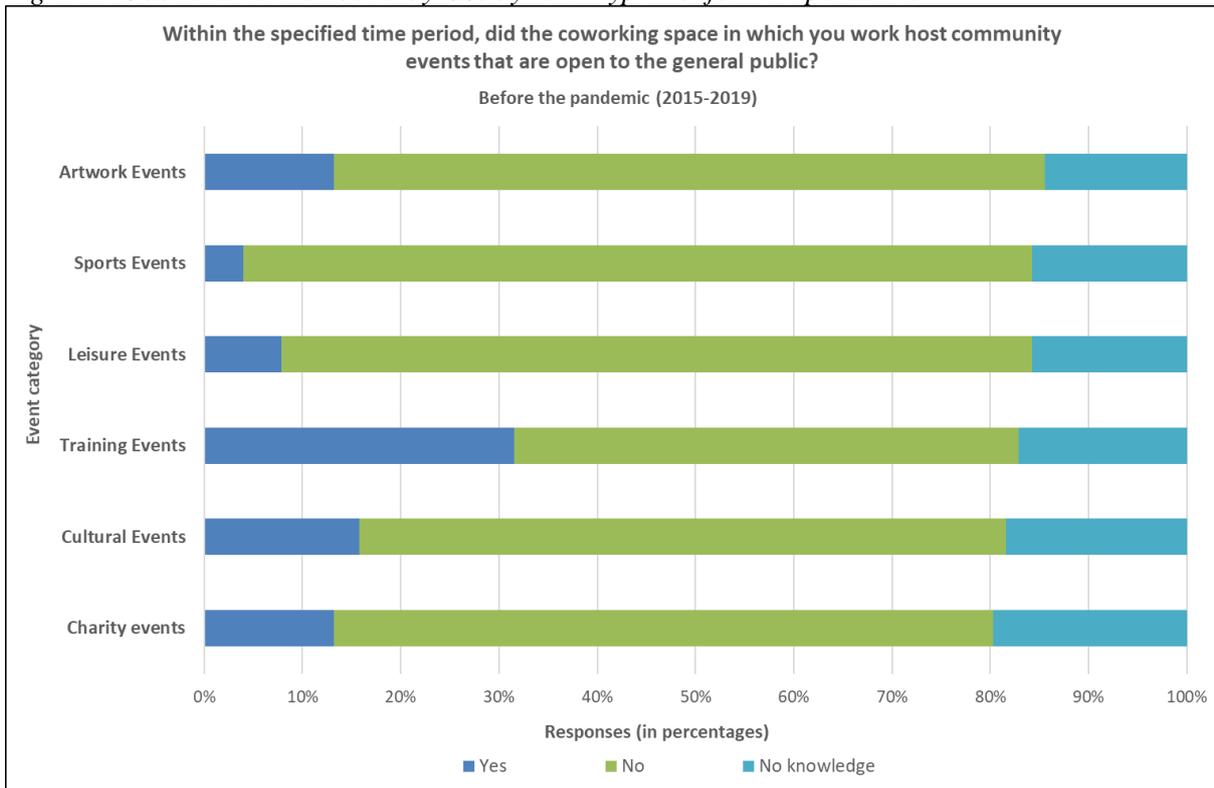
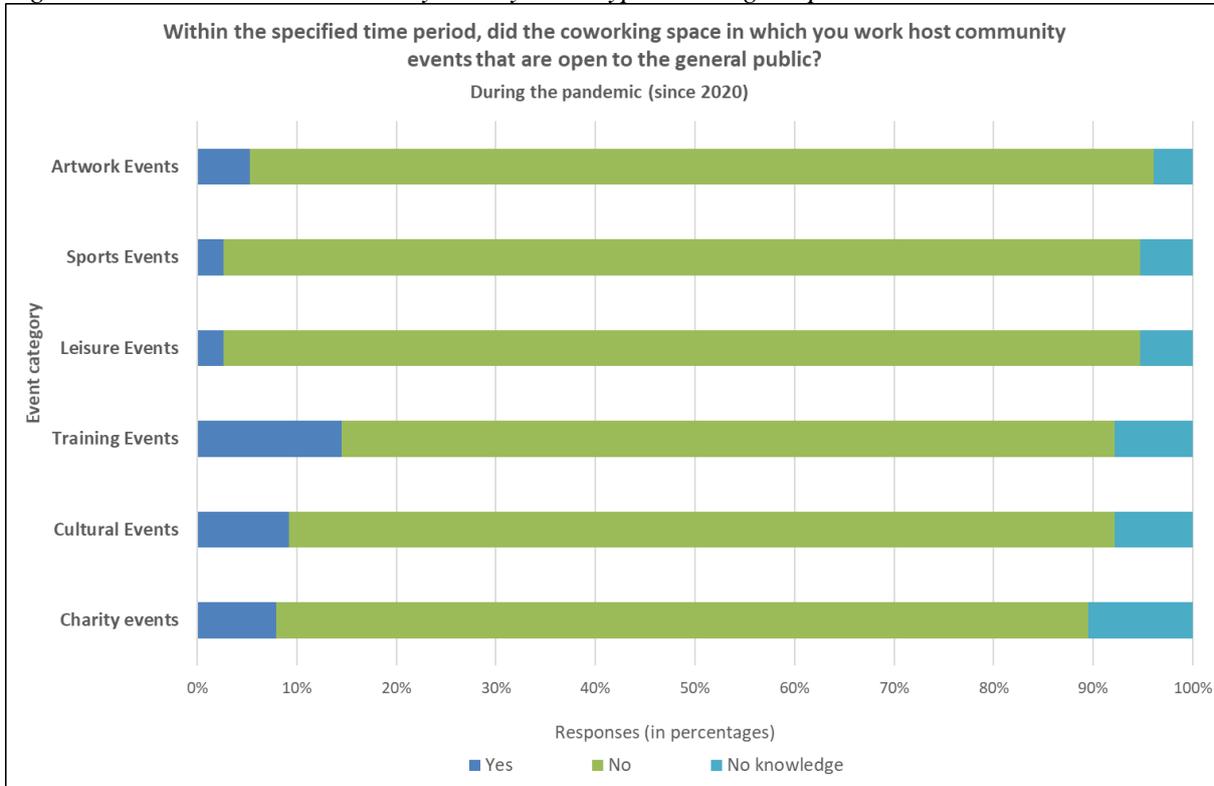


Figure 4. Observed events hosted by CSs by event type – during the pandemic

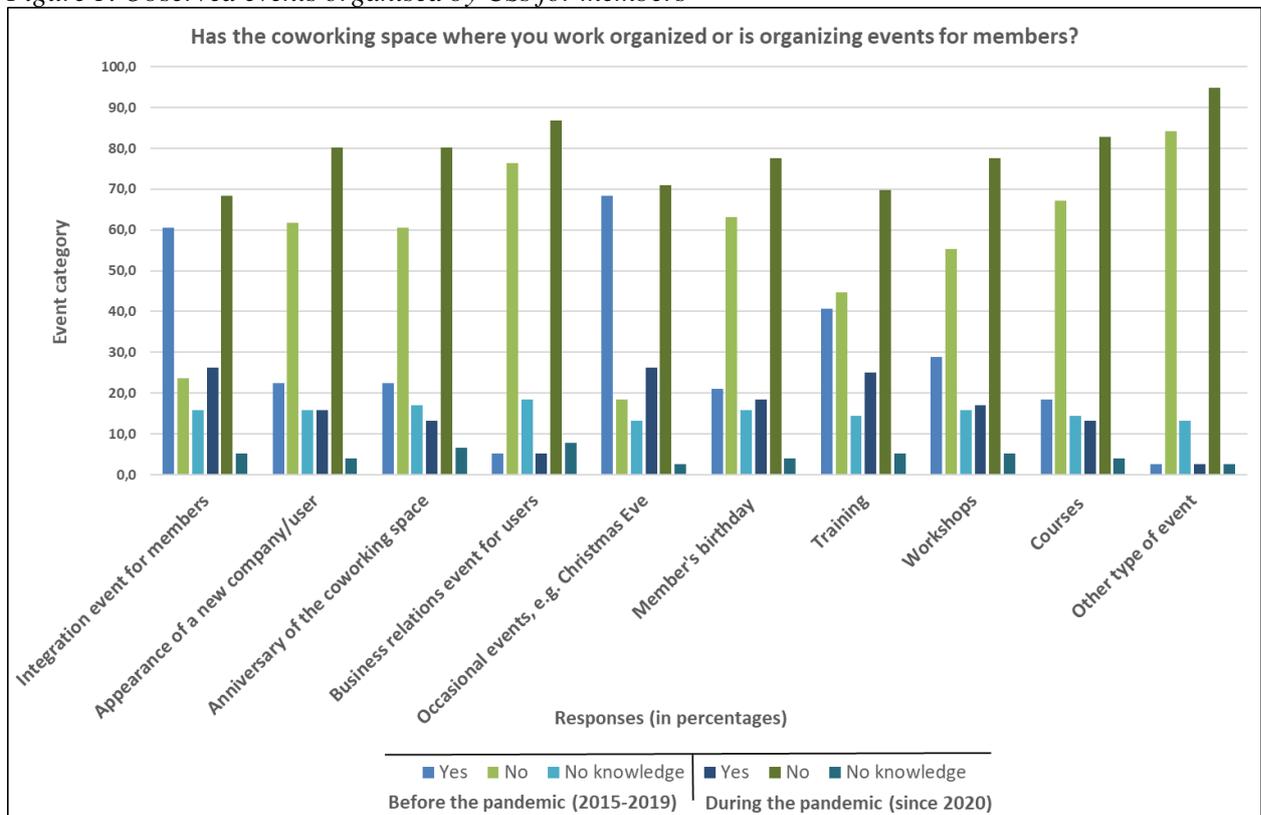


4.3 Impact of CSs on the creation of the inner community

CSs engaged extensively in organising events designed for their users. Previous to the pandemic period, 60.5% of respondents indicated that their spaces hosted team-building events

for members. In addition, 68.4% of CSs involve themselves in organising occasional events such as Christmas Eve, and 40.8% host training (Figure 5). Respondents indicated oftentimes prior to the pandemic period that they organised activities that occurred both during working hours and occasionally in the evenings. In addition, some CSs co-organized events with other organisations, which mainly involved drawing and painting workshops. However, according to several CSs, their participation in strengthening community ties was not significant due to the fact that their primary reason for organising events consisted in attracting new clients. Some CSs indicated that the good atmosphere among the staff is very important to the owners, in addition, the contacts between the members who also meet privately outside the space are visible. It is noticeable that the impact of COVID-19 pandemic has negatively affected the creation of the inner community, due to a definite decrease in organised activities. One interviewee indicated that prior to the outbreak of the COVID-19 pandemic, they often held events for all interested parties; however, during the pandemic, they held just small and short events for co-workers, only when restrictions allowed.

Figure 5. Observed events organised by CSs for members



5 CONCLUDING REMARKS

Conducted studies indicate that spatial transformations in the surroundings of CS are noticeable, but they refer mainly to the processes of revitalization of existing buildings or the emergence of new residential and service buildings (like restaurants), the development of which took place both before and during the pandemic (**RQ1**). These changes may be occurring due to the development of the locality, which is not necessarily related to the specificity of having a coworking space in the area. However, adjustments to the space around CSs according to the needs of the users are reported, e.g. through alterations and developments such as improvements and adjustments to a small architecture. Considering global trends, it is important to note the lack of solutions aimed at improving, revitalising or creating new green

spaces around the CS. The cooperation of CSs located in Poland with local institutions mainly focuses on partnering with service companies (**RQ2**). There is a lack of connections with local institutions allowing for co-operation between users of the space. Moreover, the activities of Polish CSs aimed at creating a community in space and activating the local community are also insignificant; however, some CSs indicated that they are involved in the life of the local community by supporting activities such as charity. This approach of closing themselves off from the surroundings by CSs may be due to the specificity of their location in business districts, which was also emphasised in interviews – some people suggested that they are not organisers of events due to the fact that people working in their district tend to stay there during working hours. As pointed out, coworking spaces in Poland mainly represent the corporate type, which may influence their limited involvement in organising events for co-workers (**RQ3**). However, it is necessary to emphasise the contribution of CSs in building internal communities by organising community integration events and occasional events. The period of 2019-2021 was extremely hard for the survival of CSs, the COVID-19 pandemic contributed to further withdrawal of CSs from these activities due to increasing restrictions (**RQ4**). Certain spaces were temporarily closed, potentially negatively impacting the connections between users and collaboration between members. Some of the responses showed that the cooperation between the owners of the space and its users is very positive, which is reflected in the great support that both sides showed during the pandemic. Often users, despite the lack of use of CSs, continued to pay for the rental costs, which helped in these difficult times to maintain the space. However, this period has shown that the strength of influence of Polish CSs on both spatial, economic and social spheres is limited, though further research remains necessary to better understand the occurring processes.

ACKNOWLEDGMENTS

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REFERENCES

- Akhavan, M., Mariotti, I., Astolfi, L., Canevari, A. (2018), *Coworking Spaces and New Social Relations: A Focus on the Social Streets in Italy*, Urban Science.
- Capdevila, I. (2014), Different inter-organizational collaboration approaches in coworking spaces in Barcelona. SSRN Electronic Journal, <http://doi.org/10.2139/ssrn.2502816>.
- DeskMag (2019), *The 2019 Global Coworking Survey*.
- Gandini, A. (2015), The rise of coworking spaces: a literature review. *Ephemera: Theory and Politics in Organisation*, 15 (1), ISSN 2052-1499.
- Holienka, M., Racek, F. (2015), *Coworking spaces in Slovakia*, Comenius Management Review.
- Jones, D., Sundsted, T., Bacigalupo, T. (2009), *I’m outta here! How coworking is making the office obsolete*. Austin: Not an MBA Press.
- Kojo, I., Nenonen, S. (2017), Evolution of co-working places: drivers and possibilities, *Intelligent Buildings International*, 9:3, 164-175, DOI: 10.1080/17508975.2014.987640.
- Kojo, I., Nenonen, S. (2016), Typologies for co-Working Spaces in Finland – What and How? *Facilities*, 302–313. doi:10.1108/09564230910978511.
- Lorenzen, M., Foss, N.J. (2002), Cognitive coordination, institutions, and clusters: an exploratory discussion. In *Cooperation, Networks and Institutions in Regional Innovation Systems*, Edward Elgar, Cheltenham, UK.

- Manzini Ceinar I., Mariotti I. (2021), The effects of COVID-19 on Coworkng Spaces: Patterns and Future Trends. In I. Mariotti, S. Di Vita and Akhavan M. (Eds.) *New Workplaces— Location Patterns, Urban Effects and Development. Trajectories A Worldwide Investigation*, pp pp 277-297 . DOI: 10.1007/978-3-030-63443-8.
- Mariotti, I., Akhavan, M., Rossi, F. (2021), The preferred location of coworking spaces in Italy: an empirical investigation in urban and peripheral areas. *European Planning Studies*, 1-23. DOI: 10.1080/09654313.2021.1895080.
- Mariotti, I., Pacchi, C., Di Vita S. (2017), Coworking Spaces in Milan: Location Patterns and Urban Effects. *Journal of Urban Technology*, 24(6), 1-20. DOI:10.1080/10630732.2017.1311556.
- Micek G., Bednar P., Rafaj O., Belvončikova E., Paas T., Alfieri L., Małochleb K, Matoškova J. (2022), Independently-run coworking spaces and effects of the COVID-19 pandemic. In I. Mariotti I., P. Bednar, M. Di Marino (Eds.) *The COVID-19 pandemic and the Future of Working Spaces*, London, Routledge-RSA Regions & Cities Book Series – Regions, Cities and COVID-19. (in press).
- Moriset B. (2014), Building new places of the creative economy. The rise of coworking spaces. W: 2nd Geography of Innovation International Conference.
- Parrino L. (2015), Coworking: assessing the role of proximity in knowledge exchange, *Knowledge Management Research & Practice*, 13:3, 261-271, DOI: 10.1057/kmrp.2013.47.
- Smętkowski M., Celińska-Janowicz D., Wojnar K. (2019), Nowe przestrzenie gospodarcze metropolii. Struktura, funkcje i powiązania obszarów biznesu w Warszawie. Wydawnictwo Naukowe SCHOLAR, Warszawa.
- Spinuzzi C. (2012), Working Alone, Together: Coworking as Emergent Collaborative Activity. *Journal of Business And Technical Communication*, 26(4), 399–441.
- Waters-Lynch J., Potts J., Butcher T., Dodson J., Hurley J. (2016), Coworking: A Transdisciplinary Overview (January 26, 2016). Available at SSRN: <https://ssrn.com/abstract=2712217> or <http://dx.doi.org/10.2139/ssrn.2712217>

SESSION 2C: CORPORATE REAL ESTATE

Addressing leadership challenges in times of digitalisation of the workspace - recommendations for industry and science

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ABSTRACT

This paper reflects on a roundtable consisting of 30 CEOs from various industries with a focus on the real estate sector, which was academically accompanied by professors from the fields of real estate, digitalisation, HR, and ethics. The impetus came from the practitioners asking for guidance on how organisations should adequately deal with the changes brought about by increasing digitalisation changing the work environments without letting the social aspects fall behind the functional and technical orientation of an organisation. The paper thus explores the question of what "human" digitalisation can look like. It focuses on the tasks and opportunities of leadership: How can leaders balance the opportunities and possibilities of digitalisation with the individual needs and social relationships of people in organisations in such a way that people feel good, stay healthy, are innovative and work productively? The motivation of the authors and two non-profit organisations in the working group "Digital Leadership" was to compile recommendations in the areas of leadership, digitalisation, corporate culture, and work environment that impact employee health, innovation, and performance to support anyone who leads people and organisations. Thus, this is a practice-oriented research paper that addresses a broad spectrum of leadership issues in the context of digitalisation through a combination of focus groups and a Delphi study. The paper highlights key aspects of successful transdisciplinary collaboration, and summarises the most important findings of the working group. In addition to the effective methodology used, the key finding is that a balance should be maintained between digital work on the one hand, and physical, functional and interpersonal requirements on the other. Well-considered leadership and a variety of organisation-specific measures are critical success-factors. Instead of "radical renewal", the digitalisation of workplaces requires a continuous improvement process in consultation with all stakeholders and with special consideration of environmental factors.

Keywords

Leadership, Digitalisation, Transformation, Culture, Health, Innovation, Recruiting, Onboarding.

1 INTRODUCTION

Economic activity is undergoing a comprehensive transformation (Fortmann and Kolocek, 2019). The COVID-19 pandemic has exacerbated a change that was already ongoing before:

digitalisation is penetrating business models and fundamentally changes the way we work. While technology is supposed to make our lives and work better, more efficient and more sustainable, digitalisation also has an ambivalent effect on the way people interact in companies (Creusen et al., 2017). In order to maximise their digital potential, companies need to shape it responsibly and sensitively. It is necessary to differentiate between the economic, social and cultural benefits and the potential dangers of digitalisation. Employees, as individuals with their own value, are at the centre of all entrepreneurial considerations - including those that go hand in hand with digitalisation. It is becoming increasingly important to act on the opportunities and possible risks of digitisation in the work context (Creusen et al., 2017). In this context, leadership (for a definition of leadership, see Tannenbaum et al., 1961) is also changing: on the one hand, it is increasingly shifting into the virtual space, and on the other hand, it requires enhanced skills and different leadership personalities than was the case just a few years ago. Leadership by position does not meet the needs of many, especially younger employees in the digital age, and previously existing hierarchies are being called into question (Wörwag and Cloots, 2020). Modern, value-oriented leadership sets positive expectations. It inspires, empowers and motivates ideally, intellectually and individually. Transformation and digital leadership competence thus complement traditional leadership competences and are an essential prerequisite for dealing with ambiguity and growing complexity in the interest of the organisation and the people (Kollmann, 2020; Kensbock, 2018). Many businesses regardless of their sector have a lot of catching up to do in this area, especially since management structures have grown over the years and not yet caught up with the digital era. It is important to take corrective action here (Wörwag and Cloots, 2020). The authors within the working group ('WG') consist of members of two non-profit organisations ('Associations'), herewith present practitioner-oriented recommendations for 'digital leadership' that maintain a balance between working digitally on the one hand and physical, functional and interpersonal requirements on the other hand. The recommendations emerged from focus group discussions of 30 top managers, predominantly from real estate, and four professors from the fields of real estate management, digitalisation, human resources, and ethics. Various aspects in the fields of culture, innovation, health and performance, and onboarding and recruiting are illustrated by best practice examples and thus enable individual approaches to be implemented immediately in daily management work. The focus of this paper lies in the systematic transdisciplinary development process, an overview of the broad field of organisational and leadership topics addressed by the WG, and essential insights to effective digital leadership. The detailed results were published in a freely available guide in June 2022 (Adam et al., 2022).

2 BACKGROUND, DRIVERS AND ELEMENTS OF DIGITAL LEADERSHIP

2.1 An Introduction to Digital Leadership

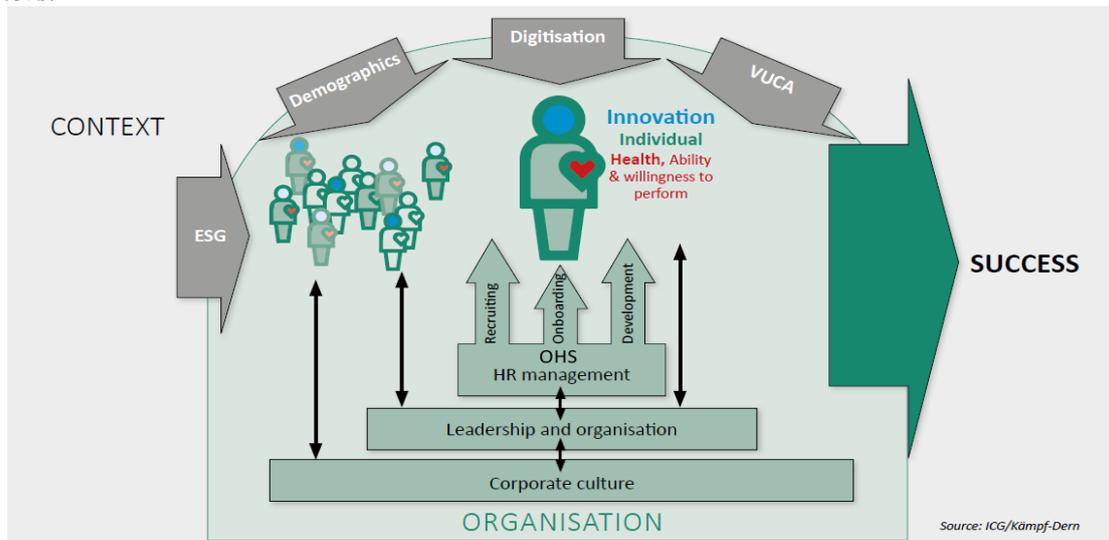
Many companies today are undergoing accelerated cultural, demographic and digital change, a transformation characterised by volatile, uncertain, complex and ambiguous (VUCA) environments (Jobst-Jürgens, 2020). These changes and their speed affect the corporate culture as well as the innovativeness, health, willingness and ability of employees to perform, and are thus linked to changing leadership and human resources management requirements. All of the aforementioned aspects have a significant influence on the success of the company (Creusen et al., 2017). 'Digital leadership' is a response to these changes and challenges (Kensbock, 2018). From a holistic perspective, digital leadership means results-oriented leadership in times of digital change and the transformation processes derived from it. It refers to leadership that is based on recognition and role models and not on position (Creusen et al., 2017). With a high level of social and emotional competence, it embraces change at an early stage, enables agile working, and offers - non-digital and digital - problem-solving concepts (Wagner, 2018).

Leadership is an interpersonal influence and involves taking responsibility for a company, the people in the company, and thus also for oneself (Tannenbaum et al., 1961). Particularly under the increasing influence of technology with its tendency to promote social distance, those involved must be protected from becoming anonymous objects instead of well-respected subjects. This responsibility can be translated into visions, goals and work assignments, taking into account corporate values, sustainability and communication processes. A sustainable (digital) leadership style is characterised by change management competences with in-depth social and emotional components, relationship building, communication, appreciation, and trust (See e.g. Hargreaves and Fink, 2012; Avery and Bergsteine, 2011). These qualities are not only needed for accompanying digital transformation and for far-reaching transformation into future-proof business models. Employees are encouraged within a framework of proactive and accompanying leadership with an appreciative feedback culture and supported in making a meaningful contribution in changed working environments. Goals are defined jointly in order to sensitise and motivate the people working to achieve them. The core elements of digital leadership are therefore organisational culture, innovation, the influence of leadership on health, performance and success, as well as recruiting and onboarding.

2.2 Drivers of Digital Leadership

Derived from the literature, the following drivers set the context of the above-mentioned core elements: VUCA, demographics, digitalisation, and ESG, which are presented in Figure 1 as a framework and very briefly described below.

Figure 1. Overview of the drivers, elements and outcome of Digital Leadership. Elaboration of the authors.



VUCA⁹: An essential driver for digital leadership is an environment that, due to the volatility, uncertainty, complexity and ambiguity of the systems in a globalised world, gives special importance to continuous improvement and realignment in the sense of innovation capability for the company (Millar et al., 2018). Digital leadership has the task of enabling and promoting these continuous improvement processes up to realignment, including the self-reflection necessary for this. This can be achieved, among other things, through the acceptance and constructive use of mistakes, i.e. the development of a credible mistake (tolerance) culture (Bennett and Lemoine, 2014).

⁹ volatility, uncertainty, complexity and ambiguity

Demographics: The opportunities for each company are increased by using the perspectives of different generations. It is useful to combine the experience of long-serving employees with the impressions and expectations of young professionals. Different attitudes of people towards themselves, their work, and their perspectives for their own and the company's future development have a supporting effect on the success of the company (Macky et al., 2008). Generations' expectations of their own "work-life balance" play an important role: In many cases, younger generations no longer strive for hierarchy and its traditional importance. Aspects such as the meaningfulness of one's own actions come to the fore and are paired with expectations of one's own success and that of the company. It is therefore necessary to combine the views of the generations in order to permanently improve the ability to innovate in the company.

Digitalisation is constantly influencing the whole value chain of traditional companies and thus driving transformation. Digital transformation will have the greatest success when it is thought out from the user's point of view. This means that users are the central stakeholders so that digitalisation can act as a means to an end (Schallmo et al., 2019; Schallmo et al., 2021). The action maxim includes a four-stage digitalisation agenda - consisting of analysis, prioritisation, implementation and anchoring - that builds on change processes that put people at the centre and inspire and involve them at each single stage and in every moment.

ESG does not only concern the hard criteria of the taxonomy by the EU (European Commission, 2020), but rather also the social and management elements (Gillan et al., 2021). This is a unique opportunity to position one's company not only from a regulatory perspective but also from a sustainability perspective in corporate management and strategy. A stakeholder orientation across all groups and age levels offers a unique opportunity for innovation with the aim of positioning the company as a sustainable, social and powerful leader. This also requires a holistic approach. A joint agreement on goals and the pooling of resources to develop the best possible implementation and monitoring tools are ways to achieve competitive advantages (Rabaya and Saleh, 2022).

2.3 Elements of Digital Leadership

Organisational Culture: companies define themselves not only as economic but also as social or socio-technical systems in which the individual areas are interdependent. For this reason, a professional corporate culture based on integrity, values and trust is just as important as technical expertise. The perception of societal and social responsibility is thus inseparably entailed in economic action (Bienert et al., 2015).

Innovativeness: developing or increasing the ability to innovate is an essential part of the (digital) leadership task and requires innovation management responsibilities or even innovation units within companies (Hauschildt et al., 2016). The basis for innovativeness is the culture of trust described above. It is also crucial to couple experience with new perspectives, not to be afraid of open exchange, and to establish a culture of open innovation. The latter will enable open knowledge sharing between internal and external stakeholders and can be applied along every stage of an innovation process (Burchardt and Maisch, 2019).

Health includes all physical and mental aspects in a holistic sense, i.e. also a willingness to perform and the ability to deliver (DFK Verband für Fach- und Führungskräfte, 2020). Digitalisation poses a significant threat to the health of employees, because the intensity of digital work has increased dramatically within a year, measured by the time spent in virtual meetings, the number of chat messages (even after hours), the number of emails, work on electronic documents, or unplanned and unstructured virtual communication (Microsoft, 2021). Even if one were to assume only a shift from analogue to virtual communication, the effort to send or receive messages with reduced body language signals leads to higher stress and exhaustion and a reduction in motivation and engagement (Microsoft, 2021). Emerging

negative health developments, such as a sustained loss of motivation, can be addressed through effective leadership in the sense of holistic occupational health and safety (OHS) management. This not only has a positive effect on the employees themselves, but also on the company and the company's success through the employees' higher motivation and performance (DFK Verband für Fach- und Führungskräfte, 2020).

Recruiting and Onboarding: today, managers face transposed framework conditions when selecting and recruiting new employees. The company is applying for potential employees and not the other way around. The decision-making parameters of candidates have changed, meaning that the range of influencing factors that are dealt with in the selection process is much wider than before and goes into more depth. Beyond job profiles, life plans and the desired freedom of choice are discussed and negotiated (Kitzinger, 1995). People cannot be won over or they leave organisations if their needs are not addressed (Armutat et al., 2018).

3 METHODOLOGY

The problem to be investigated by the WG – to address the leadership challenges in times of digitalisation of the workspace – is a complex social issue, as shown in the previous section. For this kind of problem, it is recommended to use a qualitative and explorative approach (Kitzinger, 1995). The Associations have had experience with such approaches and were thus able to use a proven methodology. It consists of a combination of Online Focus Groups (OFG) and the Delphi Method (DM). In the following, the methodology is briefly described with reference to the relevant scientific articles. The Online Focus Group (OFG) approach (Morgan, 1996) entails qualitative research in which several people express their views simultaneously on a topic that is often characterised by a variety of aspects (Kitzinger, 1995). Whereas the aim in market research focus groups (Bloor, 2002) is to obtain a congruent picture of the perceptions, attitudes, opinions, beliefs and views of a homogeneous target group (Odimegwu, 2000), in e.g. social sciences and in urban planning the aim of OFG is that the participants inspire each other (Lindlof and Taylor, Bryan, C., 2017) in such a way that the most comprehensive picture possible emerges (Marshall and Rossman, 2016). Either the focus group leaders or the group itself can then prioritise these diverse aspects and related findings can be formulated in concrete terms. When the same participants come together in several rounds, synchronously or asynchronously, to evaluate and further develop their insights based on summaries and additions made between the panel sessions, the focus group approach develops into a Delphi method approach (Rowe and Wright, 2001). *“Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel. It is believed that during this process, the range of the answers will decrease and the group will converge towards the “correct” answer. Finally, the process is stopped after a predefined stop criterion (e.g., number of rounds, achievement of consensus, stability of results), and the consensus of the final rounds determine the results”* (Lofaro, 2015). In the working group here, about 30 top managers (with varying participation), four professors with deep industry knowledge, and two Associations’ executives met online three times (60 minutes per meeting) to define the problem and approach. The one association’s managing director, a top industry executive, and a professor in human resources – also president of the other association – took notes at these meetings. Together, the three developed an introduction that clarified the jointly developed problem statement, and the next steps. This included dividing the entire group into four thematic groups (Culture, Innovation, Health & Performance, and Onboarding & Recruiting), each consisting of four to eight members, who met up to three times to deepen and structure their topics and add best practices and recommendations. Additionally, the groups were asked to provide graphical illustrations of their insights. The group results were then shared with the entire WG, whose members read and evaluated the texts individually. Members shared their

findings in two more plenary sessions, each again lasting an hour, with the initiators moderating and taking notes (Odimegwu, 2000). The next step was to combine the group results into a paper that was revised, according to the panel feedback and own expertise, by a six-member editorial team in two rounds. This included further developing the graphs in such a way that visualised the connections between the individual group parts. The editorial team, which took on the role of facilitators in the DM, consisted of the three initiators plus three group leaders, thus in total three industry managers and three professors. After each round of editing, the text went back to the entire membership of the project for review, with only minor changes made in each case through individual written feedback from the members. Finally, a proofreading and graphic editing took place to produce the freely available guide. The essential insights will be sketched in the following sections.

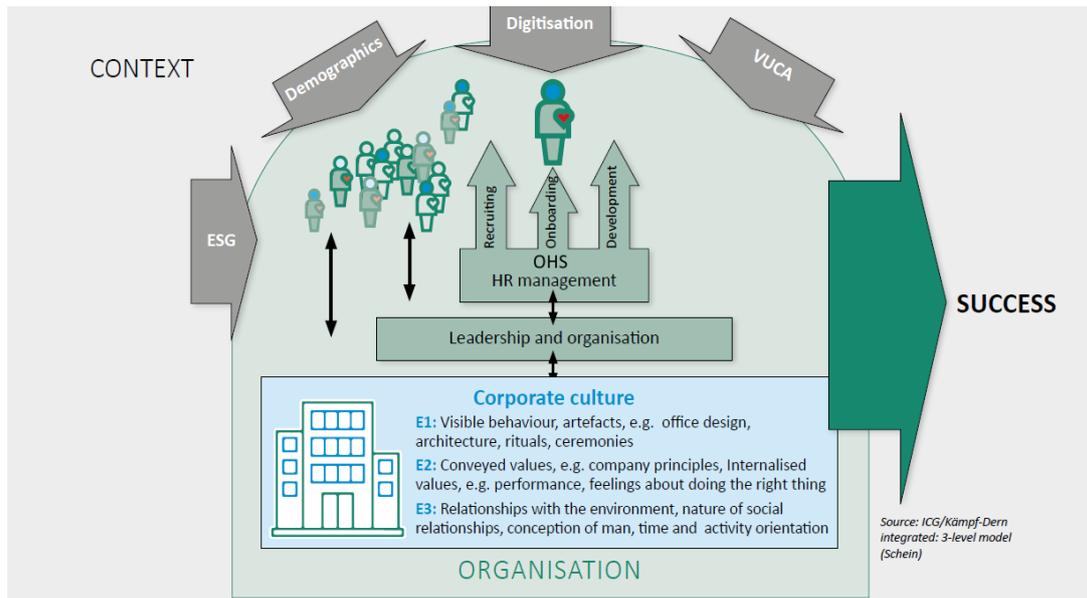
4 FINDINGS FROM ONLINE FOCUS GROUPS (OFG) AND DELPHI METHOD (DM): DIGITAL LEADERSHIP IN PRACTICE

The following subsections are the high-level results from the online focus groups and the application of the Delphi method of the WG.

4.1 Organisational Culture – Foundation of Digital Leadership

In times of accelerated digitalisation, advanced globalisation, and the associated transformation requirements for companies, the search is on for characteristics and drivers of sustainable corporate governance as well as effective approaches to support corresponding leadership and corporate culture development. To find solutions, it is necessary not to limit leadership to a one-dimensional element between a leader and the employees, but to recognise the organisational culture in its entirety as an essential component of a sustainable leadership style. Schein's three-level model (Schein, 1990) (included in Figure 2), consisting of "basic assumptions", "norms and standards" and "artefacts", can help to develop and classify starting points and measures for corporate culture development. In this respect, digital leadership is not only based on artefacts of digitalisation, but must - as in the past - also deal with changed or adaptable norms and standards as well as basic assumptions in order to develop a sustainable basis for leadership and corporate success. Organisational or corporate culture development is not only an explicit and central task to ensure the effectiveness of the organisation. Corporate culture - as shown in Figure 2 - also forms the basis for the other fields of action and leadership tasks: How to shape the future, involve stakeholders, deal with scarce resources, treat employees or fulfil the organisation's duty of care for the health and development of their employees. This all depends on the organisation's basic values and thus, according to Schein, on the corporate culture.

Figure 2. Organisational culture as foundation of Digital Leadership. Elaboration of the authors.



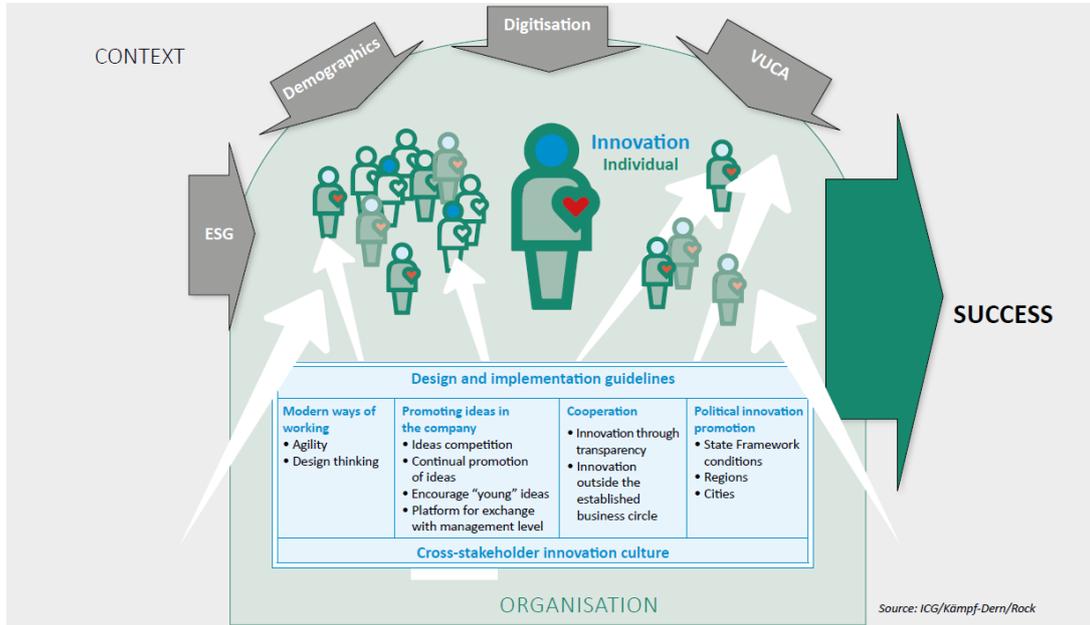
Accordingly, a culture of trust is fundamental for the cultural embedding of value-oriented leadership, also for the promotion of agility, flexibility, identity and self-leadership in companies, and thus essential for corporate success. The development of a culture of trust that is relevant to success can be supported through the appropriate design of operational practices and processes (Fortmann and Kolocek, 2019). Dialogue-based communication processes are particularly suitable for promoting changes in corporate culture at the level of perception. They help in recognising and subsequently changing the differences between the employees' own and others' perceptions. Finally, the workplace is a place that makes corporate values and visions tangible in space with workplace management offering artefacts such as branding and office design that give support and orientation to employees. It can also significantly support a corporate cultural transformation in the sense of “digital leadership” towards agility, flexibility and self-organisation. Flexible working models, a corresponding culture of trust and a high-quality working environment and equipment will therefore be (even) more important elements in the future to attract and retain committed and qualified employees.

4.2 Innovativeness – Core Competency for Change

Not only the digital transformation, but all the drivers mentioned in section 2, force companies to be agile and change in order to keep pace with changing requirements and framework conditions. This requires a culture of innovation within companies that encompasses all areas and works “across stakeholders”. The business model, the underlying processes and the leadership culture must therefore be subject to an ongoing review in order to identify the need for adaptation or even radical changes in good time. Based on this dynamic, short distances between knowledge carriers and close cooperation are required. New ways of working (e.g. agility and design thinking) are promoted by flexible space concepts and a high degree of supportive trust culture and open communication. Continuous improvement and innovation come from promoting ideas within the company and across hierarchies, thus questioning processes, workflows, services and products. Every company should therefore have tools to actively promote these questioning processes and take up the resulting ideas. Innovation is usually based on the ideas of individuals. In a globally networked world, however, cooperation, e.g. between market leaders and start-ups, accompanied by financial investors and established

companies, is also crucial. The state and politics have a responsibility to create the necessary breeding ground for these innovation processes.

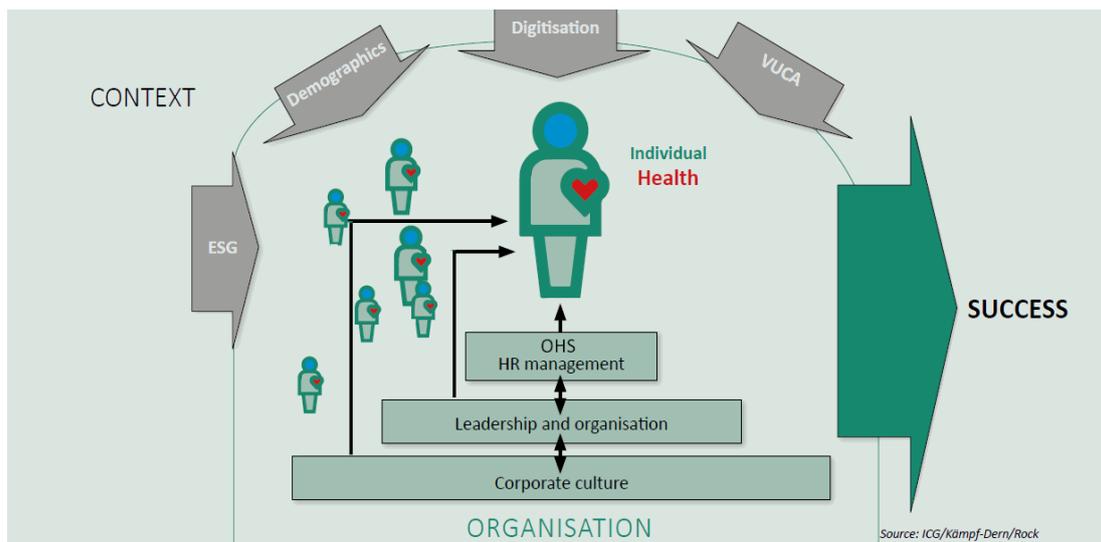
Figure 3. Context and guidelines for cross stakeholder innovativeness. Elaboration of the authors.



4.3 Health - prerequisite for motivation, performance and success

The above-mentioned transformation triggered by the different drivers, with changes occurring at high speed, often affects employees' health, motivation and performance in a negative way. All three aspects have a significant influence on the success of a company.

Figure 4. Health, capability, motivation & readiness to perform. Elaboration of the authors.



The positive effect of holistic occupational health and safety management (OHS) is on both employees and managers, and should be taken into account, as all groups are burdened by accelerated transformation. The WG has identified typical or particularly critical situations and aspects that have the potential to impair or damage the health and performance or willingness

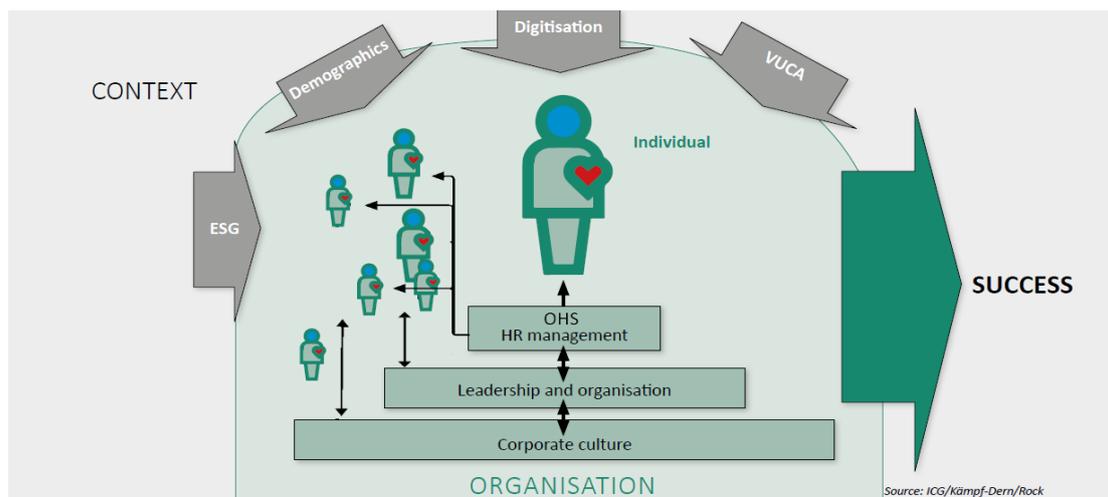
to perform of employees due to digitalisation and VUCA environments. However, managers have a wide range of possibilities to positively influence these situations directly or indirectly. These possibilities can be divided into four areas:

- **Direct influence on the conditions through management / leadership**, e.g. through the own awareness and behaviour of the executives themselves, who show how to deal with given situations in a health-conscious and performance-promoting way, or who design structures and processes accordingly
- **Indirect influence through a health-promoting corporate culture**, which e.g. perceives employees as holistic social beings, including their respective occupational and non-occupational strains, or the continuous inclusion of the topic of health in corporate communication.
- **Indirect influence through personnel policy / HR management measures**, e.g. demographic analyses and group specific packages of measures in relation to health-related goals for strategic corporate management, including health-related KPIs as well as their planning, management and control
- **Measures for (co-)shaping by the employees themselves**, which are to be specifically adapted to and with the employees or which can be shaped by them, whereby it is not sufficient to consider only the work situation.

4.4 Recruiting and on-boarding - finding and keeping the right people

In a recruiting process increasingly driven by the “war for talent”, applicants ask significantly more critical questions and therefore communicate more clearly. Hierarchies, processes and organisational structures fade into the background; instead, the focus is on freedom and self-realisation. This change now faces the special framework conditions of virtual leadership, in which interviews can often only be conducted via video conferencing, which partly reinforces the changes mentioned above. Through new technologies and self-organising, agile teams, the recruiting process is increasingly decoupled from the manager. Overall, the changes described also lead to a new understanding of roles. In some cases, it is more important to fill roles instead of positions.¹⁰ All this must be taken into account in the recruiting processes.

Figure 5. HR-Management. Elaboration of the authors.



Recruiting has to be followed by on-boarding. Due to the already described expansion of decision-making parameters of new employees and the fact that they can work somewhere else

¹⁰ Result of a survey among 150 clients in 2021, conducted by IKP EXECUTIVE SEARCH Berlin

than in the office, on-boarding today encompasses much more than just the introduction to the IT, the organisation and the essential processes. Corporate philosophy, measurable and tangible criteria of sustainable corporate management, vision, purpose, corporate culture and values are also considered important factors for a good future-oriented collaboration. The particular challenge is to implement all this in a meaningful way and in an increasingly digital context. Delphi results clearly show that, in the opinion of employees, networking and social exchange within the team and among colleagues are the most neglected aspects of working in places other than the office. However, precisely these two factors are essential for new employees to have a successful start and a high emotional attachment to the company. In an environment like this, it is recommended to develop digital on-boarding concepts that differ significantly from traditional on-boarding - among other things, by being even more interactive. In order to actually experience the “DNA” of a company, the specific working atmosphere and corporate culture as well as the values, the possibility of a time window that is not only determined by a productivity-oriented agenda but is available for informal exchange among colleagues, becomes ever more important. Digitalisation also has a number of advantages. One of these is that on-boarding can begin before the employee actually joins the company. The time between signing the contract and the first day of work can already be used to connect the new employees emotionally with the company.

5 LIMITATIONS

Reflecting upon the results and the methodology used, this paper has the following advantages and limitations. Most advantages of this methodology are those of OFGs and the DM:

- Because of the online format and the importance of the topic, a huge number of otherwise very busy top-managers participated in the project, thus contributing several hundred years of leadership experience and summarising many years of digitalization (Moore et al., 2015).
- In a staged approach with – in total – five panel sessions and 5 x 3-4 group sessions the broad and complex topic could be broken down and addressed in a systematically and professionally moderated approach.
- Switching between panel and group meetings, synchronous and asynchronous formats (Moore et al., 2015), adapted well to the availability as well as to the interests of the participants (Rezabek, 2000).
- There was a clear, advantageous group effect observed during the online panel discussions, leveraged by the group discussions and individual reflections.
- The recommendations are discussed and evaluated by a large number of experts.
- As all participants acted out of their own interest, the cost of the project was very low (Marshall and Rossman, 2016).

Typical limitations of these methodologies could be partly avoided, partly applied:

- While often the reduced capacity to assess non-verbal behaviour in online settings has been quoted to be a huge disadvantage, the largely improved video capabilities together with the fact that many participants knew each other in person from pre-Corona times lessened the importance of this limitation.
- Additionally, the topic was not so sensitive so that body language was less important – and facial language was well visible.
- A usual problem of the DM is that experts are not sufficiently qualified and/or do not cover the field sufficiently. This was not the case here, since the group included a broad variety of 30 top-managers, four professors and two associations.
- A qualitative DM would often use recording of the sessions and code all material to fully adhere to scientific research. This was not possible in the applied setting, as it would have

required resources that were not existent. Yet, the multiple rounds of consulting with the whole group should make up for this.

- However, this increased the time necessary for this study, which is a common problem with the DM. A staged approach with all the rounds to be taken until reaching consensus needs some time, in this case more than 1.5 years.

6 CONCLUSION

It is the responsibility of management and leadership to set an example of change and to initiate and support transformation. Particularly important are dialogue-oriented communication processes that are appropriate to the situation in the context of the long-term development of a culture of trust. The prerequisite for effective culture-oriented leadership in the digital age is the development of a clear understanding of the role and communication behaviour of all managers through regular reflection on their own role and communication as part of a professional understanding of self-leadership. Innovation skills and the associated recommendations for action are essential components of the digital leadership approach. This applies both at the level of the executive and throughout the entire company, if innovative capability is also a cross-stakeholder culture of innovation. The entire value chain of a company, from recruiting and on-boarding to a communicative culture of trust, including health aspects, innovation capability, and employee development, serves the company's success in the changing processes. Changes benefit those who actively adapt to them. Building on these explorative results, empirical studies in the businesses should follow. They should address the following questions: Which of the various measures in the different leadership areas have the companies already implemented to a greater extent, and which to a lesser one? Are there structural or sectoral differences in this respect? Which measures do the companies consider to be particularly effective? Are there any dominant success factors in this respect? The active participation of the companies, i.e. the transdisciplinary collaboration, in the development of the guidelines seems to make it much easier to initiate, finance and carry out such empirical studies. In this respect, the authors hope for new findings soon, because digital leadership is still in its very early stages.

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REFERENCES

- Adam, B., Barthelmes-Wehr, K., Frensch, S., Kämpf-Dern, A., Kummert, I., Rock, V. (2022), Digital Leadership - Führen im digitalen Zeitalter. Berlin.
- Armutat, S., Bartholomäus, N., Franken, S., Herzig, V., Helbich, B., editors (2018), Personalmanagement in Zeiten von Demografie und Digitalisierung. Herausforderungen und Bewältigungsstrategien für den Mittelstand. Wiesbaden: Springer Gabler.
- Avery, G. C., Bergsteiner, H. (2011), Sustainable leadership practices for enhancing business resilience and performance. *Strategy & Leadership*, 39, 5–15, doi:10.1108/10878571111128766.

- Bennett, N., Lemoine, J. (2014), What VUCA Really Means for You. *Harvard Business Review*, 92, 10.
- Bienert, S., Schäfers, W., Zinnöcker, T., Knips, W. (2015), Nachhaltige Unternehmensführung in der Immobilienwirtschaft. Köln: Immobilien-Manager-Verl.
- Bloor, M. (2002), Focus groups in social research. London: Sage.
- Burchardt, C., Maisch, B. (2019), Digitalization needs a cultural change – examples of applying Agility and Open Innovation to drive the digital transformation. *Procedia CIRP*, 84, 112–17, doi:10.1016/j.procir.2019.05.009.
- Creusen, U., Gall, B., Hackel, O. (2017), Digital Leadership: Führung in Zeiten des digitalen Wandels.
- DFK Verband für Fach- und Führungskräfte (2020), Betriebliches Gesundheitsmanagement in der Unternehmensführung. Handreichung für Sprecherausschüsse der Leitenden Angestellten. Essen, Germany, info@dfk.eu.
- European Commission (2020), EU Taxonomy for sustainable activities. Final report of the Technical Expert Group on Sustainable Finance, https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf
- Fortmann, H. R., Kolocek, B. (2019), Arbeitswelt der Zukunft. Trends - Arbeitsraum - Menschen - Kompetenzen. Wiesbaden: Springer Gabler.
- Gillan, S. L., Koch, A., Starks, L. T., Hargreaves, A., Fink, D. (2021), Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889, doi:10.1016/j.jcorpfin.2021.101889.
- Hargreaves, A., Fink, D. (2012), Sustainable Leadership. Honeybee and Locust Approaches. Jossey-Bass.
- Hauschildt, J., Salomo, S., Schultz, C., Kock, A. (2016), Innovationsmanagement. 6., vollständig aktualisierte und überarbeitete Auflage.
- Jobst-Jürgens, V. (2020), New Work. Was relevante Arbeitnehmergruppen im Job wirklich wollen - eine empirische Betrachtung. Wiesbaden: Springer Gabler.
- Kensbock, J. (2018), Building Bridges over Troubled Waters—How Individuals, New Ventures, and Established Organisations are Facing Challenges in Dynamic Contemporary Business Environments: An Approach Linking Entrepreneurship, Psychology, and Organisational Behaviour.
- Kitzinger, J. (1995), Qualitative research. Introducing focus groups. *BMJ (Clinical research ed.)*, 311, 299–302, doi:10.1136/bmj.311.7000.299.
- Kollmann, T. (2020), Digital Leadership. Grundlagen der Unternehmensführung in der Digitalen Wirtschaft. Wiesbaden: Springer Gabler.
- Lindlof, T. R., Taylor, Bryan, C. (2017), Qualitative communication research methods: SAGE Publications.
- Lofaro, R. J. (2015), Knowledge Engineering Methodology with Examples. In: D. B. A. Khosrow-Pour, editor. *Encyclopaedia of Information Science and Technology, Third Edition*: IGI Global. pp. 4600–07.
- Macky, K., Gardner, D., Forsyth, S. (2008), Generational differences at work: introduction and overview. *Journal of Managerial Psychology*, 23, 857–61, doi:10.1108/02683940810904358.
- Marshall, C., Rossman, G. B. (2016), Designing qualitative research. Thousand Oaks, California: Sage.
- Microsoft (2021), The Next Great Disruption is Hybrid Work – Are We Ready? Work Trend Index: 2021 Annual Report, <https://pulse.microsoft.com/uploads/prod/2021/09/2021-Work-Trend-Index-Annual-Report-Presentation-1.pdf>

- Millar, C. C. J. M., Groth, O., Mahon, J. F. (2018), Management Innovation in a VUCA World: Challenges and Recommendations. *California Management Review*, 61, 5–14, doi:10.1177/0008125618805111.
- Moore, T., McKee, K., McCoughlin, P. (2015), Online focus groups and qualitative research in the social sciences: their merits and limitations in a study of housing and youth. *People, Place and Policy Online*, 9, 17–28, doi:10.3351/ppp.0009.0001.0002.
- Morgan, D. L. (1996), Focus Groups. *Annual Review of Sociology*, 22, 129–52, doi:10.1146/annurev.soc.22.1.129.
- Odimegwu, C. O. (2000), Methodological Issues in the Use of Focus Group Discussion as a Data Collection Tool. *Journal of Social Sciences*, 4, 207–12, doi:10.1080/09718923.2000.11892269.
- Rabaya, A. J., Saleh, N. M. (2022), The moderating effect of IR framework adoption on the relationship between environmental, social, and governance (ESG) disclosure and a firm's competitive advantage. *Environment, Development and Sustainability*, 24, 2037–55, doi:10.1007/s10668-021-01519-5.
- Rezabek, R. J. (2000), Online Focus Groups: Electronic Discussions for Research. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 1, doi:10.17169/fqs-1.1.1128.
- Rowe, G., Wright, G. (2001), Expert Opinions in Forecasting: The Role of the Delphi Technique. In: J. S. Armstrong, editor. *Principles of Forecasting*: Springer, Boston, MA. pp. 125–44.
- Schallmo, D., Williams, C. A. (2021), Holistic Digitalization: Strategy, Transformation, and Implementation.
- Schallmo, D., Williams, C. A., Boardman, L. (2019), Digital Transformation of Business Models — Best Practice, Enablers, and Roadmap. *Digital Disruptive Innovation: WORLD SCIENTIFIC (EUROPE)*. pp. 119–38.
- Schein, E. H. (1990), Organisational Culture: What it is and How to Change it. *Human resource management in international firms*: Springer. pp. 56–82.
- Tannenbaum, R., Weschler, I. R., Massarik, F. (1961), Leadership and Organization. A behavioural science approach.: McGraw-Hill.
- Wagner, D. J. (2018), Digital Leadership. Kompetenzen - Führungsverhalten - Umsetzungsempfehlungen. Wiesbaden: Springer Gabler.
- Wörwag, S., Cloots, A. (eds.) (2020), Human Digital Work – eine Utopie? Erkenntnisse aus Forschung und Praxis zur digitalen Transformation der Arbeit. Wiesbaden, Heidelberg: Springer Gabler.

Smart working and new scenarios for companies' headquarters

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ABSTRACT

Assolombarda, as an entrepreneurial association, has been working for some time on the topic of organisational transformations, smart working policies and their effects on the spatial arrangement of companies. Assolombarda has been doing it both by analysing its member companies' activities and by providing training, support, and advice. The COVID-19 pandemic, by increasing the intensity and the extensivity of the adoption of remote working, led many more companies to question their organisational models and the rationales of their territorial presence. Over the course of 2021, Assolombarda held panel discussions with some of its members to examine the complexity of the phenomenon of organisational and spatial changes, identify major trends, and build a set of guidelines to be provided to companies interested in redefining their workplace settings. In this work, starting from the presentation of data on the context and the adoption of smart working policies among Assolombarda member companies during the pandemic, I will examine major trends identified through the interaction with firms, within three main topics: the linkages between organisational changes and new approaches on companies' headquarters; the process behind the transformation of workplaces; the opportunities for a new relationship between companies' locations and the surrounding areas.

Keywords

Smart working, Headquarters, Companies, Workplace, Employees.

1 INTRODUCTION

This work aims to analyse and give an interpretation to the relationship between the implementation of organisational models based on "smart working" and ways of using, managing, and re-thinking companies' headquarters. As the pandemic forced both an intensive and extensive adoption of remote-working, companies had to reconsider their organisational models and to question the rationale of their physical presence. This document aims to investigate these topics in their complexity, based on the first-hand experience of companies, and to provide general tendencies on new ways of using, managing and potential redevelopment of headquarters.

2 METHODOLOGY AND PURPOSE

This work stems from a process of engagement with a select group of Assolombarda member companies held during the spring of 2021. Assolombarda is the association of companies operating in the Metropolitan City of Milan and in the provinces of Lodi, Monza and Brianza, Pavia. Approximately 6.800 firms of all dimensions and belonging to all industrial sectors, producing services, goods or both are members of Assolombarda. During this process people with different positions within companies were involved (entrepreneurs, managers, human resources, facility managers). During the discussions, companies were asked to elaborate on different topics: 1) the companies' remote working experience during the pandemic emergency period; 2) transformations implemented in the headquarters; 3) willingness to adopt a "diffused

office” model; 4) the implementation of organisational choices supporting collaborative processes; 5) the relationship between headquarters and the urban environment. The aim of this process was to also share experiences between companies, provide insights and explore ways to approach great organisational changes emerged during the pandemic, as processes regarding redevelopment or redesign of headquarters can be long and complex. The main focus group consisted of seven companies, all with offices/headquarters in the wider Milan metropolitan area. The panel was quite diverse, both in terms of size and sector: small manufacturing companies, multinational service-sector enterprises, local and national public-service providers.

Table 1. Participants in the discussion panels

Company Sector	Scope	Number of employees (in MI, MB, LO, PV provinces)
Insurance services	Multinational	Approx. 700
Manufacturing	Multinational	Approx. 400
Public service provision	Local	Approx. 400
Business support services	Local	< 10
ICT	Multinational	Approx. 400
Manufacturing	Local	< 100
Public service provision	National	Approx. 200

3 THE LOCAL SCENARIO OF SMART WORKING DURING THE PANDEMIC

In order to frame the smart working phenomenon in all its complexity, it is important to understand its impact on the territorial system and the organisational strategies of companies, in terms of (1) quantification of the phenomenon, (2) impacts on people’s mobility, (3) real estate market dynamics, (4) changes to workspaces, (5) evaluation by employees. The information contained in this paragraph is relevant to the territories of Milan metropolitan area and it’s based on data available in the first half of 2021, coherently with the timing of engagement of companies. According to Italian legislation, smart working (“Lavoro agile” in Italian) is defined as a goal-related way of working which can be executed either within or outside the companies’ offices, without fixed place and time frame, with the support of ICT technology. This definition allows a wide degree of flexibility over the choice of place, and it’s substantially different from teleworking (or extreme forms of remote working), which envisage the definition of a fixed work position outside the company offices and very limited or no access to the headquarters.

(1) Smart working will evolve from a tool employed to guarantee business continuity during an emergency to a new organisational model. Among the companies questioned by Assolombarda, 59% reported the intention to continue to adopt the smart working model after the pandemic, up from 28% of companies using it pre-pandemic. However, there are significant differences based on the localization, with 75% of companies headquartered in Milan municipality willing to continue using smart working, against 54% of those located in the rest of Milan metropolitan area.

(2) Sustainable mobility models might be under pressure due to a wider use of individual means of transport, reduced capacity, and appeal of public transport. In Milan, after lockdowns in 2020 the usage of private cars quickly bounced back to pre-covid levels, while public transport never reached the 50% capacity level. In this context, remote working can become a factor capable of reducing and modifying the demand of mobility towards business districts. In this sense, the reduction of commuting times is the most relevant advantage of smart working,

according to interviewees by Nomisma (Osservatorio “The world after lockdown” – Nomisma 2020).

(3) The impacts on the office real estate market are yet to be seen. During 2020 the corporate real estate investments have been in line with the 2015-19 average. Even if there has been a 26% drop in the number of office transaction in 2020 compared to the previous year, according to Nomisma’s analysis (Osservatorio sul Mercato Immobiliare novembre 2021 – Nomisma) office prices values in Milan bounced back from 2021 onwards, outperforming other large Italian cities.

(4) In cases where smart working is considered a corporate organisational strategy, not only a simple shift to remote working, it is also more likely that time and place flexibility will be complemented by a re-thinking of office spaces. Those companies that already have implemented organic smart work policies, more frequently have redesigned their workspaces. In companies with smart working policies implemented before the pandemic activity there are more likely activity-differentiated spaces, with the presence of informal social areas, personal lockers, phone booths, areas for concentration work and more spaces for meetings (Smart Working tra remote working e smart office: Ricerca 2020 – Osservatorio Smart Working Politecnico di Milano).

The data show that since March 2020, the shock caused by the pandemic and the health response measures deeply impacted ways of working in our territory, especially in the service sector. While it’s clear that this resulted in a great acceleration of transitions in the way of working that were already taking place, it is also important to consider the effect of temporary health measures put in place by authorities, which impacted modes of working and mobility.

4 IMPACTS OF ORGANISATIONAL CHANGES

In this section we present opportunities and critical aspects of new ways of working emerged from the discussion with Assolombarda’s member companies.

4.1 Opportunities of new ways of working

According to the involved companies, the increase of productivity is the main advantage of new ways of working that involve flexibility over place and space. With the transition towards mature smart working models, employees are allowed to choose the place that better supports their working tasks, both on and off the company headquarters. This allows increased productivity as, for instance, people can find settings that better support individual concentration work or collaborative tasks. The increase of employees’ quality of life is another commonly cited advantage of smart working, which mostly derives from reduced commuting. The presence of smart working policies also increases the attractiveness of companies on the job market, particularly of those located in least connected surroundings. As proved during the pandemic, business continuity can be adequately safeguarded with the shift to remote working. This can also be the case in other emergencies that might impact companies’ headquarters, such as extreme climate events, transit issues, high pollution levels, and other issues limiting accessibility to headquarters. Finally, by reducing the number of weekly work-home trips, smart working can reduce the environmental impact of commuting, if accompanied by sustainable mobility management policies. With the reduced intensity of use of headquarters due to increased remote working, the environmental impacts of buildings can be reduced through a re-design of facility and energy management policies.

4.2 Critical aspects of remote working

With a strong shift to remote working emerged during the pandemic, companies also started to indicate critical aspects of new organisational models and potential ways to address them. The most widespread concern from companies is the loss of corporate culture and belongingness

due to reduced in-person interactions with co-workers and managers. With the transition towards hybrid work models, companies need to consider the need to create more spaces and opportunities that allow positive interactions to keep employees' motivation and shared corporate identity. As often informal and casual meetings are where new ideas are born, reduced spontaneous interaction opportunities can decrease the level of innovative ideas developed by companies. Therefore, managerial and design choices regarding companies' buildings must consider the need for spaces that foster the opportunities for creative meetings between employees and with external organisations. While online tools allow to reach wider audiences in training programs, remote working can limit on-the-job training and people's development. This is particularly critical when companies need to include new human resources that can encounter challenges in adapting to new working environments due to limited in-person contacts with colleagues and managers. Companies need to consider new methods to engage people, create shared knowledge and transfer experiences, balancing online tools and in-person circumstances.

5 GUIDELINES FOR THE FUTURE OF WORKPLACES

This section outlines the main outcomes of the discussion that occurred with Assolombarda member companies, encompassing the themes of organisational transformations, workspace interventions and the wider impact of companies' offices on surrounding urban environments.

5.1 Smart working requires a different approach to companies' organisation and workplaces

Starting from the consideration that most of the smart working experiences during the pandemic were forced by emergency regulations, which reduced space flexibility and imposed "home working" to many employees, companies acknowledged the need to re-think their organisational structure to some extent. Firstly, complete smart policies require flexibility of choice on the location of the work performance (either the office, home, or other compatible spaces). This calls for organisations to reflect on the work settings and location choices made by employees, fostering the use of headquarters for collaborative activities while allowing individual activities to be performed elsewhere. Secondly, to fully implement smart working policies, companies need to introduce organisational tools that can guarantee an adequate balance between individual flexibility over time and place of work and the corporate requirements to sustain high levels of embeddedness, motivation, and objectives' commonality. Finally, corporate headquarters are increasingly acquiring the function of place for collaboration among workers and external stakeholders (customers, suppliers, partners) and remain essential for the development of a sense of belonging to the organisation.

5.2 Transformation of workplaces is a complex and iterative process

One of the key factors to be considered in workplace management is the need to keep managerial and organisational culture aligned with the way corporate spaces are used and managed. This requires a constant monitoring and change management process that enables the transformation of spaces coherently with corporate strategies. As emerged from the discussion with Assolombarda's member companies, organisational changes have in space transformation a strategic complementary process. Therefore, there is the need to involve in workplace management processes different corporate functions, particularly top management, human resources, facility management and real estate management. As the transformation of workplaces is a strategic corporate policy there is the clear requirement of a strong commitment and support from the companies' leadership teams. Also, workplace transformation can be intended as a proactive corporate policy, functional to the introduction of relevant organisational changes, such as mergers, integration of new business units, processes digitalization. Key common traits that were reported by organisations approaching workplace

transformations are: the activation of employees' engagement and listening processes, the need for external professional advice, the trial of pilot projects before engaging in company-wide changes. Moreover, the workplace transformations towards models aligned with smart working requirements need to be strongly linked to each company's specificities, both in terms of work activity and of real estate strategy. It is the case that one size does not fit all, as the spatial setup needs to address the company specific activity, its location, real estate ownership characteristics, and digitalization level. However, despite significant differences in the way companies approach workplace transformation as a result of organisational changes, there are some key commonalities:

- the headquarters as a place for collaboration: increased space for meetings and exchange of ideas.
- the headquarter as a social space: more auxiliary spaces for conviviality to foster corporate culture and spirit.
- activity-based-workplace: differentiated setups linked to the needs of the various tasks carried on by employees during the work hours.
- flexibility and shared desks: linked to the reduction of individual workstations (favouring collective spaces), there is the need to introduce workplace monitoring and management solutions.
- Employees' well-being: increased attention towards workplace comfort and its impact on productivity, improving workplace performance in terms of acoustics, climatization, lighting and ergonomics.

5.3 Opportunities from a new relationship between companies and urban environments

The implementation of smart working policies by companies and of new ways of using company headquarters can also lead to opportunities to rethink territorial arrangements. While a higher adoption of smart working, by reducing flows towards headquarters, can lead to potential negative impacts on nearby commercial and economic activities, this can be compensated by more intense presence of people within residential neighbourhoods. Therefore, is the need to include new urban functions in business districts, where large service-sector companies are often located, in order to keep them alive and vital beyond office hours. For example, corporate headquarters can foster the vitality of business districts by opening up to the surrounding areas, offering shared proximity services. The reshuffling of flows towards large urban areas can be the opportunity to re-think urban mobility in a sustainable way, reducing overlaps on mobility between different competing groups of users (e.g., workers, students, tourists). Finally, new ways of using workspaces can lead to the sharing of services which are traditionally intended for an exclusive use by a company (e.g., canteens, conference rooms) with the neighbourhoods in which headquarters are located. There is a clear opportunity to re-evaluate the relationship between workplaces and urban environments, towards a more balanced territorial development. The changes ignited by the pandemic need to be evaluated carefully, looking at the opportunities to enhance urban quality of life while minimising the negative effects of reduced people's mobility towards workplaces.

6 CONCLUSIONS

We must recognize that we are currently in a moment characterised by great transformations regarding companies and their organisational models, as the pandemic accelerated managerial transformation processes that, at least in Italy, were moving at a slow pace. Therefore, while it is fundamental to question the long-term implications of new ways of working, it is important to consider that such transformations are not over yet. Companies must be quick to adapt to external challenges in order to keep their competitive status, but also be aware of the complexities and long-term implications of workplace transformation strategies. As companies

increasingly compete over talent, workplace's location, and quality, as well as organisational strategies play a key role in attracting qualified human resources. Therefore, while taking into account the mismatch between the speed of organisational changes and the slow pace of real estate transformation, companies face the challenge to transform their workplaces in flexible and future-proof ways, putting employees' needs at the centre. This work aims to offer a first glance on companies' strategies regarding organisational changes and their impact on workplace strategies. Given the role of Assolombarda, we aim to continue to observe companies' strategies in order to be able to share experiences among associates and offer strategic advice.

REFERENCES

- Assolombarda (2021), "Lo smart working in numeri – anno 2021", Rapporto n° 04/2021.
- Assolombarda (2021), "Il lavoro agile oltre l'emergenza", Ricerca n° 5/2021.
- Nomisma (2020), "Osservatorio, The world after lockdown".
- Nomisma (2021), "Osservatorio sul Mercato Immobiliare marzo 2021".
- Politecnico di Milano - Dipartimento di ingegneria gestionale (2020), "Lo smart working ai tempi del COVID-19: come cambia il lavoro dopo l'emergenza – Ricerca 2020".
- Politecnico di Milano - Dipartimento di ingegneria gestionale (2020), "Smart working tra remote working e smart office".

Workplace diversification, workspace flexibilisation and company strategies post pandemic. Lessons from a Paris Region case study

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ABSTRACT

The development of the knowledge economy and the growing use of Information and Communication Technologies (ICT) are transforming office work in many ways, including from a spatial perspective. Workplaces are becoming multi-locational, and workspaces located in company premises include a growing proportion of collaborative and shared spaces (open spaces, flexi offices, collective workstation etc.). There is a growing literature on the issues arising from the current reorganisations of workplaces and workspaces, with an additional focus since the start of the pandemic, which has favored the adoption of remote working, especially home-based teleworking, and its spread to new economic sectors and fields of activity. However, there is a scarcity of data about these questions, which are the subject of this article. It investigates companies' policies about the links between remote work, workplaces and workspaces in the Paris Region (France), with specific attention to the impacts of the pandemic. It offers an analytical framework based on a literature review, and some preliminary findings drawn from 20 stakeholder interviews and the first analysis of questionnaires (200) in an ongoing online survey of company head offices. The findings suggest first that previous trends in workplace diversification, such as the regular practice of homeworking have received a boost from the pandemic. Emerging trends were also confirmed, like the use of coworking spaces or satellite offices. In addition, the spread of regular telework has prompted an expansion of the labor market area within and outside the Region. Second, while our survey does not show a clear link between remote working and increased workspace flexibilisation, some interviews suggest that multi-locational working, and in particular regular remote working, could constitute a management tool with the effects of making open-space and flexible offices more acceptable to employees. These ideas will be tested during the next phase of this ongoing research project.

Keywords

Remote work, Workplaces, Workspaces, Pandemic, Head offices.

1 INTRODUCTION

The development of the knowledge economy and the growing use of Information and Communication Technologies (ICT) are transforming office work in many ways, including from a spatial perspective (Pajevic and Shearmur, 2021; Shearmur, 2021). On the one hand,

workplaces (defined here as the locations where employees perform their different tasks) are becoming more diverse: for decades now the fixed and single workplace located in company premises has ceased to be the only (or even the dominant) model (Vilhelmson and Thulin, 2001; Crague, 2003; Lejoux and Pochet, 2019). Hybrid forms of workplaces have developed. In many economic sectors and fields of activity, work can now be done in various locations, either fixed (such as the home, a satellite office of the company, a telecenter, etc.), or temporary (in a train, a café, etc.) when workers are on the move. Consequently, new spatialities of work are emerging at city (Reuschke and Ekinsmyth, 2021) and country levels. For instance, digital nomadism, a lifestyle that combines remote working and vacation, is developing in many countries across the world (Hermann and Paris, 2020). At region and city levels, the geography of new work spaces (NWS), such as coworking spaces, makerspaces, etc. is attracting growing scholarly interest this (Berbegal-Mirabent, 2021; Mariotti et al., 2021). On the other hand, the design and uses of workspaces (defined here as the way office spaces are organised in employer premises) are changing. Workspaces are becoming increasingly flexible and activity-based (Cochard et al., 2019; Eismann et al., 2022). Shared offices, open-space offices and flex-offices are a growing trend (Lai et al., 2021). This raises a number of questions about the impact of such changes in the quality of work (Wheatley, 2021), dehumanisation (Taskin et al., 2019) and employee well-being (Lütke et al., 2021), work efficiency (Nappi and Eddial, 2021; Yunus and Ernawati, 2018), daily travel (Cerqueira et al., 2020; Ellder, 2020; Stiles and Smart, 2021), and urban development (Fiorentino, 2019; Yu et al., 2019), including corporate real-estate management (Jilhä et al., 2019). There is a growing literature about the issues arising from the current reorganisations of workplaces and workspaces, with an additional focus since the start of the pandemic, which has boosted the adoption of remote working, especially homeworking, and its spread to new economic sectors and fields of activity (Adrjan et al., 2022; De Palma et al., 2022). In many companies, remote working is likely to outlast the pandemic. This may change the nature of office work in terms of both workplaces and workspaces, with more hybrid working (multi-locational workplaces) and more flexible workplaces, and some companies even moving premises, especially head offices, to new locations (Ferranti and Newman, 2021). However, knowledge about these matters remains sparse and it is this scarcity that our article seeks to address. The article investigates the links between remote working, workplaces, and workspaces, with specific attention to the impact of the pandemic. It analyses companies' policies and strategies. Our research is in the field of geography and planning, enriched by an interdisciplinary approach crossing management sciences and sociology. It proposes an analytical framework based on a literature review, and some preliminary findings drawn from 20 stakeholder interviews and the first analysis of recent questionnaires survey of company head offices (200 completed ones). It is structured as follows. The first section offers a brief literature review and describes our analytical framework. The second section presents the case study (the Paris Region) and the methodology used. The third section gives some preliminary results from our ongoing research. The conclusion summarises the main findings, exposes the limitations of our work, and proposes avenues for future research in this field.

2 LITERATURE REVIEW AND ANALYTICAL FRAMEWORK

For decades, office work has been evolving in the direction of greater diversity in the workplaces used by employees, and greater flexibility in the workspaces located in employer premises. These trends, which are not unconnected but have mostly been analysed separately, may accelerate with the Covid-19 pandemic and the development of remote working, especially home-based teleworking (Athanasidou and Theriou, 2021). With growing use of ICT and greater employee mobility, workplaces are becoming more and more diverse (Di Marino and Lapintie, 2018). They now encompass fixed locations such as the office, the home

(and even a second home, whether owned or rented), and a myriad of private and public “third places”, whether work-specific (such as telecenters, coworking spaces, etc.) or not (cafés, libraries, trains, airports, etc.). Moreover, some multi-site companies use satellite offices, particularly to reduce commuting distances (Bailey and Kurland, 1999) or, more recently, to reduce the risks of infection in the workplace (Kim et al., 2021). These trends are difficult to measure since statistics are lacking. The traditional office and the home seem to remain the main places of work for most employees, i.e. the places where they spend most of their working time (Shearmur, 2021). However, the development of multi-locational working is attracting increased attention in the academic literature, around questions such as the organisation of tasks between multiple workplaces (Hislop and Axtell, 2009), impacts on travel behavior, gender factors (Burchell et al., 2021), gentrification (Besson, 2021), urban and rural development (Di Martino and Lapintie, 2018), etc. Furthermore, by accelerating the adoption of remote working practices and their spread to new economic sectors and fields of activity (e.g. support function), the pandemic may increase the practice of multi-location work for many employees (Tagliaro and Miglione, 2021). Work from home will probably remain the main form of remote work. However, remote work from second homes (or vacation places), in satellite offices or in third places may also become more common practices in the coming years (Nanayakkara et al., 2021), especially in large urban areas subject to serious transportation problems. The development of remote working and multi-location working practices may also have an impact on the size and design of office spaces. One question is whether the spread of remote working, and particularly home-based teleworking, may encourage companies to reduce the size of office space? Another is whether it may accelerate the flexibilisation of work with impacts on office spaces (i.e. the flex-offices organisation, use of shared offices, etc.), since fewer employees may be simultaneously present on company premises. With the development of remote work, and especially home-based telework, company premises are increasingly used for interactions between employees: meetings, collaborative work, informal discussions, etc. (Tagliaro and Ciamarella, 2016). Consequently, the conventional office is likely to continue evolving in the coming years in the direction of activity-based working areas. In particular, companies’ premises may host a growing number of open and collaborative spaces, such as meeting rooms and some informal areas, in order to adapt to the growing need for formal and informal interactions between employees on the day(s) when they are working in company premises. Moreover, previous research has demonstrated that teleworking mitigates the drawbacks associated with open working environments (open-space, flex-office), such as interruptions to professional activity and the stress they generate (Vayre, 2021). The development of remote working could thus make the reorganisation of conventional workplaces more acceptable for employees. Finally, the development of multi-location working practices could have an impact on – and reciprocally be fuelled by – companies’ location strategies (Naor et al., 2021). Remote working can contribute to changes in real estate strategies, with the idea that need for office space could be reduced – or reduce the surface area needed for office work – which could in turn encourage some companies to relocate either within the same urban area (whether in the city center or in the outskirts) or to another urban (or rural) area (Haider and Anwar, 2022).

3 CASE STUDY AND METHODOLOGY

3.1 The Paris Region

The Paris Region (France) corresponds to the administrative region called Île-de-France. This Region accounts for 19% of the French population, 23% of jobs, and 37% of executive personnel (compared with 15% in the rest of France), notably because of the presence of numerous corporate head offices (Insee, French institute for statistics). Three out of 10 jobs are

located in the municipality of Paris. More than 8 out of 10 jobs are in the tertiary sector (scientific and technical activities, commerce, information and communication, etc.). Knowledge-intensive activities and head offices are primarily concentrated in Paris and in the adjacent Department to the West, Hauts de Seine (business district of La Défense). Finally, because of the structure of employment and the spatial distribution of population and jobs, which generate long commuting distances, remote working was more common than in the rest of France before the pandemic (Aguiléra et al., 2016).

3.2 A mixed research methodology

Our work, which is part of an ongoing two-year research project at Gustave Eiffel University funded by the Paris Region (until January 2023), is based on a mixed methodology utilising both qualitative and quantitative methods (Perrin et al., 2022). It comprises 3 phases:

- An exploratory phase based on a review of the literature and documentation, with the addition of 20 interviews conducted with different stakeholders in companies, public organisations, and in the real estate sector.
- A questionnaire-based survey of private company head offices (in all locations and of different sizes, mono or multi-site) located in the Paris region.
- Interviews with managers in selected companies, identified during the questionnaire survey (work in progress).

This article presents the first analyses of the questionnaire survey. The questionnaire was targeted at executives or human resources (HR) managers. Because of government restrictions and the need to work remotely, we had to postpone the launch of the online questionnaire-based survey twice. After distributing the questionnaire online (February-April 2022), due to the difficulty in reaching the target, the questionnaire was adapted and administered by phone in May 2022. The phone survey yielded 200 completed responses. Companies with head offices located in the Paris Region were surveyed. This survey focuses on private companies with office activities, with at least 20 employees. We have chosen to survey small, medium and large companies in order to identify the issues and constraints related to size. The aim of this survey is to establish a typology of the ways companies manage the diversification of workplaces and the reorganisation of workspaces. After a short set of standard questions about the company (economic sector, number of sites in the Paris Region and outside, number of employees, etc.), the questionnaire covered the following ground about the head office:

- Location (at municipality level), design of office spaces, and assessment of current location and premises (in terms of accessibility by car and public transit, size of activity space, design of office space, etc.).
- Plans relating to location, workplaces, and workspaces (for instance in terms of the development of collaborative spaces) in the coming years.
- Organisation of work: number of employees, remote and multi-locational working (practices and support policies) before the pandemic (in 2019) and now, workspaces allowed, and policies for remote work in the future (after the pandemic),
- A set of questions about the impacts of the pandemic on the development of multi-locational work and recruitment policy.

Based on the results of this questionnaire survey, and in order to better understand the constraints and trade-offs involved, executives of representative companies will be interviewed during the next phase of the research.

4 PRELIMINARY RESULTS

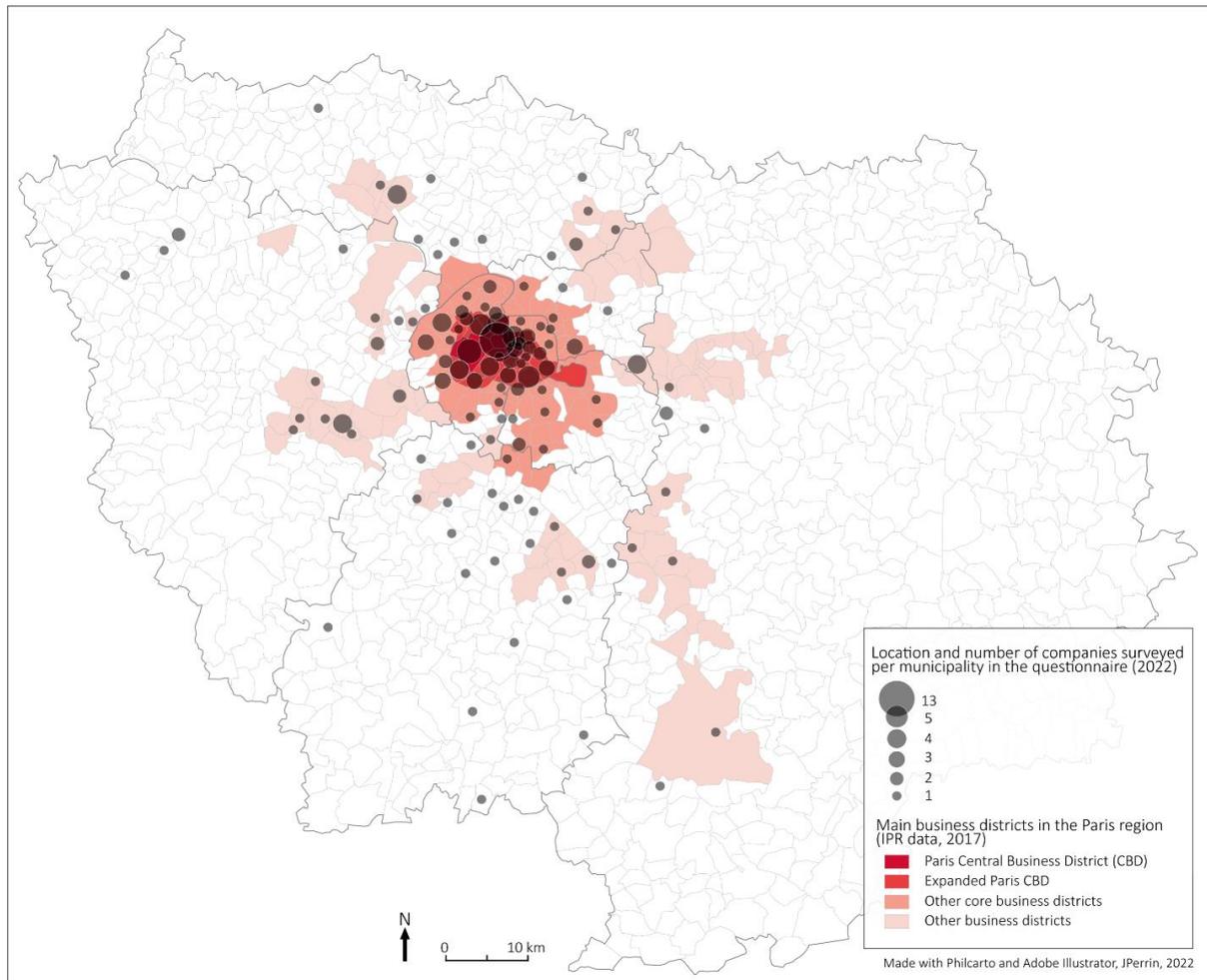
The results presented here are preliminary, they are based on the first analysis of the 200 completed questionnaires (phone survey), and the 20 exploratory interviews. They show two main interesting trends that will need to be confirmed by further statistical processing and the third phase of interviews with company executives (started in summer 2022).

4.1 Brief description of the sample

The panel was sampled according to company size and includes 40.5% small companies (20 to 49 employees), 39.5% medium-sized companies (50 to 249 employees) and 20% intermediate or large companies (over 250 employees). The third category is deliberately over-represented in order to be studied¹¹. Concerning the profile of the people who answered the questionnaires, a majority are HR managers (41%) or executives (33.5%), others are CFO (18%). Regarding the companies surveyed, the most represented sector of activity is services (54%), and in particular the sector classified as “Scientific and technical activities, administrative and support services” (26% of the sample). The spatial distribution of the companies surveyed (head offices) (Figure 1) is consistent with the distribution of the major business centres in the region, with the Paris (32.5%) and La Défense (20.5%) areas mainly represented. 47% are multi-site companies and among these companies, 79% have several sites in the Paris Region. About head offices, 60% of companies surveyed are in rented premises. We observe an emerging trend: 2% of the panel is domiciled in a coworking space. For 68% of the panel, more than half of the premises are used for office activities (43% only for that).

Figure 1. Companies surveyed and main business districts in the Paris region

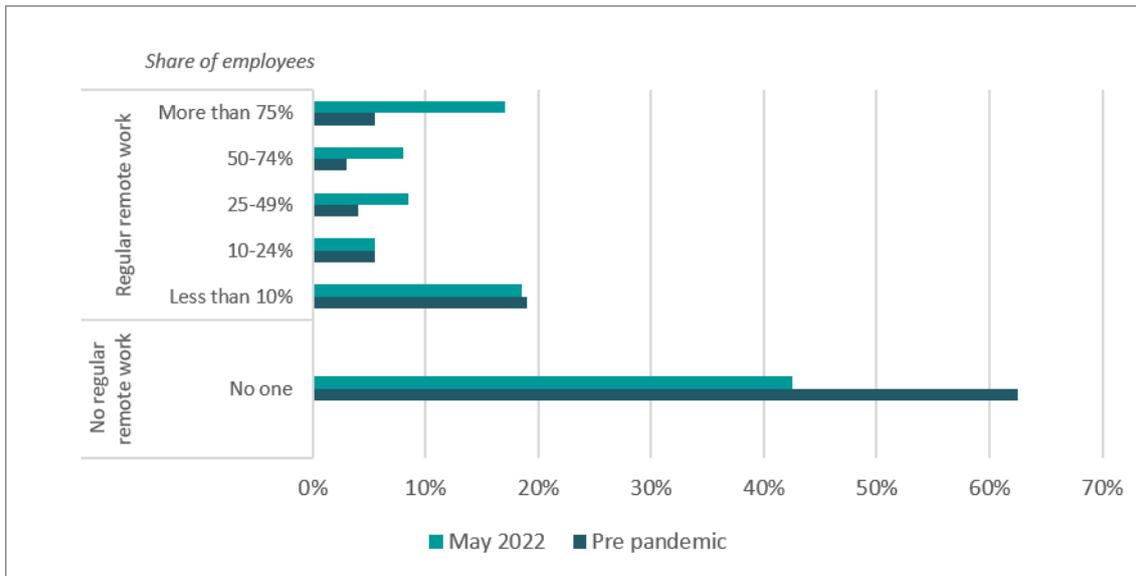
¹¹ In Paris Region, 61% of companies have less than 50 employees, 30% have 50 to 249 and 9% have more than 250 (Insee, SIRENE data, 2020).



4.2 Spread of remote work, workplace diversification, and geographical expansion of the labour market

Our data allows us to analyse company's policies on remote work. The practice of regular remote work (i.e. working away from the conventional office at least 1 day per week) by a part of the employees is here a key indicator. Regular remote work has spread since the beginning of the pandemic (Figure 2). More companies are concerned: from 38% before the COVID-19 pandemic to 58%, with a stronger spread for medium-sized companies (+25 points). Within companies, the share of employees remote working regularly has increased: 25% of companies, this now concerns more than 50% of employees. In companies with regular remote work, the most common patterns are 2 days (37%) and 1 day (36%) per week.

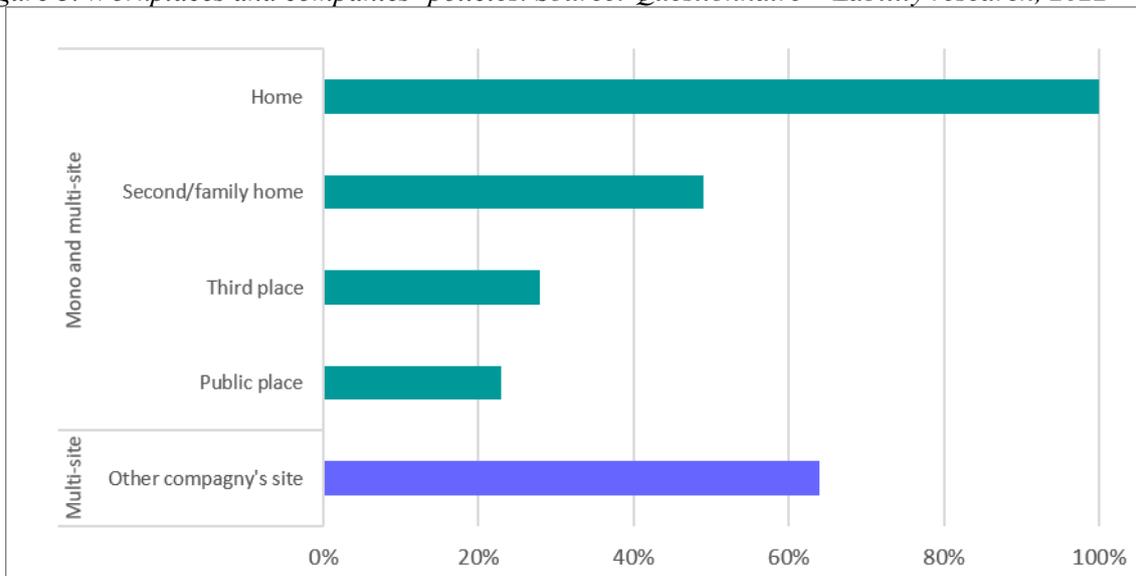
Figure 2. Companies and share of employees remote working regularly. Source: Questionnaire – Liability research, 2022



The first parts of the research gave some insight into this increase: it reflects (i) the preferences of employees, (ii) would allow a higher productivity and (iii) enhanced attractiveness on the labour market. The pandemic thus maintained remote working or extended it to jobs to functions that were not previously considered teleworkable. It changed the perception of remote work: it is now less about teleworking jobs than about teleworking tasks. However, full teleworking is not the rule (less than 2% of the companies with regular remote work have a main pattern of more than 4 days per week). Hybrid work arrangements, where people continue to go to the office about 3 days a week, seems to be becoming the “new normal” in many companies.

Our data allow us to qualify these company policies regarding remote work, about possible accompanying measures. We also have the workplaces (outside the traditional office) allowed by company policy (Figure 3).

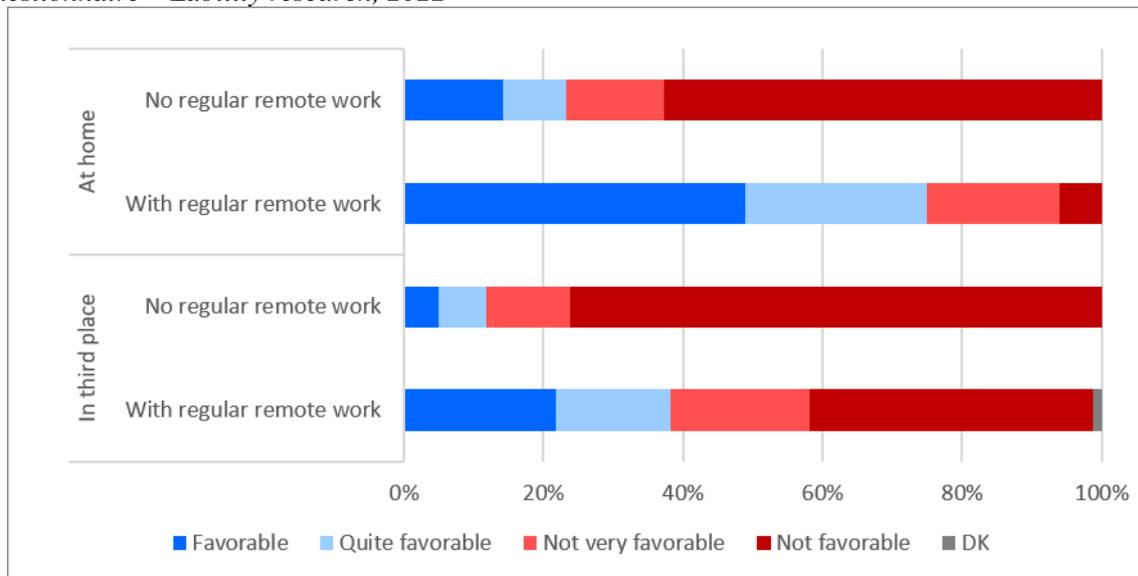
Figure 3. Workplaces and companies’ policies. Source: Questionnaire – Lability research, 2022



All companies with regular telework put measures in place: 90% provide ICT equipment and tools and 42% provide or finance office furniture and supplies. Also, all companies with regular

remote work allow work from home (25% offer a monetary compensation for that), and almost half allow work in a second or family home. Third places are allowed by 28% of these companies and 19% finance (partially or totally) the access to coworking spaces. For companies with regular remote work, 61% observed more employees working from home compared to before the pandemic. For those that allow third places, 44% have more employees working in these spaces. Another indicator of workplace diversification concerns multi-site companies. 64% of them allow their employees to work in other sites than their main place of work (Figure 3): for 51%, more employees practise it. In the next few years, 11% of the companies surveyed are considering developing the use of satellite offices. The first phases of the research enabled us to collect the feelings of both office real estate stakeholders and company representatives about the development of remote work. We observed a convergent discourse on the *search for balance*. In the questionnaire, we asked what the company's position is in the next few years regarding the use of remote working in different places (Figure 4). Companies with regular remote work are more open about it. However, the answers are nuanced and seem to us to translate this present floating on the search for balance.

Figure 4. Companies' position in the next few years about remote working in different places. Source: Questionnaire – Lability research, 2022



Our questionnaire survey confirmed findings from the interviews: the growth of remote working favours a geographical expansion of the labour market area. Companies seem less reluctant to hire employees living a long way from their premises than before the pandemic. 77% of companies in our sample agree that they expanded their labour market area within the Paris Region as a result of the pandemic, 15% report that their recruitment area has expanded outside the Paris Region, though 4% outside France. This enlargement of the recruitment pool seems to be an indirect spatial effect of remote work: because of the pandemic and its spread, in Paris Region companies seem less reluctant than before to hire employees living further from their premises, at least in the case of head offices. To sum up, earlier trends in workplace diversification, especially regular homeworking, were boosted by the pandemic, a finding largely confirmed by the interviews with the different stakeholders. The use of third places and satellite offices is not the norm, but are more considered in company policies. Workplace diversification is not just linked to remote work, as evidenced by the evolution of the use of different company premises.

4.3 Increased workspace flexibilisation

About workspaces, 72% of the companies studied premises, there are open space offices. 42% have flex office organisation (at least partly) and 18% of the sample have fewer workstations than employees. The companies were asked about possible projects in the next few years involving (i) a move of the head office, (ii) a change in the size of the premises (iii) a reorganisation of the workspaces (Table 1).

Table 1. Companies with projects concerning head office workplace and workspace in the next few years. Source: Questionnaire – Lability research, 2022

		Share of panel responding yes
Move	<i>Decided</i>	3%
	<i>In reflection</i>	1,5%
Surface	<i>Increase</i>	15%
	<i>Decrease</i>	7%
Reorganisation	<i>Decided</i>	7%
	<i>In reflection</i>	16%

Our data do not show, at this point, a clear link between work reorganisations changes in working arrangements and relocation projects. Also, while the idea of reducing the size of office space was highly reported by the media in the early months of the pandemic, it is little considered by the companies surveyed (7%). More companies are considering changing the layout of their offices (23%): 7% have decided and 16% are thinking about it. The projects are diverse and concern both open and closed spaces (individual offices), as well as collective spaces. This last point confirmed findings from the interviews, with new expectations concerning meeting rooms and other collective work spaces, as well as catering areas, which are now more and more designed to be both convivial and supporting collaborative uses. These projects concerning workplaces and workspaces are combined in a significant proportion of observations: 22% of companies considering a reorganisation are also considering a move and 45% also a change in the surface area of the premises. 18% of companies with projects are considering changes to all three spatial levers (which is 5% of the total panel). In 46% of cases, these projects have emerged since the pandemic. However, only a quarter of companies link these projects to remote work: 10% strongly and 15% partially. While it is difficult at this stage of our research to qualify the link between the development of remote working and increases in workspace flexibility, we make the assumption (based on the exploratory phase) that the spread of regular remote working could be a management tool intended to make flex-office organisation more acceptable to employees. This hypothesis will be tested during the third phase of this research project.

5 CONCLUSION

The changes in working organisations and practices during the pandemic were an adaptation to health issues and public policies, and represented a boost to earlier trends. Our results show that remote working is part of an ongoing change by companies in the management of workplaces, in the direction of increasing diversity, and also in the management of workspaces in and out of offices. However, the home and the conventional office will remain the main workplaces, although satellite offices, coworking spaces, etc. will also develop in the future. This article presents the first results of the questionnaire survey. These show that, while changes are underway, the management of the organisation and places of work by companies are following different trajectories. The spread of remote work is part of bigger changes in the organisation of work. As an opening question, companies were asked about the current period

affected by the COVID-19 pandemic: (i) for 14%, it is a period of acceleration of changes initiated earlier, (ii) it is a period of adaptation that will strongly reorient the future organisation for 26% and (iii) that will partially reorient the future organisation for 28%, (iv) for the remaining third, it is a temporary period of adaptation. Here we find a first group, referred to as *leaders* in several interviews, who are proactive in terms of changes in work organisation and whose strategies or policies have been widely publicised. While this group is notable, it is not in the majority. We also find those *searching for balance*, mentioned earlier about remote work roles. Our first findings also strongly nuanced changes in progress or to come. Our work has many limitations, and present preliminary findings. Future analyses of our data, and the final phase of the research (interviews with company executives) will make it possible to establish a typology of (i) adaptation modes and (ii) the link between management of the work organisation and the workplaces. It will allow a better understanding of the trade-offs and constraints that explain these different company policies. Our first results strongly nuanced the weight of the diffusion of remote work in the current evolution. Interviews will allow us to better qualify its role.

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REFERENCES

- Adrjan, P., Ciminelli, G., Koelle, M., Judes, A., Schwellnus, C., Sinclair, T. M. (2022), Working from Home after COVID-19: What Do Job Postings Tell Us? Available at SSRN 4064191.
- Aguilera, A., Lethiais, V., Rallet, A., Proulhac, L. (2016), Home-based telework in France: Characteristics, barriers and perspectives. *Transportation Research Part A: Policy and Practice*, 92, 1-11.
- Akhavan, M., Vita, S. D., Mariotti, I. (2021), Introducing the Worldwide Phenomenon of Flexible Workplaces. In *New Workplaces—Location Patterns, Urban Effects and Development Trajectories* (pp. 1-9). Springer, Cham.
- Athanasiadou, C., Theriou, G. (2021), Telework: systematic literature review and future research agenda. *Heliyon*, 7(10), e08165.
- Bailey, N. B. K. D. E., Kurland, N. B. (1999), The advantages and challenges of working here, there, anywhere, and anytime. *Organisational dynamics*, 28(2), 53-68.
- Bencivenga, M., Camocini, B. (2022), Post-pandemic scenarios of office workplace: new purposes of the physical spaces to enhance social and individual well-being.
- Berbegal-Mirabent, J. (2021), What do we know about co-working spaces? Trends and challenges ahead. *Sustainability*, 13(3), 1416.
- Besson, R. (2021), Role and limits of third places in the fabrication of contemporary cities. *Territoire en mouvement Revue de géographie et aménagement. Territory in movement Journal of geography and planning*, (51).
- Burchell, B., Reuschke, D., Zhang, M. (2021), Spatial and temporal segmenting of urban workplaces: The gendering of multi-locational working. *Urban Studies*, 58(11), 2207-2232.
- Cerqueira, E. D. V., Motte-Baumvol, B., Chevallier, L. B., Bonin, O. (2020), Does working from home reduce CO2 emissions? An analysis of travel patterns as dictated by workplaces. *Transportation Research Part D: Transport and Environment*, 83, 102338.
- Cochard, N. (dir.) (2019), *Guide de la flexibilité de l'organisation et de l'environnement de travail. Théorie et pratique*. Edition du moniteur.

- Crague, G. (2003), Des lieux de travail de plus en plus variables et temporaires. *Economie et statistique*, 369-370, 191-212.
- De Palma, A., Vosough, S., Liao, F. (2022), An overview of effects of COVID-19 on mobility and lifestyle: 18 months since the outbreak. *Transportation Research Part A: Policy and Practice*, 159, 372-397.
- Di Marino, M., Lapintie, K. (2018), Exploring multi-local working: challenges and opportunities for contemporary cities. *International Planning Studies*.
- Eismann, T. T., Pakos, O., Rücker, M., Meinel, M., Maier, L., Voigt, K. I. (2022), Understanding the Mechanisms of Activity-based Workspaces: A Case Study. *Environment and Behaviour*, 54(1), 170-210.
- Elldér, E. (2020), Telework and daily travel: New evidence from Sweden. *Journal of Transport Geography*, 86, 102777.
- Ferranti, K., Newman, J. (2021), Corporate headquarters leasing: Key considerations for a post-pandemic workplace. *Corporate Real Estate Journal*, 11(1), 32-44.
- Fiorentino, S. (2019), Different typologies of 'co-working spaces' and the contemporary dynamics of local economic development in Rome. *European Planning Studies*, 27(9), 1768-1790.
- Harris, R. (2016), New organisations and new workplaces: Implications for workplace design and management. *Journal of Corporate Real Estate*.
- Hermann, I., Paris, C. M. (2020), Digital Nomadism: the nexus of remote working and travel mobility. *Information Technology & Tourism*, 22(3), 329-334.
- Hislop, D., Axtell, C. (2009), To infinity and beyond?: workspace and the multi-location worker. *New Technology, Work and Employment*, 24(1), 60-75.
- Jylhä, T., Remøy, H., Arkesteijn, M. (2019), Identification of changed paradigms in CRE research—a systematic literature review 2005-2015. *Journal of Corporate Real Estate*.
- Kim, S., Lee, Y., Choi, B. (2021), Adoption of Satellite Offices in Response to a Pandemic: Sustainability and Infection Control. *Sustainability*, 13(14), 8008.
- Lai, L. W., Chau, K. W., Davies, S. N., Kwan, L. (2021), Open space office: A review of the literature and Hong Kong case studies. *Work*, (Preprint), 1-10.
- Lejoux, P., Pochet, P. (2019), Désynchronisation des temps et dissociation des lieux de travail. Les actifs à mobilités atypiques en Rhône-Alpes. *Espaces populations sociétés*, 2019/1, online.
- Lütke Lanfer, S. S., Becker, C., Göritz, A. S. (2021), Well-being in open space offices: The role of office features and psychosocial working conditions. *Work*, 68(2), 317-332.
- Mariotti, I., Akhavan, M., Rossi, F. (2021), The preferred location of coworking spaces in Italy: an empirical investigation in urban and peripheral areas. *European Planning Studies*, 1-23.
- Nanayakkara, K. T., Wilkinson, S. J., Ghosh, S. (2021), Future office layouts for large organisations: workplace specialist and design firms' perspective. *Journal of Corporate Real Estate*.
- Naor, M., Pinto, G. D., Hakakian, A. I., Jacobs, A. (2021), The impact of COVID-19 on office space utilisation and real-estate: a case study about teleworking in Israel as new normal. *Journal of Facilities Management*.
- Nappi, I., Eddial, H. (2021), Real cost of flex-offices: discourse and reality. *Journal of Corporate Real Estate*.
- Pajević, F., Shearmur, R. (2021), Where are the knowledge workers? The case of Silicon Valley North in Ontario, Canada. In *New Workplaces—Location Patterns, Urban Effects and Development Trajectories* (pp. 233-250). Springer, Cham.

- Perrin, J., Aguiléra, A., Terral, L. (2022), Covid 19 and remote work in Paris region area (France): how do companies manage workplaces and workspaces? Annual meeting of American Association of Geographers (AAG), 25 feb-1st march.
- Reuschke, D., Ekinsmyth, C. (2021), New spatialities of work in the city. *Urban Studies*, 58(11), 2177-2187.
- Shearmur, R. (2021), Conceptualising and measuring the location of work: Work location as a probability space. *Urban Studies*, 58(11), 2188-2206.
- Stiles, J., Smart, M. J. (2021), Working at home and elsewhere: daily work location, telework, and travel among United States knowledge workers. *Transportation*, 48(5), 2461-2491.
- Tagliaro, C., Ciaramella, A. (2016), How to Manage Corporate Real Estate and End-Users Engagement into Smart Work-place Change Strategies: A Case Study. In 2016 CIB World Building Congress (WBC), Tampere (Vol. 2, pp. 750-766).
- Tagliaro, C., Migliore, A. (2021), "Covid-working": what to keep and what to leave? Evidence from an Italian company. *Journal of Corporate Real Estate*.
- Taskin, L., Parmentier, M., Stinglhamber, F. (2019), The dark side of office designs: towards de-humanization. *New Technology, Work and Employment*, 34(3), 262-284.
- Vayre, É. (2021), Comment télétravailler demain? *L'Économie politique*, 92(4), 62-73.
- Vilhelmson, B., Thulin, E. (2001), Is regular work at fixed places fading away? The development of ICT-based and travel-based modes of work in Sweden. *Environment and planning A*, 33(6), 1015-1029.
- Wheatley, D. (2021), Workplace location and the quality of work: The case of urban-based workers in the UK. *Urban Studies*, 58(11), 2233-2257.
- Yunus, E. N., Ernawati, E. (2018), Productivity paradox? The impact of office redesign on employee productivity. *International Journal of Productivity and Performance Management*.

Workplace Benchmarking: current benchmarking practice of the real estate industry and benchmarking demands of corporate real estate organisations

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ABSTRACT

Through benchmarking, organisations can discover business insights and turn data into actionable outcomes to increase business performance. This study looks into the experience of corporate real estate (CRE) organisations with workplace benchmarking, aiming to better understand the current benchmarking practice and the benchmarking demands of organisations with large corporate real estate portfolios. In this qualitative explorative study, we conducted 10 semi-structured interviews with CRE and workplace managers, and one group interview with four CRE and workplace management consultants from Switzerland and Germany. Most participants work in large national organisations (n=2) or at multinationals (n=8) and represent various industries, including pharmaceuticals, consulting, software, telecommunications, transportation, banking and insurance. Data was analysed through thematic coding. We uncovered some underlying themes that describe the current practice and the demands for workplace benchmarking of CRE organisations. We identified three key aspects: **1) added value of benchmarking** (“workplace benchmarking: part of the raison d’être of CREM”), **2) barriers for benchmarking implementation** (“lack of systematic methods”, “missing standardisation, comparability, uniformity”, “different standards for data quality”, “measuring remains a challenge”, “passive use of data”), and **3) benchmarking demands** (“need for holistic benchmarking”). This study showed that although it is recognized that benchmarking is valuable to give insights into the effectiveness of the strategy, organisations struggle with the implementation, due to missing standardisation and the lack of systematic methods. These findings can inform the development of CRE benchmarking solutions regarding industry demands, especially for the creation of workplace benchmarking tools. Additionally, this study investigated the benchmarking practice and demands of CRE organisations during the transition from “home-office mandates” to “return to the office”, triggered by the COVID pandemic around summer 2021, giving insights into how CRE organisations have been using data and benchmarking to support the decision to optimise their workplace strategies.

Keywords

Workplace benchmarking, Benchmarking practice, Corporate real estate.

1 INTRODUCTION

As part of a research project on workplace benchmarking, we conducted a qualitative interview study, where we asked corporate real estate practitioners and real estate and workplace consultants about their experience with workplace benchmarking. Our research aim was to better understand the current benchmarking practice and the benchmarking demands of organisations with large real estate portfolios. The interview study took place in summer 2021

and is part of a larger research and development project that seeks to develop a standardised methodology and the tools to gather and analyse workplace benchmarking data, to measure workplace performance.

2 THEORY

Over the last few years, companies have increasingly transitioned to new working practices supported by innovative workplace concepts (Riratanaphong and van der Voordt, 2015). This has sparked an interest in the added value of the workplace for businesses (Petruaitiene and Jylhä, 2015; Riratanaphong and van der Voordt, 2015). At the same time, the increasing pressure to efficiently use space, which can be the second highest cost factor for organisations (Commission for Architecture & the Built Environment, 2005; Steiner, 2006; Miller et al., 2014), motivates executive management to demand specific metrics to measure this added value (Jones Lang LaSalle, 2019). Yet, measuring the added value and impact of facilities on the business can be a challenge. Several authors (e.g., Riratanaphong et al., 2012; Jensen and van der Voordt, 2016; van der Voordt and Jensen, 2018) have studied the phenomena and focused on defining the added value of Facility Management (FM) and Corporate Real Estate (CRE) for organisations, with emphasis on work environments and on identifying value-adding parameters in buildings. They focus on the extent to which buildings, facilities and services are aligned with organisational needs. Building on this, Hoendervanger et al. (2016) identified interventions, tools and indicators to measure the added value of these building parameters. Riratanaphong and van der Voordt (2015) presented a study on the added value of workplaces and instruments to measure its performance, and found that organisations did not implement performance measurement systems due to poor practical applicability, although the organisations have a certain awareness of which performance criteria to measure. The authors recommend benchmarking as an approach for performance measurement. Similarly, benchmarking is considered a relevant instrument for quality measurement and performance improvement for Corporate Real Estate Management (CREM) (e.g., Jensen and van der Voordt, 2017; van der Voordt and Jensen, 2018). Measuring the added value of the workplace can entail measuring the quality of office environments through the integration of data from the building, the users (e.g., behaviour, assessments, and outcomes like health and productivity), and the operative building management processes. Also, the impact of the workplace on employee performance, work/life balance and employee retention are acquiring more attention, as drivers of workspace innovation are drifting from cost centric approaches to user-centred outcomes (Creighton, 2014, as cited in Kämpf-Dern & Konkol, 2017). This increases the focus on the impact of the workplace on employee satisfaction, talent attraction and retention and drives the need for workplace performance measurement. Furthermore, the COVID-19 pandemic has changed the way offices are used, the location of work (Naor et al., 2021), and increased the need for measuring workplace impact. Yet methodological challenges remain, and organisations lack guidance for implementing measurement solutions. Støre-Valen and Lohne (2016) identified methods to assess building performance and found these methods had a limited scope as they focused only on one aspect of the building. Also, Tagliaro (2018a) proposed a system of performance indicators for strategic design, management and use of offices, highlighting the need for frameworks to align the functional areas related to workplace performance (Tagliaro, 2018b). Zhou et al. (2019) and Tagliaro et al. (2021) also found gaps in the methods used to collect space utilisation data, indicating the need for guidelines for workplace data collection. Benchmarking, as a process that seeks to establish the potential for improvement in an organisation through systematic performance comparison across peers and industries (European Committee for Standardisation, 2012), enables organisations to discover business insights and turn data into actionable outcomes to increase performance.

Benchmarking helps organisations discover best practices set in the context of their business environment and gives them orientation of where the market is heading to, helping them identify levers to optimise their business practices. In this sense, workplace benchmarking can be an alternative to provide reference indicators of how different office concepts function in practice and deliver measures of the impact of the workplace on the business and optimization possibilities. Yet for a long time, practical applications of workplace benchmarking have been limited to financial and space indicators (Massheder and Finch, 1998, as cited by Stoy & Kytzia, 2005, p. 19), leading to efficiency driven decision making, without focusing on the human-centric approach needed for the high performing workplace (e.g., Kämpf-Dern and Konkol, 2017). The development of benchmarking has been hindered by multiple factors such as lack of resources, lack of technical knowledge in planning benchmarking projects, benchmarking partners, lack of understanding of benchmarking, management commitment and fear of sharing information are barriers to implementing benchmarking (Adebanjo et al., 2010). Yet, in the last decade, new multidimensional approaches to measure and benchmark workplace performance are emerging. Customer and end-user related measurements have been given more importance: for example, indicators of satisfaction, quality and effectiveness of service delivery in the workplace were suggested as possible end-user related measurements to monitor (Shamma and Hassan, 2013). Van der Voordt and Jensen (2017) also proposed measuring spatial and cost factors in combination with employee outcomes and design features of the office space. Kämpf-Dern and Konkol (2017) suggested integrating organisational factors (e.g. human resources, strategic goals, change factors) together with company specific performance-based actions to create high performing workplaces, and indicated the need for performance evaluation systems with context and organisation specific performance parameters. Furthermore, a continuous process that demands monitoring and optimization of the workplace performance can ensure a high performing office environment, which is why benchmarking can be an integral part of the corporate workplace strategy (Kämpf-Dern and Konkol, 2017). This evidence indicates that a holistic benchmarking solution is required.

3 METHODOLOGY

To profile the benchmarking demands and practice within the companies, we conducted ten semi-structured interviews with CRE and workplace management practitioners, and one group interview with four real estate and workplace management consultants.

3.1 Participants

A total of ten participants participated in individual interviews. Most participants work in large organisations, either at a national level (n=2) or at a multinational level (n=8); they represent different industries, including pharmaceuticals (n=3), banking and insurance (n=2), consulting (n=2), transportation (n=1), software development and telecommunications (n=2). Eight participants are based in Switzerland, one in Germany, and one in the USA. Five participants work in workplace management and four participants work in real estate management. Only one participant works in data management. Four real estate and workplace management consultants are from Switzerland (n=3) and Germany (n=1) and participated in one group interview.

3.2 Data collection

Participants were recruited through purposive sampling (Battaglia, 2008). An email invitation and a project information flyer were sent to 20 experts, out of which we recruited ten participants. The interviews were semi-structured following a predefined interview guideline, but follow-up questions were asked if the interviewee mentioned relevant information for the research. The interview had two parts: general aspects of benchmarking and relevance of the KPIs developed in the project. Definition and description of KPIs were provided to participants

before conducting the interview. Each participant had an individual interview in German (n=9) or English (n=1), conducted online (via ZOOM and MS-Teams) between July and August 2021 by the two authors. The interviews were recorded via video format and lasted from 50 minutes to one hour. Participants of the group interview were recruited by the industry partner. To determine consultants' perspectives about workplace benchmarking, participants were asked for their opinions on drivers and barriers of benchmarking, benchmarking in the consulting process, approaches to benchmarking and KPIs. The group interview was conducted online (via MS-Teams) in September 2021 and lasted two hours. The digital white board *Miro* was used as a tool for the group interview; participants could add notes to each discussion topic directly on the online board. Each discussion topic lasted between 5-15 minutes. The group interview was protocolled through concurrent note taking by an observing member of the project team and documented as an interview protocol together with the notes from participants in the digital white board. All quotes not originally in English have been translated by the authors.

3.3 Data analysis

The 10 interviews were selectively transcribed (not verbatim transcriptions; Azevedo et al., 2017; Altheide et al., 2003) and summarised in interview notes. Thematic analysis was used to identify patterns (themes) in the data, following step 1 to 5 of the framework by Braun and Clarke (2006). Both authors individually read the interview notes and generated initial codes of the selectively transcribed data. Then they identified the emerging themes by collating common codes across participants. After each step, a discussion between the two authors was conducted to resolve any interpretative differences. Finally, prevailing themes were compiled into a matrix. Codes from the group interview were added into the matrix by one author. All quotes not originally in English, have been translated by the authors.

4 RESULTS

We uncovered seven underlying themes that describe the current practice and the demands for workplace benchmarking of CREM organisations, that can be grouped into three key groups: **1) added value of benchmarking** ("workplace benchmarking: part of the *raison d'être* of CREM"), **2) barriers for benchmarking implementation** ("lack of systematic methods", "missing standardisation, comparability, uniformity", "different standards for data quality", "measuring remains a challenge", "passive use of data"), and **3) benchmarking demands** ("need for holistic benchmarking"). The study showed that although the added value of benchmarking for the business is widely recognized, organisations struggle with the implementation of benchmarking, due to missing standardisation and the lack of systematic methods.

1. Workplace Benchmarking: part of the *raison d'être* of CRE. Benchmarking is recognized as a method to generate value for the core business and the office users. "[Our driver] is to influence the performance of the business with the workplace" (Participant 5, Pharma); "[Our driver] is to generate added value for the core business" (Participant 6, Pharma). Benchmarking helps CRE units to define the value of their function for the organisation and helps them provide arguments to the general management for decision making about the real estate portfolio. Benchmarking and the data behind it have been defined as the *raison d'être* of CRE as it provides valuable information about the portfolio and the effectiveness of the current strategy. "Benchmarking is part of our reason for existing" (Participant 3, Telecom); "We need benchmarking to deliver arguments to the management" (Participant 4, Transportation); "We need to deliver arguments to management to demonstrate why we need the space resources" (Participant 7, Pharma); "[Benchmarking] is not a priority because we want it, it is a basic principle to continue being relevant" (Participant 10, Software).

Concretely, participants reported that they need to gain insights on user satisfaction and measurements about the efficiency of their portfolios. Additionally, the disruption caused by the COVID-19 pandemic generated large management attention on workplace metrics. The need to optimise utilisation of the office space and support the new needs of workers has gained increased importance, which drives CRE to turn to benchmarking to support decision making. The results showed the complexity of implementing benchmarking is a common challenge for all participants. Moreover, some participants indicated data security, and data transparency as a challenge. Theme two to six give a deeper dive into the barriers that hinder the adoption of benchmarking, showing that these relate to the conceptual approach to structure benchmarks and to the methods and tools used for collecting and processing data.

2. Lack of Systematic Methods. Participants emphasised the lack of systematic benchmarking solutions. Most of them reported that they do not follow any concrete approach to benchmarking: “We do internal benchmarking. Although we don’t do it systematically and it is not coordinated globally” (Participant 2, Consulting). The benchmarking practice in the organisations of the participants has mostly grown organically and follows internally developed concepts for data aggregation. Most organisations also rely on internally developed tools, which makes the comparison across external peers challenging. “[We don’t have...] any systematic methods, but we have an excel based cockpit” (Participant 8, Insurance); “[The method for benchmarking is] our own creation based on Excel” (Participant 4, Transportation); “There are not the right tools available.” (Participant 1, Banking). Additionally, participants reported the industry is lacking standards on how to consolidate the volume of data, how to aggregate the diverse sources and types of data and transfer this information into relevant business insights to optimise the portfolio.

3. Missing Standardisation, Comparability, Uniformity. At the core of benchmarking lies comparison, for which the comparability of peers is essential to any benchmarking system. The lack of standardisation, comparability, and uniformity of the measurements was highlighted by the participants as one of the biggest challenges for the implementation of benchmarking. They specified that missing standards result in big variation in choice and calculation approaches for metrics, variations in measurement practice across regions and inconsistencies in how organisations define the variables to be measured. Participants reported the need for standardisation, not only to enable quantitative comparisons, but also to enable the comparison of qualitative factors to set the data in context. “[Our demand is] to be uniform and standardised, so that the comparison is possible” (Participant 8, Insurance); “[Our demand is] to be qualitatively comparable. That means that the context factors should be similar” (Participant 3, Telecom); “You can’t know if you are the best without external benchmarks. But the benchmarks are not comparable” (Participant 3, Telecom); “[It is a barrier] when data can’t be applied because everyone measures differently” (Participant 4, Transportation).

4. Different Standards for Data Quality. The quality of current benchmarking approaches was questioned by the participants. They reported that overall, the quality of benchmarking is not good enough and that many benchmarking solutions are not well structured: “We have seen a lot, read a lot, and compared a lot, but those were not good experiences regarding quality. The topic is not structured enough to get good benchmarks” (Participant 3, Telecom). Additionally, many of the available data sources have varying and inconsistent accuracy levels which affect precision and quality of data. Besides, within the individual organisations, these demands for data quality are widely different as organisations value different levels of precision: “It is really ineffective because data quality is not same across companies” (Participant 5, Pharma).

5. Measuring Remains a Challenge. Even though the technical possibilities for data collection are advancing, participants reported that measurement remains challenging, specifically, the

measurement of combined metrics (from the space utilisation, employee data and space design) to get insights, not only about the space, but also about the users. Most participants recognized the added value of such metrics, but they report that in order to combine qualitative and quantitative information about the portfolio which considers both the space and the users, new measurement approaches are required. “Building data is available almost to the minute but data from the users is only available with delay. In surveys a lot gets lost. The data have a different time horizon” (Participant 1, Banking); “Many things can influence a survey. There are too many questions and people burn out; surveys are too long” (Participant 5, Pharma); “There are links between these combined metrics, but it is hard to measure them. The influencing mechanisms are very subtle” (Participant 8, Insurance); “I don’t know any methods to measure this other than surveys. Space utilisation in combination with employee performance would be interesting” (Participant 7, Pharma).

6. Passive Use of Data. Another challenge that surrounds benchmarking practice is turning data into actionable business insights. Most participants reported that they have measurement systems in place and actively collect data on their portfolios, nevertheless, the data is used passively, mostly ad-hoc, as organisations lack the resources to actively transfer data into actionable business knowledge. For example: “[The data] is available daily but no one is looking at it currently” (Participant 1, Banking). This turns benchmarking into a passive source of information that is not always acted upon: “We use benchmarking for information but not for direction” (Participant 5, Pharma). For this reason, organisations have not yet exploited the potential for benchmarking.

7. Demand for New Solutions: Need for Holistic Benchmarking. Participants reported that the focus of their real estate related measurements is shifting from space efficiency to more user related measurements. Main topics that are gaining increased attention are user satisfaction, user performance (productivity), user health and wellbeing, talent retention and user experience: “It is becoming increasingly important what happens outside the Workplace Metrics” (Participant 6, Pharma); “As an organisation, we are in a shift: we don't care about space or workstations, we care about people” (Participant 10, Software). They report the trend is shifting to more integrated measurement solutions, especially in collaboration with other enabling business functions, like human resources and information technology: “If we link space quality and productivity and there is a correlation, the added value is very high” (Participant 3, Telecom); “I need to have the benchmark as information, how does the interaction work (with data from HR and IT, and feedback from everyone in the organisation)” (Participant 10, software). Participants reported the need for holistic benchmarking solutions that focus on combined metrics: “In the past everything was about cost per square metre, today everything is viewed more holistically” (Participant 6, Pharma); “The aim is to get out of the survey business and create more holistic metrics” (Participant 5, Pharma). They indicated single key indicators are not to derive actionable insights. They indicated the key is in the power of combined information. In conjunction with experience, knowledge and intuition, benchmarking is a valuable tool to show the direction in which the real estate portfolio is heading.

5 DISCUSSION

The results of our interview study are consistent with the discussion in the literature. The interest in measuring the added value of the workplace to the business (Petrulaitiene and Jylhä, 2015; Riratanaphong and van der Voordt, 2015) is still an ongoing trend as our study showed that CRE units are continuously aiming to generate business impacts. Our study showed advancements regarding the scope of measurement, and that companies are willing to be more holistic about measuring and go beyond space and financial metrics and adopt a more user

centric approach to measure workplace performance, as suggested by Shamma and Hassan (2013), Kämpf-Dern and Konkol (2017) and Van der Voordt and Jensen (2017). Nevertheless, the lack of adequate instruments (e.g., Riratanaphong and van der Voordt, 2015; Støre-Valen and Lohne, 2016, Zhou et al., 2019; Tagliaro et al. 2021) continues to challenge the implementation of benchmarking. Our findings suggest there is a disconnection between the perceived importance of benchmarking and the actual business practices to implement it. The timing of this study (i.e., with ongoing remote work mandates in summer 2021) could have influenced the forward attitude towards benchmarking reported by participants, as the pandemic confronted organisations with the shortcomings to their monitoring systems. Nonetheless, the understanding that benchmarking is key to measure business performance has long been a core business principle that is not yet widely implemented, at least not in a structured manner, by CRE units and the CRE industry. Although this qualitative study makes it difficult to generalise, the findings suggest that the CRE industry is still lacking solutions that are feasible for implementation. The findings show there is a need for benchmarking solutions that enable organisations to measure workplace performance, to standardise workplace processes and data collection, to increase transparency and comparability, and to generate evidence-based management theories of how the workplace generates business impact beyond the borders of each organisation to move workplace theory forward.

6 CONCLUSION

This paper presented an interview study in which the experiences of workplace and real estate experts with benchmarking were elicited. It was shown that while the added value of benchmarking as a method for measuring the added value of the workplace to the business is widely recognized, the lack of systematic, standardised methods hinders the implementation. The disruption brought by the COVID-19 pandemic has fundamentally changed the business practices of CRE units and highlighted the importance of workplace metrics to support decision making. On the one hand, this study shows the shortcomings that real estate markets are dealing with in terms of methods to measure workplace performance. On the other hand, it shows that the ongoing disruption offers an unprecedented chance to encourage the discussion of evidence-based solutions which measure the value of the workplace to the business.

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REFERENCES

- Adebanjo, D., Abbas, A., Mann, R. (2010), “An investigation of the adoption and implementation of benchmarking”, *International Journal of Operations & Production Management*, 30, 11, 1140-1169. <https://doi.org/10.1108/01443571011087369>
- Altheide, D., Johnson, J., Bloom, L., Lahey, M., Bloor, M., Burgess, R., Clavarino, A., Najman, J., Silverman, D., Cobb, A., Hagemaster, J., Cook, G., Corbin, J., Strauss, A., Crabtree, B., Miller, W., d'Agincourt-Canning, L., Cox, S., Daly, J., West, P (2003) “Transcription quality”, Holstein, J and Gubrium, J (Eds.), *Inside Interviewing*, SAGE Publications, Thousand Oaks, CA, 266-287. <https://dx.doi.org/10.4135/9781412984492>
- Azevedo, V., Carvalho, M., Costa, F., Mesquita, S., Soares, J., Teixeira, F., Maia, Â. (2017), “Interview transcription: conceptual issues, practical guidelines, and challenges”, *Revista De Enfermagem Referência*, 4, 14, 159–168. <https://doi.org/10.12707/RIV17018>

- Battaglia, M.P. (2008), "Purposive Sample", Lavrakas, P.J. (Ed.), *Encyclopaedia of Survey Research Methods*, SAGE Publications, Thousand Oaks, 524-525. <https://doi.org/10.4135/9781412963947>
- Braun, V., Clarke, V. (2006), "Using thematic analysis in psychology", *Qualitative Research in Psychology*, 3, 2, 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Commission for Architecture & the Built Environment (2005), "The impact of office design on business performance", available at: <https://www.designcouncil.org.uk> (accessed 25 March 2022)
- European Committee for Standardisation (2012), Facility Management - Part 7: Guidelines for Performance Benchmarking (European Standard No. BS EN 15221-7:2012). <https://www.en-standard.eu/bs-en-15221-7-2012-facility-management-guidelines-for-performance-benchmarking/>
- Hoendervanger, J. G., Bergsma, F., van der Voordt, T. (2016), "Tools to manage and measure adding value by FM and CREM", van der Voordt, T. & Jensen P. A. (Eds.), *Facilities management and corporate real estate management as value drivers: How to manage and measure adding value*, Routledge, London, 299–322.
- Jensen, P.A., Van der Voordt, T. (2016), *Facilities management and corporate real estate management as value drivers: How to manage and measure adding value*, Routledge, London
- Jones Lang LaSalle (2019), "Benchmarking 101: Why all the fuss?", available at: <https://www.us.jll.com/en/views/benchmarking-101-why-all-the-fuss> (accessed 25 March 2022).
- Kämpf-Dern, A., Konkol, J. (2017), "Performance-oriented office environments – framework for effective workspace design and the accompanying change processes", *Journal of Corporate Real Estate*, 19, 4, 208–238. <https://doi.org/10.1108/JCRE-03-2017-0009>
- Massheder, K., Finch, E. (1998), "Benchmarking methodologies applied to UK facilities management", *Facilities*, 16, 3/4, 99–106. <https://doi.org/10.1108/02632779810205639>
- Miller, R., Casey, M., Konchar, M. (2014), *Change Your Space, Change Your Culture: How Engaging Workspaces Lead to Transformation and Growth*, Wiley, New York.
- Naor, M., Pinto, G. D., Hakakian, A. I., Jacobs, A. (2022), "The impact of COVID-19 on office space utilisation and real-estate: a case study about teleworking in Israel as new normal", *Journal of Facilities Management*, 20, 1, 32-58. <https://doi.org/10.1108/JFM-12-2020-0096>
- Petrulaitiene, V., Jylhä, T. (2015), "The perceived value of workplace concepts for organisations", *Journal of Corporate Real Estate*, 17, 4, 260-281. <https://doi.org/10.1108/JCRE-06-2015-0014>
- Riratanaphong, C., van der Voordt, T., Sarasoja, A. (2012), "Performance measurement in the context of CREM and FM", Jensen, P.A., van der Voordt, T., & Coenen, C. (Eds.), *The Added Value of Facilities Management: Concepts, Findings and Perspectives*, Polyteknisk Forlag, Lyngby
- Riratanaphong, C., van der Voordt, T. (2015), "Measuring the added value of workplace change: Performance measurement in theory and practice", *Facilities*, 33, 11/12, 773-792. <https://doi.org/10.1108/F-12-2014-0095>
- Shamma, H., Hassan, S. (2013), "Customer-driven benchmarking", *Benchmarking: An International Journal*, 20, 3, 377–395. <https://doi.org/10.1108/14635771311318144>
- Steiner, J. (2006), "The art of space management", *Journal of Facilities Management*, 4,1, 6–22. <https://doi.org/10.1108/14725960610644195>
- Stoy, C., Kytzia, S. (2005), "Office building efficiency and capacity benchmarks", *Facilities*, 23, 1/2, 16–30. <https://doi.org/10.1108/02632770510575875>

- Støre-Valen, M., Lohne, J. (2016), “Analysis of assessment methodologies suitable for building performance”, *Facilities*, 34, 13/14, 726-747. <https://doi.org/10.1108/F-12-2014-0103>
- Tagliaro, C. (2018a), *A Place for the Workplace to Work. A system of performance indicators for strategic design, management and use of the workplace [unpublished doctoral dissertation]*, Politecnico di Milano, Milan.
- Tagliaro, C. (2018b), “Workplace performance in Italy: key indicators from key users”, paper presented at Transdisciplinary Workplace Research Conference, 19-21 September, Tampere.
- Tagliaro, C., Zhou, Y., Hua, Y. (2021), “A change in granularity: measure space utilisation through smart technologies”, *Facilities*, 39, 1/2, 64-79. <https://doi.org/10.1108/F-08-2019-0093>
- Zhou, Y., Tagliaro, C., Hua, Y. (2019), “From Hour to Minute: Non-technical Challenges for Measuring Office Space Utilisation with Smart Technologies” Paper presented at CIB World Building Congress 2019 ‘constructing smart cities’, 17-21 June, Hong Kong.
- van der Voordt, T. J.M., Jensen, P. A. (2018), Measurement and benchmarking of workplace performance. *Journal of Corporate Real Estate*, 20(3), 177–195. <https://doi.org/10.1108/JCRE-10-2017-0032>

SESSION 3A: CRITICAL THINKING AND WORKING ENVIRONMENTS

Workplace affordances of social well-being: a conceptual framework

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ABSTRACT

The prolonged working from home during the recent pandemic has increased awareness of the social function of the office: employees missed informal social interaction with co-workers, face-to-face meetings, and spontaneous encounters. If the trend of hybrid working persists, one of the main functions of the physical office will be to support face-to-face interaction and social bonding for increasing well-being, innovation, and organisational commitment. This short paper explores how workplace design could support the social well-being of its users based on established theory in the field of environmental psychology. First, individual social well-being at work and social workplace affordances are defined. Next, workplace affordances for social well-being are deduced from theories on the psychology of space, such as Space syntax theory, Privacy regulation theory, Behaviour setting theory, and Place attachment theory. From this analysis, three categories of workplace design features are induced which could support social well-being at work: interaction affordances, privacy affordances, and identity affordances. A conceptual framework is presented that connects social well-being components to these three categories of affordances. This framework can serve as a starting point for the collection of empirical studies, the deduction of specific social affordances from design practice, and the development of design strategies for enhancing social well-being in offices.

Keywords

Workplace design, Affordances, Social interaction, Privacy, Sense of community.

1 INTRODUCTION

The forced working from home during the COVID-19 pandemic confirmed that the advantages of remote working are a better work-life balance, improved work efficiency and increased flexibility and autonomy (Babapour Chafi et al., 2021; Ipsen et al., 2021). However, to fulfil the human need for connectedness, build trust for collaboration, and support creative processes, in-person interaction at the office is still required. Sander et al. (2021) conclude that as the availability of devices for remote work increases, proximity in face-to-face interaction becomes even more important. Face-to-face communication is essential to maintaining social relationships with co-workers (Nardi & Whittaker, 2002). Although online connections can protect from the harm of social isolation, their benefits are limited and online relationships do not foster well-being (Marinucci et al., 2022). Already in the early stages of the pandemic, many office workers wanted to return to their office, most of all because they missed people-

related activities, such as meetings, socialising with colleagues, spontaneous face-to-face interaction and feeling part of the community (Gensler Research Institute, 2020). In several studies, people considered isolation from colleagues among the biggest challenges while working from home (Babapour Chafi et al., 2021; Marzban et al., 2021). The homeworkers' thwarted needs refer to social well-being, which is an essential component of an individual's health (WHO, 2006) and subjective well-being (Gallagher et al., 2009). Hybrid working, i.e. alternating working from home with working at the office, may better fulfil workers' social needs if they work at the office regularly and for entire days on end, and do not just come in for meetings, to increase opportunities for spontaneous encounters. This means that the office has to attract people by offering workspaces that can compete with the home office for quiet, privacy and ambience, and make up for disadvantages such as commuting time by offering ample opportunities for socialising and feeling part of a community (Appel-Meulenbroek et al., 2022; Colenberg & Keyson, 2021; Leesman, 2021). How can we create social offices that attract employees and support their social well-being? The research on the relationship between social well-being and the physical work environment is limited and scattered across disciplines. This paper aims to provide a scope for further research. First, social well-being at work and workplace affordances are defined. Then, relevant and established theories in the field of environmental psychology are discussed. From these theoretical perspectives, social affordances are deducted and connected to components of social well-being at work. The presented conceptual framework can guide future research, for example, the collection and analysis of published studies and assessment of design practices.

2 SOCIAL WELL-BEING AT WORK

According to Fisher (2014), social well-being at work consists of 'feeling embedded in meaningful communities and having satisfying short-term interactions and long-term relationships with others.' This definition includes long-term eudaimonic well-being, which refers to the experience of growth, purpose and engagement, and hedonic well-being, which includes judgments of satisfaction, and experience of positive and negative moods and emotions. It may comprise the fulfilment of employees' social needs, such as feeling connected and having joyful encounters, affective responses to the behaviour of others, such as incivility and territorial behaviours, and the experience of co-presence with implications for crowding and privacy (Colenberg et al., 2020). The social well-being component of embeddedness refers to belongingness (Malone et al., 2012), or fulfilment of the innate need to belong (Baumeister & Leary, 1995). At work, a meaningful community may be a formal team, department or organisation, or an informal group of co-workers. Hagerty and Patusky (1995) view a sense of belonging as the experience of fit and valued involvement in relationships. They found that contact and fit with friends and shared backgrounds and experiences create belongingness. At work, feeling embedded may include a sense of community, group cohesion, and affective and normative organisational commitment (Fisher, 2014), while social exclusion and ostracism may undermine embeddedness and lead to loneliness. A sense of community results from feelings of inclusion, importance, mutual benefit, and shared emotions with others at work (Blatt & Camden, 2007). On the other hand, negative relationships undermine workgroup cohesion (Morrison, 2008). In summary, these studies imply that feelings of embeddedness result from positive social interactions and positive interpersonal relationships. Social interaction includes verbal and non-verbal behaviour, such as seeing, hearing and smelling other people, eye contact and smiling or 'dirty looks'. It ranges from mere co-presence to communication in person or through media, and it can be one-on-one or in a group. Additionally, social interaction can be contextual, forming a background to individual activities, or enabling the transmission of information (De Jaegher et al., 2010). At work,

positive interactions support the experience of vitality, feeling appreciated and useful, and they aid in building and maintaining relationships (Stephens et al., 2011). Positive relationships provide emotional and instrumental social support (Dutton & Ragins, 2007). Unwanted social interactions at work can cause noise annoyance (Di Blasio et al., 2019), which may be expressed in negative social behaviour. Negative interactions, such as incivility and disrespect, lead to dissatisfaction with co-workers and psychological distress (Cortina et al., 2001). This indicates that not only the quantity and quality of social interactions at work but also their control influence the development of relationships and embeddedness.

3 SOCIAL WORKPLACE AFFORDANCES

The above conceptualization implies that to enhance social well-being at work, the workplace design should facilitate positive social interactions, support building and maintaining relationships, and evoke a sense of community and feelings of belonging. Additionally, the workplace should aid the prevention of negative social interactions and feelings of alienation. On the one hand, positive interactions can be facilitated by promoting the onset of social interactions at desired times or places. It could even include offering positive conversation topics. Disturbing others should be prevented to limit negative experiences of social interaction. On the other hand, facilitating positive interactions includes offering circumstances for longer and more intimate conversations that deepen relationships and foster belongingness. Characteristics of a physical environment or artefact that, in the eye of the user, enable or constrain certain behaviour are called affordances. Originally, affordances were considered to arise from direct perception. Gibson (1977) defined them as what the environment offers the user, ‘what it provides or furnishes, either for good or for ill’. However, since the introduction of the concept of affordance to the design community by Norman (1988), it has taken on a variety of different meanings (McGrenere & Ho, 2000). Still and Dark (2013) consider all affordances to be *perceived* affordances resulting from a mixture of automatic perception and cultural processes. Their conceptualization aligns with Gibson’s affordances as being dynamic and relational, and not fixed properties of a design. Additionally, they recognize that affordances can shape but never fully determine behaviour. As a subcategory of perceived affordances, Fayard and Weeks (2007) introduced the notion of *social* affordances of a work environment. They define them as ‘the social and physical characteristics that produce the propinquity, privacy, and social designation necessary for an environment to afford informal interactions.’ Similarly, Spreitzer et al. (2020) consider social affordances promoted opportunities for social connection at work. They argue that by activating prosocial behaviour and evoking prosocial emotions, the workplace design can stimulate the experience of high-quality connections and the development of positive relationships at work. Their examples include coffee bars and food spaces, affordances that signal an etiquette of quiet in certain work areas, opportunities for playful engagement, workspace personalization for social engagement, and team boundaries to strengthen the sense of belonging. Although Spreitzer et al. (2020) consider identity affordances a different category, it can be argued that these also promote social connection. Visual communication about group identity may enhance a sense of community, for example, by internal branding or display of team accomplishments. Symbols and objects in the physical work environment communicate organisational culture and values (Augustin, 2009; Elsbach & Pratt, 2007). The workplace design can signal activities and meaning, which lead to subtle changes in behaviour (Sander et al., 2019). Affordances can function as a nudge for social behaviour, for example by making it attractive and easy, referring to social norms, and prompting people at places where they are likely to be most receptive to it (Service et al., 2015). Nudging could be used to, for example, encourage informal interaction in dedicated social office spaces and promote quiet in areas for concentration work, for example

through visual communication. However, to our knowledge, the application of nudging to steer social behaviour through workplace design has not been studied yet. Reported examples of nudging through workplace design seem to be limited to physical exercise, food choice, energy use, recycling behaviour, and adherence to safety and hygiene rules (Venema & van Gestel, 2021).

4 THEORETICAL PERSPECTIVES OF SOCIAL AFFORDANCES

The field of environmental psychology comprises several psychology-of-space theories that tap into the influence of spatial design on the social behaviour and well-being of its users. Table 1 summarises the propositions of nine established theories and lists possible social workplace affordances that follow from the propositions and applications of each theory. Below the table, the affordances are grouped and their theoretical basis is discussed. Theories that may apply to social behaviour at work but were not developed to explain socio-physic relationships were excluded.

Table 1. Overview of established environmental psychology theories and related affordances for social well-being at work

<i>Theory (founders)</i>	<i>Theoretical propositions</i>	<i>Social workplace affordances</i>
Behaviour setting theory (Barker, 1968)	Social and physical features of a place (spatial unit) are related to consistent patterns of behaviour in that place	Visual communication of rules, customs and typical activities in the office space; adequate room capacity
Personal space theory (Sommer, 1969)	People have a dynamic and mobile territory around them that others may not enter	Ample or adjustable seat distance, back height, seat positioning, and size of rooms and corridors
Behaviour constraint model (Proshansky et al., 1970)	Perceived loss of control by environmental limits or interference leads to reactance and learned helplessness	Preventing obstruction or restriction of desired (social) activities; providing freedom of choice and adaptability
Defensible space theory (Newman, 1972)	Semi private spaces create a sense of ownership, allow for surveillance, and promote social cohesion	Clear boundaries, possibilities for personalization, visual accessibility
Privacy regulation theory (Altman, 1975)	People need to be able to regulate the level of social interaction to prevent feelings of crowding and stress	Enclosure to enable visual, physical or acoustical withdrawal alone or with a small group; boundary control
Environmental stress model (Lazarus & Folkman, 1984)	Daily hassles and ambient stressors can add up to serious stress levels when the benefits of coping are limited	Adequate ergonomics, including bodily, thermal, visual and acoustical comfort
Space syntax theory (Hillier & Hanson, 1984)	Spatial configuration explains how people move through, experience, and use places	Sightlines, crossing routes, physical accessibility, centrality or isolation
Territoriality theory (Brown, 1987)	Instinct and culture jointly lead to claims and defence of space, depending on setting and resources	Communication of ownership and customs, group identity markers, boundary control
Place attachment theory (Altman et al., 1992)	People can feel cognitive-emotional bonds with places and their visitors, which leads to proximity seeking	Clear place identity, room for gathering, appropriate ambience for social activities

4.1 Interaction: facilitating and stimulating social encounters

Among the listed theories, space syntax theory is the most explicit at connecting spatial characteristics to the frequency of social interaction. It suggests that the layout and enclosure of spaces and the connections between them determine the degree of physical and visual accessibility, which in turn influence people's eye contact, movement, and gathering. At office workplaces, the spatial configuration can increase random contacts, unplanned encounters, co-presence, and eye contact, and predict social network relations (Sailer & Koutsolampros, 2021). For example, having a large number of desks in their field of vision or behind their back negatively affects workers' team identity and cohesion (Sailer et al., 2021). Apart from spatial arrangement and openness, also presence or arrangement of objects and furniture may encourage social interaction. Osmond hypothesised that sociopetal seating arrangements where people face each other foster social interaction whereas sociofugal arrangements with people facing outwards hinder interaction. However, Gifford (1981) found no relation between sociopetal seating and sociability. William Whyte (1980) identified design features that promote social interaction in public places, for example, available seating, fountains, food stands, trees, activities to watch, and shelter. Like other principles of urban design, these examples could also be useful to office design. At a more general level, behaviour setting theory explains that the design of an environment creates patterns of behaviour and vice versa. In this perspective, workplace design can guide social interactions by communicating to what extent it is possible, allowed, or appreciated to approach others and have conversations in certain spaces. These affordances could be visual communication that guides social activities or physical features that enable proximity, eye contact, and specific types of conversations. People usually respond to the cues, try to take a role and conform to the rules and customs of the setting (Scott, 2005). In contrast, people may not use spaces when they do not understand which behaviour is acceptable, for example, regarding breakout spaces in offices (Oseland, 2009). Indirectly, stress caused by the environment can inhibit social interactions or change them from positive to negative experiences. Environmental stressors, such as noise and crowding, are known to reduce helping behaviour and increase aggression and withdrawal from social interaction (Gatersleben & Griffin, 2017), while the absence of those stressors increases the chances that people want to spend time in that particular environment. According to the behaviour constraint model, people will especially suffer from stress if they experience or expect the environment to hinder the desired social activities or the desired level of privacy, and they cannot change the situation. Affordances for freedom of choice (Proshansky et al., 2004) will therefore increase perceived control and reduce stress, which benefits social interaction and bonding.

4.2 Privacy: regulation of social interactions and reduction of negative effects

Affordances that facilitate desired interaction could be turned around to discourage or restrict unwanted social interactions and create intimacy. Expression of annoyance about unwanted interaction can undermine social well-being, whereas group privacy affords interpersonal bonding, increasing social well-being. In addition to the theoretical perspectives on increasing social interaction, several theories specifically address the regulation of interactions, which may reduce the risk of negative experiences of interaction. Privacy regulation theory considers privacy a dynamic process of seeking or avoiding social interaction to achieve the desired level of interaction according to circumstances and individual preferences. Too little privacy results in feelings of crowding and too much privacy creates social isolation. A recent conceptualization of perceived privacy at work includes control over how much others can see or hear of you and the absence of unwanted sound and proximity of other people (Weber et al., 2021). This means that office users need to have control of access from and to others. One way of privacy control may be seat choice. The theory of prospect and refuge (Appleton, 1984),

rooted in evolutionary psychology, states that people prefer places from which they can see over a large area and where they feel protected against possible enemies, as the human brain is calibrated to a savanna-like environment. This theory would imply that privacy affordances include long sightlines and back cover while seated or talking/working standing-up. However, there is limited evidence for this theory in application to design (Dosen & Ostwald, 2012). Altman (1975) proposed personal space and territoriality as mechanisms to control the level of privacy. Personal space is an invisible and mobile territory in a circular shape (Hecht et al., 2019) which people try to maintain towards others to prevent discomfort. Its size depends on the level of acquaintance with the other and therefore is dynamic. Hall's proxemic framework (1966) defines the preferred proximity of acquaintances, e.g. co-workers, as between 1.20 and 3.60 metres, while friends can come closer. Territoriality theory (Brown, 1987), applied to organisations (Brown et al., 2005), implies that the work environment should afford personalization and expression of ownership. Defensible space theory proposes that surveillance opportunities and territory markers reduce anti-social behaviour (Gifford, 2014), whereas the application of space syntax identified spatial isolation, not the reduction of accessibility, as a risk for negative encounters (Reynald & Elffers, 2009).

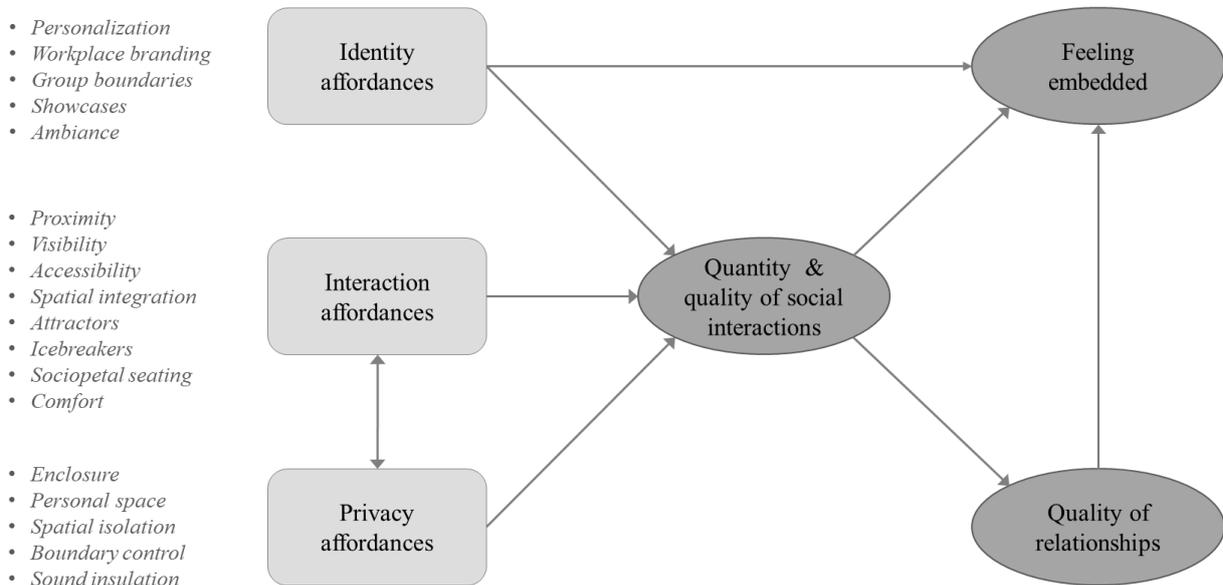
4.3 Identity: communication of group values and customs

Several theories indicate that the experience of embeddedness can be supported by the expression of group identity and physical or symbolic boundaries. Behaviour setting theory indicates that clear setting boundaries and expression of customs within them, provide users with a role to play in that setting, making them part of a small-scale social group (Popov & Chompalov, 2012). In organisations, identity marking of spatial territories raises a sense of belonging to social groups and can prevent conflicts (Brown et al., 2005). Affordances for personalization of workspaces therefore may support embeddedness and reduce negative interactions related to the use of office space. According to defensible space theory, symbolic barriers that communicate ownership, such as greenery, signage and other territorial markers, create a sphere of control where the behaviour of users is limited by social norms, while social bonds have been found to reinforce territorial behaviour (Reynald & Elffers, 2009). Clear boundaries and the identity of a place facilitate place attachment. Place attachment refers to people-place bonding, but the concept's definition has been ambivalent. The currently most promising conceptualization (Di Masso et al., 2017) explains how a person, as an individual or a member of a social group, can feel an emotional, cognitive or behavioural connection to a place regarding its physical and social qualities (Scannell & Gifford, 2010). This means that place attachment can be rooted in social ties or stem from aesthetics or functional qualities that fulfil the user's needs. Psychological ownership, e.g. through personalization, and time spent in a place predict place attachment, and frequent social interactions are important (Gifford, 2014). Place attachment leads to proximity-seeking behaviour which further strengthens the bonding. It decreases after long periods of separation (Scannell et al., 2021).

5 CONCEPTUAL FRAMEWORK

The following framework (Fig. 1) connects the social workplace affordances that were identified based on the theories about environment and behaviour to the components of social well-being.

Figure 1. Conceptual framework of relationships between categories of workplace affordances and components of social well-being at work



Social interactions have a central position in this framework. As explained in section 2, social interactions create and maintain embeddedness and relationships. From the theories in section 4, interaction affordances were deduced that create opportunities for interactions, for example by facilitating co-location and visibility of workers, stimulating encounters and providing elements that spark conversations. Privacy affordances aid regulation of the number of interactions, for example by providing boundary or access control and places to hide if desired. Both identity affordances and privacy affordances can reduce the risk of negative encounters by establishing physical or symbolic territories. Additionally, identity affordances can provide conversation topics. More directly, identity affordances can support a sense of community by facilitating the expression of group values and showcasing accomplishments. Since affordances for interaction can limit satisfaction with privacy and vice versa (Kim & de Dear, 2013), it may be necessary to separate spaces for spontaneous interactions from spaces for intimate conversations and private calls. The next step towards further development of this framework could be a systematic search of empirical studies that studied examples of these types of affordances and provide evidence of their effect on short-term and long-term social well-being. This search should expand from the field of interior design to product design, human factors, architecture, and environmental psychology, which is transdisciplinary by nature. Additionally, research on urban design, retail design and consumer behaviour may provide useful examples of affordances for interaction and identity, whereas research on hospitals and doctor's offices may provide examples of privacy affordances. Another step would be the identification of intervening variables within the relationship between workplace affordances and social behaviour. In environmental psychology, it is recognized that the physical environment can increase the probability of certain behaviour, but will not determine it. According to the eclectic model of Bell et al. (2001), factors that influence the perception of the actual workplace design are individual differences, such as preferences and disabilities, situational factors, such as work tasks or workload, social conditions, such as social climate at work, and cultural factors, such as work ethics. For example, Budie et al. (2019) demonstrated that both personal characteristics and workspace type affect workplace satisfaction, either directly or mediated by individual needs that depend on work activity.

6 CONCLUSION

This paper explored the relationship between components of social well-being at work and affordances of the workplace. Established theories in the field of environmental psychology were used to identify social workplace affordances. These theories show that social well-being at work can be enhanced by providing affordances for social interaction, privacy regulation and expression of group identity. The conceptual framework resulting from the theoretical exploration can serve as a start for further research on workplace design for social well-being, such as collecting evidence and identifying mediators.

REFERENCES

- Altman, I. (1975), *The environment and social behaviour: Privacy, personal space, territory, and crowding*. Brooks/Cole Publishing Company.
- Altman, I., Low, S. M., Altman, I. (1992), Place attachment. In *Place Attachment*. Plenum. https://doi.org/10.1007/978-1-4684-8753-4_1.
- Appel-Meulenbroek, R., Kemperman, A., van de Water, A., Weijs-Perrée, M., Verhaegh, J. (2022), How to attract employees back to the office? A stated choice study on hybrid working preferences. *Journal of Environmental Psychology*, 81, 101784. <https://doi.org/10.1016/j.jenvp.2022.101784>.
- Appleton, J. (1984), Prospects and refugees re-visited. *Landscape Journal*, 3, 91–103. <https://doi.org/10.2307/43322970>.
- Augustin, S. (2009), *Place advantage. Applied psychology for interior architecture* (1st ed.). Wiley & Sons.
- Babapour Chafi, M., Hultberg, A., Bozic Yams, N., Molina-Sánchez, H., Giorgi, G., Guajardo, D. C., Ariza-Montes, A., Chafi, M. B., Hultberg, A., Yams, N. B. (2021), Post-pandemic office work: Perceived challenges and opportunities for a sustainable work environment. *Sustainability*, 14(1), 294. <https://doi.org/10.3390/su14010294>.
- Barker, R. G. (1968), *Ecological psychology*. Stanford University Press.
- Baumeister, R. F., Leary, M. R. (1995), The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3), 497–529.
- Bell, P. A., Greene, T. C., Fisher, J. D., Baum, A. (2001), *Environmental psychology, 5th New edition* (5th ed.). Taylor & Francis.
- Blatt, R., Camden, C. T. (2007), Positive relationships and cultivating community. In J. E. Dutton, B. R. Ragins (Eds.), *Exploring Positive Relationships at Work: Building a Theoretical and Research Foundation*. (pp. 243–264). Lawrence Erlbaum.
- Brown, B. (1987), Territoriality. In D. Stokols & I. Altman (Eds.), *Handbook of environmental psychology* (pp. 505–531). Wiley-Interscience.
- Brown, G. (2009), Claiming a corner at work: Measuring employee territoriality in their workspaces. *Journal of Environmental Psychology*, 29(1), 44–52. <https://doi.org/10.1016/j.jenvp.2008.05.004>
- Brown, G., Lawrence, T. B., Robinson, S. L. (2005), Territoriality in organisations. *Academy of Management Review*, 30(3), 577–594.
- Budie, B., Appel-Meulenbroek, R., Kemperman, A., Weijs-Perree, M. (2018), Employee satisfaction with the physical work environment: The importance of a need based approach. *International Journal of Strategic Property Management*, 23(1), 36–49. <https://doi.org/10.3846/ijspm.2019.6372>
- Colenberg, S., Appel-Meulenbroek, R., Romero Herrera, N., Keyson, D. (2020), Conceptualization of social well-being in activity-based offices. *Journal of Managerial Psychology*, 36(4), 327–343. <https://www.emerald.com/insight/content/doi/10.1108/JMP-09-2019-0529/full/html>

- Colenberg, S., Keyson, D. (2021), Expected user needs towards the post-Covid office: better support of social interactions and concentration. *The Proceedings of the 20th EuroFM Research Symposium 2021*.
- Cortina, L. M., Magley, V. J., Williams, J. H., Langhout, R. D. (2001), Incivility in the workplace: incidence and impact. *Journal of Occupational Health Psychology*, 6(1), 64–80. <https://doi.org/10.1037/1076-8998.6.1.64>
- De Jaegher, H., Di Paolo, E., Gallagher, S. (2010), Can social interaction constitute social cognition? *Trends in Cognitive Sciences*, 14(10), 441–447. <https://doi.org/10.1016/j.tics.2010.06.009>
- Di Blasio, S., Shtrepi, L., Puglisi, G. E., Astolfi, A. (2019), A cross-sectional survey on the impact of irrelevant speech noise on annoyance, mental health and well-being, performance and occupants' behaviour in shared and open-plan offices. *International Journal of Environmental Research and Public Health*, 16(2). <https://doi.org/10.3390/ijerph16020280>
- Di Masso, A., Dixon, J., Hernández, B. (2017), Place attachment, sense of belonging and the micro-politics of place satisfaction. In G Fleury-Bahi, E. Pol, & O. Navarro (Eds.), *Handbook of environmental psychology and quality of life research* (pp. 65–84). Springer International Publishing.
- Dosen, A. S., Ostwald, M. J. (2012), Testing prospect-refuge theory: A comparative methodological review. *46th Annual Conference of the Architectural Science Association*.
- Dutton, J. E., Ragins, B. R. (2007), Positive relationships at work: an introduction and invitation. In J. E. Dutton, B. R. Ragins (Eds.), *Exploring positive relationships at work* (pp. 3–25). Lawrence Erlbaum.
- Elsbach, K. D., Pratt, M. G. (2007), The Physical Environment in Organisations. *The Academy of Management Annals*, 1(1). <https://doi.org/10.1080/078559809>
- Fayard, A.-L., Weeks, J. (2007), Photocopiers and water-coolers: The affordances of informal interaction. *Organisation Studies*, 28(5), 605–634. <https://doi.org/10.1177/0170840606068310>
- Fisher, C. D. (2014), Conceptualising and measuring wellbeing at work. In P. Y. Chen & C. L. Cooper (Eds.), *Wellbeing: A complete reference guide, work and wellbeing* (pp. 9–34). Wiley Blackwell. <https://doi.org/10.1002/9781118539415.wbwell018>
- Gallagher, M. W., Lopez, S. J., Preacher, K. J. (2009), The hierarchical structure of well-being. *Journal of Personality*, 77(4), 1025–1050. <https://doi.org/10.1111/j.1467-6494.2009.00573.x>
- Gatersleben, B., Griffin, I. (2017), Environmental stress. In Ghazlane Fleury-Bahi, E. Pol, & E. P. Navarro (Eds.), *Handbook of environmental psychology and quality of life research* (pp. 469–574). Springer.
- Gensler Research Institute (2020), *Back to the Office. U.S. Work from home survey 2020*. <https://www.gensler.com/gri/uk-workplace-survey-2020>
- Gibson, J. J. (1977), The theory of affordances. In R. E. Shaw & J. Bransford (Eds.), *Perceiving, Acting, and Knowing*. (pp. 67–82). Lawrence Erlbaum.
- Gifford, R. (1981), Sociability: Traits, settings, and interactions. *Journal of Personality and Social Psychology*, 41(2), 340–347. <https://doi.org/10.1037/0022-3514.41.2.340>
- Gifford, R. (2014), *Environmental Psychology: Principles and Practice* (5th ed.). Optimal Books.
- Hagerty, B. M. K. K., Patusky, K. (1995), Developing a measure of sense of belonging. *Nursing Research*, 44(1), 9–13. <https://doi.org/10.1097/00006199-199501000-00003>
- Hall, E. T. (1966), *The hidden dimension*. Anchor Books.
- Hecht, H., Welsch, R., Viehoff, J., Longo, M. R. (2019), The shape of personal space. *Acta Psychologica*, 193, 113–122. <https://doi.org/10.1016/j.actpsy.2018.12.009>

- Hillier, B., Hanson, J. (1984), *The social logic of space*. Cambridge university press.
- Ipsen, C., van Veldhoven, M., Kirchner, K., Hansen, J. P. (2021), Six key advantages and disadvantages of working from home in Europe during COVID-19. *International Journal of Environmental Research and Public Health*, 18(4), 1–19. <https://doi.org/10.3390/IJERPH18041826>
- Kim, J., de Dear, R. (2013), Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *Journal of Environmental Psychology*, 36, 18–26. <https://doi.org/10.1016/j.jenvp.2013.06.007>
- Lazarus, R. S., Folkman, S. (1984), *Stress, appraisal, and coping*. Springer.
- Leesman (2021), *Workplace 2021: Appraising future-readiness*. <https://www.leesmanindex.com/workplace-2021-appraising-future-readiness-launch/>
- Malone, G. P., Pillow, D. R., Osman, A. (2012), The General Belongingness Scale (GBS): Assessing achieved belongingness. *Personality and Individual Differences*, 52(3), 311–316. <https://doi.org/10.1016/j.paid.2011.10.027>
- Marinucci, M., Pancani, L., Aureli, N., Riva, P. (2022), Online social connections as surrogates of face-to-face interactions: A longitudinal study under COVID-19 isolation. *Computers in Human Behaviour*, 128, 107102. <https://doi.org/10.1016/j.chb.2021.107102>
- Marzban, S., Durakovic, I., Candido, C., Mackey, M. (2021), Learning to work from home: experience of Australian workers and organisational representatives during the first COVID-19 lockdowns. *Journal of Corporate Real Estate*, 23(3), 203–222. <https://doi.org/10.1108/JCRE-10-2020-0049>
- McGrenere, J., Ho, W. (2000), Affordances: Clarifying and Evolving a Concept. *Proceedings of Graphics Interface 2000*.
- Morrison, R. (2008), Negative relationships in the workplace: Associations with organisational commitment, cohesion, job satisfaction and intention to turnover. *Journal of Management & Organisation*, 14(4), 330–344. <https://doi.org/10.1017/S1833367200003126>
- Nardi, B. A., Whittaker, S. (2002), The place of face-to-face communication in distributed work. In P. Hinds, S. B. Kiesler (Eds.), *Distributed work* (pp. 83–112). MIT Press.
- Newman, O. (1972), *Defensible space*. Macmillan.
- Norman, D. A. (1988), *The psychology of everyday things*. Basic Books.
- Oseland, N. (2009), The impact of psychological needs on office design. In *Journal of Corporate Real Estate* (Vol. 11, Issue 4, pp. 244–254). <https://doi.org/10.1108/14630010911006738>
- Popov, L., Chompalov, I. (2012), Crossing over: The interdisciplinary meaning of behaviour setting theory. *International Journal of Humanities and Social Science*, 2(19), 18.
- Proshansky, H. M., Ittelson, W. H., Rivlin, L. G. (1970), *Environmental psychology - Man and his physical setting*. Holt, Rinehart and Winston. <https://www.ojp.gov/ncjrs/virtual-library/abstracts/environmental-psychology-man-and-his-physical-setting>
- Proshansky, Harold M., Ittelson, W. H., Rivlin, L. G. (2004), Freedom of choice and behaviour in a physical setting. In *Environment and the social sciences: Perspectives and applications*. (pp. 29–43). American Psychological Association. <https://doi.org/10.1037/10045-003>
- Reynald, D. M., Elffers, H. (2009), *The Future of Newman's Defensible Space Theory Linking Defensible Space and the Routine Activities of Place*. 6(1), 25–46. <https://doi.org/10.1177/1477370808098103>
- Rietveld, E., Rietveld, R., Martens, J. (2019), Trusted strangers: social affordances for social cohesion. *Phenomenology and the Cognitive Sciences*, 18, 299–316. <https://doi.org/10.1007/s11097-017-9554-7>
- Sailer, K., Koutsolampros, P. (2021), Space syntax theory: Understanding human movement, co-presence and encounters in relation to the spatial structure of workplaces. In R. Appel-

- Meulenbroek & V. Danivska (Eds.), *A Handbook of Theories on Designing Alignment between People and the Office Environment*, pp. 248–260, Routledge.
- Sailer, K., Koutsolampros, P., Pachilova, R. (2021), Differential perceptions of teamwork, focused work and perceived productivity as an effect of desk characteristics within a workplace layout. *PLoS ONE*, 16(4), e0250058. <https://doi.org/10.1371/journal.pone.0250058>
- Sander, E. (Libby) J., Rafferty, A., Jordan, P. J. (2021), Escaping the cubicle: Exploring the physical work environment of the home. In Wheatley, Daniel, I. Hardill, & S. Buglass (Eds.), *Handbook of research on remote work and worker well-being in the Post-COVID-19 era* (pp. 181–201). IGI Global. <https://doi.org/10.4018/978-1-7998-6754-8.ch01>
- Sander, E. J., Caza, A., Jordan, P. J. (2019), Psychological perceptions matter: Developing the reactions to the physical work environment scale. *Building and Environment*, 148, 338–347. <https://doi.org/10.1016/j.buildenv.2018.11.020>
- Scannell, L., Gifford, R. (2010), Defining place attachment: A tripartite organising framework. *Journal of Environmental Psychology*, 30(1), 1–10. <https://doi.org/10.1016/j.jenvp.2009.09.006>
- Scannell, L., Williams, E., Gifford, R., Sarich, C. (2021), Parallels between interpersonal and place attachment: An update. In L. C. Manzo & P. Devine-Wright (Eds.), *Place attachment: Advances in theory, methods, and applications* (2nd ed., pp. 45–60). Routledge.
- Scott, M. M. (2005), A powerful theory and a paradox: Ecological psychologists after Barker. *Environment and Behaviour*, 37(3), 295–329. <https://doi.org/10.1177/0013916504270696>
- Service, O., Hallsworth, M., Halpern, D., Algate, F., Gallagher, R., Nguyen, S., Ruda, S., Sanders, M. (2015), *EAST: Four simple ways to apply behavioural insights*. https://www.bi.team/wp-content/uploads/2015/07/BIT-Publication-EAST_FA_WEB.pdf
- Sommer, R. (1969), *Personal space: The behavioural basis of design*. Prentice Hall.
- Spreitzer, G., Bacevice, P., Garrett, L. (2020), Workplace design, the physical environment, and human thriving at work. In O. B. Ayoko & N. M. Ashkanasy (Eds.), *Organisational Behaviour and the Physical Environment* (pp. 235–250). Routledge.
- Still, J. D., Dark, V. J. (2013), Cognitively describing and designing affordances. *Design Studies*, 34(3), 285–301. <https://doi.org/10.1016/j.destud.2012.11.005>
- Thaler, R. H., Sunstein, C. R. (2008), *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press. <https://doi.org/10.1007/s10602-008-9056-2>
- Venema, T., van Gestel, L. (2021), Nudging in the workplace: Facilitating desirable behaviour by changing the environment. In R. Appel-Meulenbroek & V. Danivska (Eds.), *A handbook of theories on designing alignment between people and the office environment* (1st ed., pp. 222–235). Routledge.
- Weber, C., Gatersleben, B., Degenhardt, B., Windlinger, L. (2021), Privacy Regulation Theory. *A Handbook of Theories on Designing Alignment between People and the Office Environment*, 68–81. <https://doi.org/10.1201/9781003128830-6>
- WHO (2006), *Constitution of the World Health Organisation*. Retrieved from: https://www.who.int/governance/eb/who_constitution_en.pdf
- Whyte, W. H. (1980), *The social life of small urban spaces*. The Conservation Foundation.

The Evolution of Workplaces and the Meaning of Work from the Industrial Revolution to Pandemic Times. A Critical Perspective

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ABSTRACT

The distribution of work has been evolving, especially after the COVID-19 pandemic. Activity-based and multi-located approaches date back to the 1990s, entailing people not to perform all their tasks at the same desk all day long but moving around the office and the territory at large, as their tasks change. This has both advantages and disadvantages. However, in the wake of the pandemic, more and more companies have allowed their employees to work from home or other places for multiple days a week, especially for concentrative work, while they are redesigning the company office as mainly a place for networking and collaboration. The leading assumption is that employees who are granted the freedom to choose where and when to work are happier and, therefore, more productive. A question arises though regarding the future of work: are we going back to a spatial model that suggests a tayloristic approach to the organisation of work? Or is this differentiation of spaces a way to grant employees more freedom of choice? This paper discusses the changing structure of the spatial experience of work and how this depends and, in turn, reflects on alienating dynamics and individuals' autonomy. It presents a brief history of the evolution of workplaces and the meaning of work from both a spatial and a philosophical point of view. After an overview of the initiatives undertaken during the emergency phase of the pandemic, changing working methods and spaces, it presents the case of a multinational telecommunications company as an example of how workplace strategies and workspaces are being reorganised. The paper concludes by proposing a few directions to ensure that the new working arrangements following the pandemic do not create further alienating dynamics, but rather better meet workers' needs and autonomy of choice.

Keywords

Diffused work, Pandemic, Autonomy, Marx, Critical theory.

1 INTRODUCTION

This paper will deal with the latest developments in the organisation of workspaces after the digital revolution and after the emergency phase of the pandemic, through the use of an interdisciplinary method between architecture, workplace management and philosophy. In particular, it will talk about diffused work and how today the traditional office is undergoing a process of “deconstruction and decomposition” in favour of a whole series of other places each of which is supposed to become a hyper-specialised space equipped according to the various daily professional needs (including, spaces for meetings, for concentration, and so on). The question we aim at disentangling here is: are we going back to a spatial model that suggests a tayloristic approach to the organisation of work? Or is this differentiation of spaces a way to

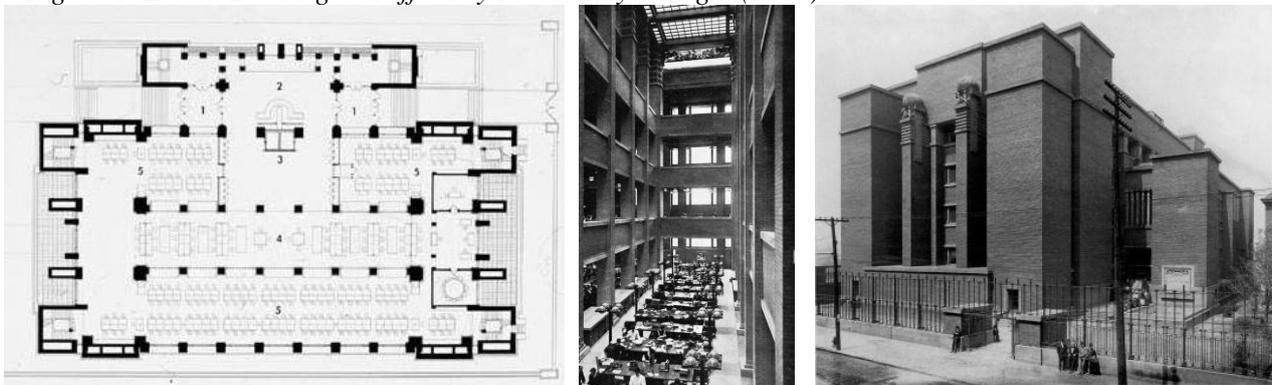
grant employees more freedom of choice? The role played by space in shaping the relationship between companies and employees is unquestioned: “*From Taylor to Foucault, space has in fact always been considered to be supportive or constraining of organisational activity*” (Lo and Feiten Diochon, 2019, p. 2). Power-based perspectives on space claim that space is constraining in the sense that spatial layout, the physical environment, and architecture are “*central in establishing and maintaining relations of power*” (Taylor and Spicer, 2007, p. 331) between employees and employers. Throughout time this relationship has evolved, together with organisation and management studies. Nevertheless, since the inception of the modern office (van Meel, 2000), individuals have never been so free to decide when, and even whether, to use the office as an anchor for their work and for their relationship with the employer. According to various observers and commentaries (e.g. Tagliaro, 2020; Fayard, Weeks, and Khan, 2021) the office is going to change its principal function of hosting work activities and is destined to become: (i) a social anchor; (ii) a training ship to pass company culture and way of working; (iii) a place for unstructured collaboration and creativity (Fayard, Weeks, and Khan, 2021). The rest of work can be performed either at home, in third places or elsewhere, based on a multi-located (Hislop and Axtell, 2009) and “hybrid” work mode (Fayard, Weeks, and Khan, 2021). The paper will therefore examine the criticalities linked to this concept of widespread work, such as a lack of planning that often leaves the management and use of these spaces to chance or the initiative of the individual (Hislop and Axtell, 2009). From a philosophical point of view, also the implications of this “colonisation” of personal spaces by the working dimension will be considered, as happened especially with working from home during and after the emergency phase of the pandemic. The paper develops as follows: in the first section, it will present a brief history of the evolution of workplaces and the meaning of work also from a philosophical point of view. Then, it will outline an overview of the initiatives undertaken during the emergency phase of the pandemic, which changed working methods and spaces. In particular, data collected on the case of a multinational telecommunications company will be reported as an example of how many companies are currently reshaping their workplace strategies and workspaces. Finally, in the last paragraph it will be asked what direction could be taken in organising workspaces to ensure that the new working arrangements following the pandemic do not create further alienating dynamics, but rather better meet workers' needs and autonomy of choice.

2 WORK AND WORKPLACES FROM THE INDUSTRIAL REVOLUTION TO THE CONTEMPORARY SCENARIO

Philosophy has repeatedly addressed the issue of work, its evolution, its management and, above all, its meaning for the individual. According to Hegel, work is even the means by which the servant (who has lost the struggle against the master according to the well-known dialectic set out in the *Phenomenology of Spirit*) can recognize themselves and recover their experience of freedom (Hegel, 1807/2018). And yet, it takes only a few generations to arrive at Marx's conception of alienation, who becomes a witness to the inequalities and injustices that characterised the expansion of the industrial revolution and the establishment of the economic system of capitalism (Marx, 1988). According to Marx, the product of labour is completely taken away from the worker, who therefore can no longer recognize themselves in what they do. Moreover, with hyper-specialisation and the introduction of the assembly line, work has become increasingly fragmented and depersonalised, so that the worker in the factory reproduce the same tasks without grasping an overall meaning, just like Charlie Chaplin's character in *Modern Times* who keeps seeing bolts even after working hours are over. In the words of Marx and Engels, “*This division of labour made it possible to supply products faster and therefore more cheaply. It reduced the activity of the individual worker to a very simple,*

constantly repeated mechanical motion which could be performed not only as well but much better by a machine.” (Marx and Engels, 1948/2020, p. 78). Not by chance, the first modern office buildings, as defined by van Meel (2000) manifest this fragmentation and depersonalization in their very architectural features. The Larkin Building in Buffalo by Frank Lloyd Wright (1904) is an example of the so-called “white collar factories” (Figure 1). In the early 20th century office, it was not uncommon to find mechanical conveyor belts to transport papers and documents from desk to desk, arranged in a classroom-like layout. The physical working environment was purposely organised so that the employees could have been monitored by the managers, thus emphasising the lack of autonomy over the work activity that Marx interprets as negative alienation. In addition to these alienating dynamics, those who were previously used to processing products in their homes, with the first textile industries are forced to move to the city in dormitory blocks and perform their work functions exclusively in the factory. People would indeed ‘go to work’, a place definitely separated, and most of the time far from home (O’Mara, 1999).

Figure 1. Larkin Building in Buffalo by Frank Lloyd Wright (1904)



Moreover, the dynamics of alienation do not stop with the already gruelling hours of work in the factory, which were initially characterised by a total lack of protection for human rights. During the 1940s, the theorists of the Frankfurt School, who took up the Marxist tradition, intercepted the totalizing and colonising tendency of the productive system of capitalism, which sought to extend its dynamics beyond the world of work. This is what Horkheimer and Adorno (1944/2002) emphasised in their essay on the cultural industry in *Dialectic of the Enlightenment*: thanks to the models transmitted by the entertainment industry and the mass media, an attempt is made to deactivate the critical spirit and the possibility of forming a class consciousness, which is essential for trying to modify the most inhuman conditions of work. The diagnosis of these authors is particularly radical: “*The powerlessness of the workers is not merely a ruse of the rulers but the logical consequence of industrial society, into which the efforts to escape it have finally transformed the ancient conception of fate.*” (Horkheimer and Adorno, 1944/2002, p. 29). Another exponent of the Frankfurt School, Marcuse, would go so far as to say that the performance principle has now replaced the reality principle itself (Marcuse, 1955/1974). In the advanced industrial society, the system of capitalism tends to absorb any drive, including those that would seem to be opposed to the system, until it comes to the paralysis of criticism and the one-dimensional society and man (Marcuse, 1964/1991). This flattening of any individual peculiarity to celebrate performance can be exemplified by the change in workplaces’ architecture. While the introduction of the so-called “Action Office” in the 1960s by Robert Prost for Hermann Miller was meant to liberate employees by allowing them to modify the desk arrangement freely, the economy was growing at too fast a pace and executives needed something more easily reproducible. Therefore, the “Action Office” was

diverted into what is popularly known as cubicle farm, as it entails every workstation being identical to the others: a “workstation for the human performer” (Saval, 2014). Since the 1960s many offices worldwide, especially in the U.S., adopted this solution, which might have contributed to people losing any drive, and their identity as distinct individuals. In the second half of the twentieth century, workplaces were undoubtedly characterised by healthier conditions than in the first factories, but after a brief period of economic boom, work once again became highly precarious. In fact, there have been a series of economic and political choices that partly annul the conquests achieved by decades of strikes and struggles for social rights. Since the 1970s, the deregulation of neo-liberalism has impoverished the so-called welfare state, imposing the paradigm of a free market without any external checks and balances. This goes hand in hand with the professionalisation of corporate real estate and facility management, and with the outsourcing of office services (Appel-Meulenbroek, Clippard, and Pfnür, 2018). In addition to lowering wages and increasing labour volatility, these choices have also led to several cyclical crises of capitalism, firstly industrial (especially in competition with the emerging economies of China, Taiwan and Singapore), but also financial (think of the 2008 disaster) and even partly digital (the dot-com bubble at the beginning of the millennium). Some argue that the growing number of contingent workers within the gig economy is granting more flexibility, independence, self-fulfilment and enterprise (Fayard, 2021). Conversely, many observe that the imperative to save on labour costs unfortunately remains one of the main business models. Beyond the wave of firings that followed first the crisis of the American real estate bubble and then the COVID-19 pandemic, we need only think of the case of the freelancers of Uber, Gloovo or other platforms who have no protection and suffer new forms of exploitation. In corporate real estate and workplace management the driver of cost reduction means reducing the cost of the facilities, which progressively led to a reduction in the number of workstations in favour of desk sharing, hot desking and hotelling policies with contrasting effects on employees productivity and performance (Bosch-Sijtsema, Ruohomäki, and Vartiainen, 2010). This work mode has been often associated to an “activity-based working” approach (Figure 2), according to which “multiple settings are provided which have different technical and physical attributes assembled to support the variety of performance ‘modes’ that take place in a work environment” (Robert Lucchetti Workplace Consultants). At the same time, advances in technology have progressively enabled workers to adopt a multi-location work mode, which supposedly empowers employees to perform different tasks at different places (Felstead et al., 2005). Nevertheless, this entails constant effort by the workers in creating and producing a workplace in the locations that they use, with uncertain power relations between them and their employers (Hislop and Axtell, 2009).

Figure 2. Activity Based Office by Robert Lucchetti Workplace Consultants



In parallel with the evolution of workspaces and workplace management, philosophy has never ceased to offer a critical analysis of the world of work such as in the research of Jaeggi (2014), Srnicek (2017) and Zuboff (2019), sometimes even proposing very radical solutions such as the introduction of the Universal Basic Income, which can be achieved by taxing not the work of human beings, but the machines and means of production (Van Parijs and Vanderborght, 2017). To sum up, two opposing narratives emerge about what work means after the industrial revolution and within capitalist system (Fayard, 2021): on one hand, work is represented as monotonous and meaningless tasks to be achieved for the production of artefacts, services or experiences in exchange for compensation (e.g. Schwatz, 2015); on the other, work enables self-fulfilment and the exploration of possible selves (e.g. Cukier, 2018). This distinction echoes the contrast between *labour* and *homo faber's work* that Arendt (1958/1998) contends, and that of Harding (2013) between labour, which reduces people into zombie-machines, and work, which empowers self-construction of individuals. Workspace design appears to resemble this tension in its evolution over time.

3 HOW COMPANIES ARE RETHINKING THEIR WORKSPACES AFTER THE EMERGENCY PHASE OF THE PANDEMIC

Newspapers, magazines and journalists have claimed that the COVID-19 pandemic has brought about a new era for the offices. In addition to guidance on safety in the workplace, there has been increasing talk about the wellbeing of workers and the need to think about how to find a compromise between the needs of the company and those of its employees or collaborators (even when this may not be about company benefits, but just the quality of the environment and relationships). This theme was, however, already present in the same years in which there was the one-dimensional flattening well described by Marcuse, precisely as an attempt to respond to these issues. In hindsight, user satisfaction and wellbeing have become important drivers in office design since the 1960s (van Meel, 2000), with the advent of environmental psychology followed by the discovery of work-related illnesses (e.g. the Sick Building Syndrome). Nowadays, based on a renewed sensitivity toward individual needs and preferences, an even more radical “activity-based” way of arranging the workspace has inspired many organisations to expand the spatial limits of work to the whole city and even broader geographical boundaries. Particularly with regard to certain jobs, the idea of shortening the working week or making it possible to work from home on certain days has been under discussion for decades, but recently it has become the dominant strategy for many companies worldwide (OECD, 2021). The assumption is that such flexible working arrangements (H.R. 4219, 2017) will, on one hand, make it easier for workers to organise their family and personal commitments and, on the other, reduce the company's fixed costs. The rise of coworking spaces since the 2000s seems to combine well with this trend. Lo and Feiten Diochon (2019) argue that such places can enable low-power actors to empower themselves, as these spaces are characterised by hybridity, indeterminacy and flexibility. Nevertheless, it was only in the context of the spread of the COVID-19 virus that a new type of working mode came to be experienced *en masse*, whereby every type of task was managed from one's own home, regardless of one's family status. This has clearly had advantages, especially in terms of lowering transport costs, in cases where the office is several kilometres away from the employee's home. In addition, in some cases there has even been an increase in productivity (e.g. Tagliaro and Migliore, 2022). However, there were also significant disadvantages, which go beyond the increasing virtuality of relationships with one's colleagues, suppliers or customers. First of all, this situation led to a lot of inconvenience for those who did not have a suitable flat to have a dedicated area for an office and who at the same time could have one or more children at home from school to manage. Like all crises, the pandemic, far from making

us all the same as certain media slogans we saw in 2020, has exacerbated social inequalities. Moreover, in many cases this has led to an undue extension of working time (e.g. Tagliaro and Migliore, 2022), since there was no longer a break between work and rest, in a sort of hypertrophic application of the performance principle described by Marcuse. Despite contrasting views on flexible work arrangements, after the most critical phase of the pandemic many companies are considering maintaining remote work for most of their employees indefinitely (The Economist, 2020) therefore dismissing their office buildings. The companies that are opting to still use the office are considering it as one of the multiple locations for work taking up only a small percentage of the work time of their employees for very specific tasks, as Felstead et al. (2005) had already anticipated. Let's discuss the example of one specific multinational telecommunications company. To document this case we use secondary sources provided by the company's workplace manager (i.e. presentations given at university courses and conferences to describe the company's future workplace strategy). This company considers that only between 20 and 40% of the overall working time will be spent in the office. Accordingly, the office becomes a "hub", a temporary location among others, including coworking spaces, cafés, home and anywhere else. Vodafone space models assume that the Hub will be used mainly for connection, co-creation and inspiration, whereas individual and concentrative work will be performed elsewhere. This re-functionalization of the office has a significant impact in terms of square metres occupied, with forecasts allowing between 20% and 40% of the current real estate to be released. The company is making this decision not independently from their employees' opinion. Workplace managers have been busy with focus groups and surveys for two years, in the attempt to figure out how to best accommodate the needs of their people. Their findings demonstrated that concentration at the office accounts for only 5% of the experience, whereas connection and co-creation are what really attract people to the office. As a consequence of these investigations, the company is taking action to refurbish their London headquarters by increasing space dedicated to connection from 8% to 42% of the floor area, augmenting space for co-creation from 20% to 45%, adding space for inspiration (that is currently non existing) up to 2%, and decreasing space for concentration from 72% to 11%. In order to support concentrative activities performed at home, the company is providing the employees with specific incentives to create comfortable home-offices, even though their surveys confirm that the most used work arrangement in the office is still the individual station. This way of planning and designing the workplace can be conceived as an extended "activity-based working" approach. In the last part of this paper, it will therefore be asked whether analogous changes in the organisation of workspaces are going in the direction of greater freedom of workers in accordance with their needs or instead towards an even more radical alienation, with a total colonisation of space and time.

4 DOES THE CURRENT ORGANISATION OF WORKPLACES ALLOW MORE FREEDOM TO ITS WORKERS OR DOES IT RISK INCREASING THE DYNAMICS OF ALIENATION?

If, according to Marx, capitalism takes away the product of labour from workers, so that they can no longer recognize or identify themselves in what they do, what is happening now when the worker seems to be progressively deprived even of the space for work? Relying on behavioural science studies and self-determination theory (SDT), a Cornell University research (Baard, Deci, and Ryan, 2004) of 320 small businesses demonstrated that the growth rate of companies whose employees were autonomous in their work was four times higher than that of control-oriented firms. The same study proved that turnover in businesses granting workers autonomy was one third than that in companies adopting top-down policies. This applies to workspace management, as well. According to Gensler (2013), employees who can choose

when and where to work are more innovative and perform better in focus effectiveness (+7% compared to employees without choice), collaboration effectiveness (+4%) and learning effectiveness (+3%). Research shows that when workers are granted freedom of choice over when and where to work, they are more productive and also happier (e.g. Bloom, Liang, Roberts, and Ying, 2015). However, after COVID-19 many companies have been wondering how to reorganise the office given the new flexible workstyle which leaves the workspace often empty or underutilised. A question arises if such reorganisation will lead to the office assuming a well-defined and rather restricted function, therefore inevitably hindering real freedom of choice. We argue that, if offices are increasingly being transformed into places for collaboration, training and culture transfer, the risk is that the supposed subject's freedom of choice is in reality constrained and multi-local work does not become a benefit but a limitation for employees whose activities will be segmented across different spaces. The risk is to go back to the taylorist approach of separation of activities and micro-silos, where management of supply chains will prevail over management of people (Pink, 2009). However, a philosophical perspective cannot be content to stop at a critique of reality; it must also imagine a possible reversal in the direction of a new and better future. If therefore several critical issues have been highlighted by Marxist thought and several authors of critical theory, one can also point to alternative ways of allowing personal re-appropriation of one's own space through a personalization of work that goes in the direction of both greater personal wellbeing and more concrete social justice. Indeed, allowing the individual professional to manage their own work is part of a concept of autonomy and participatory democracy linked to the world of work and not only in the political sphere (Gould, 1988). The question is therefore: through a reorganisation of workspaces based on the needs and well-being of the individual, is it possible to more effectively embody those assumptions of a welfare that neoliberalism has instead challenged? The idea is precisely to make workers participate in the choices of their own company, in a sort of democratic sharing that can also stimulate a virtuous feeling of belonging to the company itself (such as in the example presented above). In this sense, there is a need for greater personalization of employment contracts that would meet the concrete needs of individual workers. It is not a question of satisfying arbitrary preferences, but of having tools for analysis and classification that make it possible to assess the living conditions of the individual employee or collaborator. Therefore, employment contracts should consider three main factors, that, from our point of view, are: 1) the family condition; 2) the characteristics of one's living space; 3) the potential of choosing among a widespread network of private and public spaces for work. With regard to the first point, allowing greater flexibility in both working hours and the possibility of working from home could have a radical impact on the organisation of the individual worker's life. Clear legislation on flexible working hours and working space for those with children, regardless of gender, would reduce discriminatory practices whereby young women who become mothers are often forced into unemployment to meet family needs. The same should apply to people who take care of elderly parents or relatives, achieving a possible balance between working life and relational one that does not involve choosing one of these universes of meaning to the detriment of the other. Secondly, in order to understand whether flexible working arrangements can be an advantage for individual workers, we need to start from their living space. One could think of individual incentives to equip a part of one's home as an office, or the company could guarantee coworking spaces in different areas of the city or region. In fact, one could try to make a more targeted analysis of the potential of interactive spaces, such as the aforementioned coworking. This particular modality of workplaces' organisation both a) improves the quality of relations and thus of the working environment, b) results in an increase in productivity, guaranteed by interaction and the ability to network and not by a progressive increase in individual working hours. Meeting

the needs of the worker, even before their ambitions, could strengthen both the identity link between the individual and the company and their capacity for self-determination, without compromising the final result in terms of productivity. In this way, virtuous practices could be put in place that go in the direction of privileging the aforementioned *work* dimension over the *labour* one. In addition, if we erode the narrative of competition and individualism, we can discover new practices of corporate growth based on a more collective concept of work, given by both the sharing of physical and digital spaces, where we can understand that "*we are becoming more intelligent collectively because we are developing ways to connect partial understandings productively on a new scale*" (Stalder, 2013, p. 17). Overall, companies should be aware that "*a change in material circumstances may make it possible for new values to emerge*" (Anthony, 1977, p. 315). Therefore, a radical change in the way we conceive, plan, design and use office buildings is likely to trigger sooner or later a totally new way for individuals to identify with the work they do, share the values and culture of their organisations, and to feel empowered with real autonomy of choice. Starting from the organisation of working spaces, which necessarily also implies a rethinking of working time, it is possible to mitigate the dynamics of alienation described by critical theory and to give a different meaning to work itself, towards new forms of recognition and identity integration. The idea would be that the design should somehow counteract the tendency of spaces to host particular tasks (Felstead et al., 2005) rather than support and maximise the characteristics of the space that already make it predominantly suitable for a given task. We believe that understanding what these forms might concretely be could be the result of further and more in-depth research that exploits the interdisciplinary collaboration between architecture, workplace management and philosophy.

REFERENCES

- Anthony, P.D. (1977), *The ideology of work*, Routledge, Tavistock, New York, NY.
- Appel-Meulenbroek, R., Clippard, M., Pfnür, A. (2018), "The effectiveness of physical office environments for employee outcomes: An interdisciplinary perspective of research efforts", *Journal of Corporate Real Estate*, 20, 1, 56-80. <https://doi.org/10.1108/JCRE-04-2017-0012>
- Arendt, H. (1998), *The human condition* (2nd ed.). The University of Chicago Press, Chicago, IL (original work published 1958).
- Baard, P.P., Deci, E.L., Ryan, R.M. (2004), "Intrinsic Need Satisfaction: A Motivational Basis of Performance and Well-Being in Two Work Settings", *Journal of Applied Social Psychology*, 34.
- Bloom, N., Liang, J., Roberts, J., Ying, Z.J. (2015), "Does Working from Home Work? Evidence from a Chinese Experiment", *The Quarterly Journal of Economics*, 130, 1, 165–218. <https://doi.org/10.1093/qje/qju032>
- Bosch-Sijtsema, P.M., Ruohomäki, V., Vartiainen, M. (2010), "Multi-locational knowledge workers in the office: navigation, disturbances and effectiveness", *New Technology, Work and Employment*, 25, 3, 183-195. <https://doi.org/10.1111/j.1468-005X.2010.00247.x>
- Cukier, A. (2018), *Qu'est-ce que le travail?* [What Is Work?], Vrin, Paris, France.
- Fayard, A.L., Weeks, J., Khan, M. (2021), "Designing the hybrid office", *Harvard business review*, March-April, 1-11. <https://hbr.org/2021/03/designing-the-hybrid-office>
- Fayard, A.L. (2021), "Notes on the meaning of work: Labour, work, and action in the 21st Century". *Journal of Management Inquiry*, 30, 2, 207-220 <https://doi.org/10.1177%2F1056492619841705>
- Felstead, A., Jewson, N., Walters, S. (2005), *Changing Places of Work*, Palgrave MacMillan, Basingstoke.
- Gensler (2013), *2013 U.S. Workplace Survey. Key Findings*.

- Gould, C.C. (1988), *Rethinking Democracy. Freedom and social cooperation in politics, economy, and society*, Cambridge University Press, New York.
- Harding, N. (2013), *Routledge Studies in Management, Organisations and Society. On being at work: The social construction of the employee*, Routledge, New York, NY.
- Hegel, G.W.F. (2018), *The phenomenology of Spirit*, Cambridge University Press, New York (original work published 1807)
- Hislop, D., Axtell, C. (2009), “To infinity and beyond?: workspace and the multi-location worker”, *New Technology, Work and Employment*, 24, 1, 60-75.
- H.R. 4219 (2017), *Workflex in the 21st Century Act* <https://www.congress.gov/bill/115th-congress/house-bill/4219>
- Horkheimer, M., Adorno, T. (2002), *Dialectic of Enlightenment*, Stanford University Press, Stanford (original work published in 1944).
- Jaeggi, R. (2014), *Alienation*, Columbia University Press, New York.
- Lô, A., Diochon, P.F. (2019), “Unsilencing power dynamics within third spaces. The case of Renault’s Fab Lab”, *Scandinavian Journal of Management*, 35, 2.
- Marcuse, H. (1974), *Eros and Civilization. A philosophical inquiry into Freud*, Beacon Press, Boston (original work published in 1955).
- Marcuse, H. (1991), *One-dimensional Man. Studies in the Ideology of Advanced Industrial Society*, Beacon Press, Boston (original work published in 1964).
- Marx, K. (1988), *The Economic and philosophic manuscripts of 1844 and the Communist Manifesto*, Prometheus Books, New York.
- Marx, K., Engels, F. (2020), *Manifesto of the Communist Party*, Foreign Language Press, Paris. (original work published 1848).
- O’Mara, M. (1999), *Strategy and Place. Managing Corporate Real Estate and Facilities for Competitive Advantage*. The Free Press, New York.
- OECD (2021, September 21), *Teleworking in the COVID-19 pandemic: Trends and prospects*.
- Pink, D. (2009), *Drive: The Surprising Truth About What Motivates Us*, Riverhead Books, New York, NY.
- Robert Lucchetti Workplace Consultants <http://www.luchetti.com/rlwc/rlworkplace.pdf>
- Saval, N. (2014), *Cubed: A Secret History of the Workplace*, Knopf Doubleday Publishing Group, New York and Toronto.
- Schwartz, B. (2015), *Why we work*. Ted Books, New York, NY.
- Stalder, F. (2013), *Digital Solidarity*. PML Books, Lüneburg.
- Srnicek, N. (2017), *Platform Capitalism*. Polity Press, Cambridge.
- Tagliaro, C. (2020), “Will working from home become the new normal?” [commentary]. *Buildings and Cities*. <https://www.buildingsandcities.org/insights/commentaries/>
- Tagliaro, C., Migliore, A. (2022), ““Covid-working”: what to keep and what to leave? Evidence from an Italian company”, *Journal of Corporate Real Estate*, 24, 2, 76-92. <https://doi.org/10.1108/JCRE-10-2020-0053>
- Taylor, S., Spicer, A. (2007), “Time for space: A narrative review of research on organisational space”, *International Journal of Management Reviews*, 9, 4, 325–346.
- The Economist. (2020), “What a way to make a living”, September 12-18, 18–20.
- van Meel, J. (2000), *The European Office. Office design and national context*, 010 Publisher, Rotterdam.
- Van Parijs, P., Vanderborght, Y. (2017), *Basic Income: A Radical Proposal for a Free Society and a Sane Economy*, Harvard University Press, Cambridge-London.
- Zuboff, S. (2019), *The Age of Surveillance Capitalism. The Fight for a Human Future at the New Frontier of Power*. Public Affairs, New York.

Designing Workplaces to Align with Culture(s)

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ABSTRACT

Neuroscience studies indicate that when workplace design recognizes, reflects, and respects both users' national and organisational cultures, wellbeing and performance soar (see, for example, Veitch, 2012), but national and organisational culture are generally separately considered. The reported project integrates neuroscience research related to organisational culture, national culture, and workplace design to develop a straightforward framework that can be used in practice to create work environments that support employees as they work to their full potential within the context of their national and organisational cultures. The system presented has been extensively tested and refined in practice. The tool developed is based fundamentally in the national culture research of Hofstede and also the organisational culture research of Cameron and Quinn. Hofstede et al. (2010) identify 6 factors that describe national culture: individualism-collectivism, power distance, masculine-feminine, tolerance of uncertainty, long-term or short-term orientation, and indulgent-restrained. Hofstede's system's relevance to design decision-making has been supported, for example, by Zhang et al. (2006). Cameron and Quinn's (2006) classification system, which identifies four organisational culture types (hierarchy, market, clan, adhocracy) also has clear design implications, as identified, for example, by Zerella and colleagues (2017). The Hofstede and Cameron and Quinn systems recognise key cultural dimensions at two different scales. Three factors identified by Hofstede are particularly relevant to workplace design (individualism-collectivism, power distance, masculine-feminine) (Augustin, 2018) and a synthesis of research related to these factors indicates that there are four major classes of optimal workplaces (Augustin, 2018). Analyses focused on integrating Augustin's national culture design system with Cameron and Quinn's organisational culture types, completed in the context of decades of professional practice and reported in this paper, results in 16 separate national/organisational culture workplace design scenarios and specific, practical office design recommendations to effectively utilise available resources, human, financial, and otherwise. The model established can be used by office design practitioners to develop workplaces that boost wellbeing and professional performance and by researchers doing more conceptual studies.

Keywords

Workplace design, National culture, Organisational culture, performance, stress.

1 INTRODUCTION

Neuroscience studies indicate that when workplace design recognizes, reflects, and respects both users' national and organisational cultures, wellbeing and performance soar (see, for example, Veitch, 2012), but national and organisational culture are generally separately considered. This project integrates neuroscience research related to national culture, organisational culture, and workplace design to develop a straightforward framework that can be used in practice to create work environments that support employees as they work to their full potential within the context of their national and organisational cultures. Both national and organisational culture have been concisely defined. Hofstede et al. (2010) identify national culture as "the unwritten rules of the social game. It is the collective programming of the mind that distinguishes the members of one group or category of people from others." Fleming and

Guddenmund (2015) report that organisational culture: “influences a people’s or group’s views of the world... and is stable over time... Culture can be likened to an invisible hand that directs behaviour, influencing group member’s behavioural choices... This guiding hand is of the group’s own making.” Ample research indicates that it is important to align workplace design with national culture and also with organisational culture. For example, Grenness (2015) reports on the negative consequences of workplace design that is inconsistent with national culture, such as higher user stress levels. Space design that aligns with national culture optimises employee performance (for example, Gifford, 2014; Grenness, 2015; Hofstede et al., 2010). Multiple researchers have identified the tension-inducing consequences of organisational culture-inconsistent workplace design, while design that recognizes and reflects organisational culture boosts wellbeing and cognitive performance (Schein, 1990; Peponis et al., 2007).

2 DESIGNING FOR NATIONAL CULTURE

Hofstede, Hofstede, and Minkov (2010) present the significant parameters of national culture, and they couple their widely applied system for categorising cultures with useful design insights. The team reports that nations are:

- *Individualistic or collectivistic* and design implications of this parameter include: people from more individualistic cultures (compared to those from more collectivistic ones) have greater expectations of being able to have privacy when they wish, are less willing to share resources, are less driven to conform and follow “design rules,” are more likely to modify environments to serve immediate needs, and are less likely to signal group membership via design decisions (but more likely to use those decisions to communicate their individuality). Hofstede et al. also report on how dozens of nations score on the cultural parameters they identify.
- *More or less accepting of power differences conveying benefits, those more accepting are described as higher on “power distance.”* In cultures with relatively high power distance, people with more power have access to more/better amenities, for example and are interested in indicating their power to others.
- *Masculine (tougher) or feminine (not as tough).* In more feminine cultures, quality-of-life and pleasure-in-use, environmental responsibility, and modesty (in display, etc.), are more important than in more masculine ones. In more masculine cultures achievement and design elements that signal achievement are important.
- *More or less tolerant of uncertainty.* Less tolerance for uncertainty is linked to a greater need for rules (of all sorts, which has programming consequences), more concern about cleanliness (which has ramifications for material choices, for example), less focus on opportunities to relax, and more negative feelings toward novelty, compared to cultures with more tolerance for uncertainty.
- *Longer- or shorter-term in their outlook.* Tradition and keeping up with trends are viewed more positively in cultures with a short term-orientation; in cultures with a long-term orientation there is relatively more concern with material wear and financial returns.
- *Indulgent or restrained.* People feel freer to enjoy life in less restrained cultures.

Additional research related to the Hofstede et al. (2010) system indicates that:

- There is more concern about nonverbal messages sent via design in collectivistic than in individualistic cultures (De Mooij and Hofstede, 2011).
- Relatively more angular lines/shapes are generally preferred by people from more individualistic countries; the reverse is true for people from more collectivistic ones (Ghoshal et al., 2016; Zhang et al., 2006).

- People from cultures with a long-term orientation are generally more focused on achieving peace of mind; those with a short-term orientation on pursuit of happiness (De Mooij and Hofstede, 2011).
- Members of cultures with a short-term orientation are more willing to pay for convenience (De Mooij and Hofstede, 2002).

3 DESIGNING FOR ORGANISATIONAL CULTURE

Cameron and Quinn (2006) developed a widely used system for categorising organisational cultures, which, like that of the Hofstede team, has clear design implications.

The four organisational cultures identified by Cameron and Quinn can be briefly described by the single adjective the researchers have chosen to exemplify it (2006):

- Hierarchy – Controlling
- Market – Competitive
- Clan – Collaborative
- Adhocracy – Creative

Cameron and Quinn (2006) provide additional details about each organisational culture. In a hierarchical culture, the workscape is rigorously structured, with supported ways of acting formalised via rules and policies. In contrast, market cultures are focused on productivity and effectively competing in relevant channels. Clan cultures focus on teamwork and employee development and wellbeing as well as empowering employees. In adhocracies creative and innovative thinking and behaviours are highly valued. Research links the Cameron and Quinn culture types with workplace design parameters. For example, Wells et al. (2007) report that clan cultures supply higher-quality workspaces to their employees than non-clan ones. West and Wind (2007) share that when their case study organisation developed a workplace environment consistent with its organisational culture professional wellbeing ensued.

4 SYNTHESIS: INTEGRATING NATIONAL AND ORGANISATIONAL CULTURE REQUIREMENTS

A single system can integrate existing research on space design and national and organisational cultures to create places where people work to their full potential with high levels of wellbeing within the context of their national and organisational cultures. This paper introduces such a system, layering support for organisational culture into Augustin's 2018 program for national culture-informed design. The system reported here was both derived via and supported by articles in the peer-reviewed press, such as those cited in this text, identified as part of an ongoing, systematic, exhaustive literature review of articles related to workplace design and culture(s), etc. published in English, as well as by decades of related professional practice.

National culture has a more significant effect on optimal workplace design solutions than organisational culture, it drives viable options. As Hofstede, Hofstede, and Minkov (2010) report "Nationality defines organisational reality... [research presented] demonstrated six ways in which national cultures differ; all of these have implications for organisation and management processes." Augustin (2018) synthesises information on national culture and design. Her system reflects scores on individualism-collectivism, power distance, and masculinity-femininity and presents four major classes of optimal workplace environments (those for Striver nations, for Nurturer nations, for Developer nations, and for Coordinator nations). Design solutions for each class should be slightly adjusted for countries with relatively extreme scores on tolerance for uncertainty and/or long- or short-term orientation, using the material included in Section 2. The integration of Augustin's national culture-informed workplace design requirements (2018) with office design prerequisites based in organisational culture is the new model presented in this paper. Workplace design-related

highlights of the integration of Augustin's system with research on organisational culture consistent design are included below.

4.1 Strivers (Individualistic and Masculine/Tough Nations) - Workplace is an enabler

As Augustin (2018) reports, effective Striver work environments:

- Provide opportunities for true audio and visual privacy for individuals and for groups
- Duplicate resources when necessary; Strivers are not keen on sharing (which can result in assigned workspaces).
- Can be modified, at an individual and group level, as users deem necessary; the malleability important to Strivers and Nurturers means that these users have more control over their at-work experiences than is desired by members of other groups.
- Signal individuality.
- Flout "design rules."
- Do not focus on quality-of-life for users; Strivers prize achievement and will sacrifice comfort to realise it; functionality, efficiency, and effective action are key design considerations.
- Feature relatively more angular design elements (whether in three-dimensions with furniture or architectural elements, or two-dimensions with upholstery patterns, wall treatments, etc.) than in Developer and Coordinator spaces.
- Need not focus too much on environmentally responsible options; Strivers are not as enthusiastic about designing green as some others.
- As Augustin (2018) reports, "An archetypal workspace that would support Strivers features a central meeting/laboratory space ringed by individual work areas with floor-to-ceiling walls whose shared space facing walls are transparent glass sliding doors with curtains that can be drawn."

Strivers can be low or high on power distance. High or low power distance scores for Strivers, Nurturers, Developers and Coordinators result in the same sorts of tweaks to environmental design. For example, in higher power distance Striver workplaces there will be more apparent relative rank (based on power/status) indicated via design and aesthetic options and more amenities that are available only to those who have achieved a particular status. Countries were categorised as individualistic-collectivistic, etc., based on their relative score on cultural parameters reported by Hofstede et al. (2010), with the average rank being the boundary between classifications, for example, as individualistic or collectivistic. Individualistic, tough, low power distance countries include Australia, Austria, Canada, Germany, Great Britain, Hungary, Ireland, Israel, Italy, Japan, New Zealand, and the United States. India is, for instance, an individualistic, tough, high power distance country. The new model presented in this paper customises spaces for Striver nations based on organisational culture types present (market, hierarchy, adhocracy, and clan; Cameron and Quinn, 2006).

Striver-Market Culture Combinations. Design for this grouping aligns highly consistent organisational and national culture requirements. For all national and organisational culture pairings, the tightest alignments, such as this one, are the most likely to be present and to thrive (Hofstede et al., 2010). Striver-Market work environments will be meticulously tuned to increase the likelihood of winning, by individuals and groups, whether "winning" is buying commodities for production at low prices or profitable stock market trading. It is also key that victories are acknowledged. If instantaneous interpersonal communication is required to effectively capitalise on competitive conditions, shielding between workers will be minimised. Since these spaces need to be tuned to team-specific needs, it is especially important to collect information from users.

Striver-Hierarchy Combinations. These workplaces will be more constrained than other Striver pairings, with decisions on allocations of workplace resources, from space to sit-stand desks, influenced by rules/systems as well as how distribution may lead to accomplishing desired objectives.

Striver-Adhocracy Combinations. People working within this combination are likely to be particularly attuned to providing opportunities for individuals and groups to concentrate/focus and to make sure that everyone has any resources they may need to be creative. Comfort can be sacrificed to promote creativity. People in this combination will make environmental changes and if design does not support doing so the space will “ugly up” fast. Break areas and refreshment zones are important in the context of helping users’ brains work as well as possible.

Striver-Clan Combinations. Clans will feel quite challenged here because for Strivers the wellbeing of individuals and groups are less important than what they achieve. For clans, amenities and opportunities to refresh are significant for the quality-of-life they support. Clan groups will enjoy the opportunity to present themselves in the spaces developed and there will be more positive feelings about curvilinear design elements here than among other Strivers.

4.2 Nurturers (Individualistic and Feminine/Not Tough Nations) - Workplace is home base

The best workplaces for Nurturer nations (Augustin, 2018):

- Supply visual and audio privacy for individuals and for groups when desired. Nurturer private spaces will be more pleasant places to spend time than those frequented by Strivers, with comfortable casual furniture instead of more purpose-driven conference tables and chairs, for instance. For Nurturers, goals are met, but not at the expense of quality-of-life.
- Combat employee stress. Self-actualization is important for Strivers and Nurturers, and not as important for Developers and Coordinators. Self-actualizing can add to stress levels, so tension-reducing design elements are useful in self-actualization-important environments. For example, colours used by Strivers and Nurturers should be not very saturated but relatively light, as these shades support knowledge work and are relatively relaxing to view (Valdez and Mehrabian, 1994). Self-actualization quests make coherent space planning more difficult.
- Do not require resource sharing.
- Support living pleasant lives. Among Strivers, individuals/teams can command space and other resources that they need to achieve goals, but for Nurturers there may also be casual spaces controlled by particular groups (and occasionally individuals) for relaxation as well as a team room. Strivers focus on wellbeing as it directly optimises performance while Nurturers are interested in people living pleasant lives as they work. You may find a fancy coffee maker in a Nurturer break area because employees will like using it, there will be a coffee machine in a Striver break room also, but not so people can enjoy the coffee, but so that they can remain caffeinated.
- Be changeable and flexible in use.
- Allow individuals and groups to “say” what they want about themselves via personalization/customization while they reject any “design rules” they want to ignore.
- Present relatively more angular than curvilinear design elements.
- Thoughtfully and thoroughly support the health of the planet.
- Augustin (2018) reports that “An archetypal workplace for Nurturers brings hygge (Billie and Sorensen, 2007) to the workplace with pleasant enclaves created for each distinct workplace group.”

Individualistic, not tough, lower power distance countries include Denmark, Estonia, Finland, Lithuania, Norway, Sweden, and The Netherlands. France is an individualistic, not tough, high power distance nation.

The new model presented in this paper customises spaces for Nurturer nations based on organisational culture types present (adhocracy, market, hierarchy, and clan; Cameron and Quinn, 2006).

Nurturer – Adhocracy Combinations. This is the tightest Nurturer pairing. The form of Nurturer - Adhocratic spaces must support creativity by members in any way they can, which may require stress-reducing sensory experiences or elevated quality-of-life, for example. People living in this combination will particularly value space flexibility/change options, ones that allow them to do whatever they need to do to be creative while still having positive life experiences. Adhocracies are likely to have spontaneous meetings, so meeting space options must support some unscheduled use. To fully understand what any adhocracy needs for creativity requires research with the group.

Nurturer-Market Combinations. This combination will be willing to trim the comfort of their spaces to compete effectively in ways that other Nurturers find hard to understand. In this blend, market groups are likely to have the stress reducing design elements and design-in-use flexibility that will actually contribute to their success in meaningful ways, but that they would not themselves see as necessary.

Nurturer-Hierarchy Combinations. In these configurations, pre-established systems have a significant effect on environmental conditions experienced as do completing tasks and quality-of-life. These systems might relate, for example, to amenities that groups with different professional responsibilities have access to.

Nurturer-Clan Combinations. Clan cultures can particularly relish amenities encouraged by a feminine culture and take full advantage of related opportunities presented. With clans, amenities are important so that users live pleasant lives, as the users define “pleasant”, so there can be clashes rooted in design-decision justification. Clan cultures are particularly attuned to member wellbeing and can prioritise that over nearly all else.

4.3 Developers (Collectivistic and Masculine/Tough Nations) - Workplace is a machine Workplaces for Developer nations (Augustin, 2018):

- Supporting extensive communal experiences (and efforts), privacy is less important than it is to Strivers and Nurturers (although all employees need privacy from time-to-time (Gifford, 2014)). Open environments in general are more acceptable to Developers than they are to Strivers and Nurturers (although they pose a challenge to work requiring concentration and focus for all (Gifford, 2014)).
- Allow sharing of professional resources, which can lead to design efficiencies not possible in spaces for Strivers and Nurturers.
- Are designed to support primary anticipated space use; flexibility/changeability requirements are minimal.
- Send messages, via design, about membership in demographic/sociological groups and not individuality. Design decisions generally will conform to design rules users are familiar with. Nonverbal communication via design and design elements is more important in collectivistic cultures than in individualistic ones, so research with users is required to make sure that they “read” the right things, about themselves and others, in spaces created.
- Feature relatively more curvilinear than rectilinear three- and two-dimensional design elements.
- Promote efficiency and achievement. Developers are part of a big family, one with goals and objectives and a job to get done.
- Communicate familiarity via design options, in more individualistic cultures alternatives can seem more expressive (Jordan, 2000).
- Are not driven by environmental responsibility.

- As Augustin (2018) reports, “An archetypal workplace environment for Developers is a large workplace with expansive view lines (a “field” of desks, for example) where the group as a unit can perceive it is moving toward goal achievement.”

Collectivistic, tough, low power distance countries include Greece and Pakistan. Sample collectivistic, tough, high power distance countries are Brazil, China, Hong Kong, Malaysia, Mexico, Philippines, Singapore, and Venezuela.

The new model presented in this paper customises spaces for Developer nations based on organisational culture types present (hierarchy, clan, adhocracy, and market; Cameron and Quinn, 2006).

Developer – Hierarchy Combinations. This pairing is particularly oriented to respecting and acting in accordance with established systems that clearly lay out “how things are done around here.” These systems, to some extent, simplify space programming, which cannot proceed without knowledge of what has been codified. Nonverbal communication is particularly important in this combination. Meetings are likely to be planned in hierarchical cultures and workplace design needs to support this tendency.

Developer-Clan Combinations. This combination is likely to be challenged in ways that can be difficult to temper via design. Members of clans can fear that individual needs will get lost in a Developer “machine.” Resolving disconnects like this requires great skill on the part of designers.

Developer-Adhocracy Combinations, In this combination, groups are likely to be provided with a space that supports their goals along with the ability to make changes that they feel are required to support their creativity, as long as these modifications do not conflict with collectivistic design options. Users will value design familiarity as it supports their creativity. Designers for this combination must carefully investigate how a space can support creative endeavours now and in the future and design what is learned via this research into areas provided when sites are occupied.

Developer-Market Combinations. For this combination, goal achievement is important and as long as this can be accomplished via shared resources and other conditions consistent with design in collectivistic contexts (which can support differentiated environments) all will work well. It is important that when spaces for this pairing are originally occupied the physical environment is developed to support any anticipated future requirements. Market cultures are content to work in familiar design as long as it supports “victory” in the competitions of interest.

4.4 Coordinators (Collectivistic and Feminine/Not Tough Nations) - Workplace is a haven

In workplaces for Coordinator nations (Augustin, 2018):

- Sharing resources is acceptable and private spaces are not a priority.
- Designing in use flexibility is relatively less important.
- Design “rules” are followed.
- Design elements that promote cordiality are prized because harmony and consensus are important in collectivistic cultures. Examples of these sorts of design options are warm surface colours (Choi et al., 2016) and seat cushions on chairs (Ackerman et al., 2010).
- Space customizations do not promote individuality.
- Support for interpersonal bonds, via co-location and similar mechanisms, can take precedence over efficiency of layout.
- User quality-of-life is important and potential for positive, pleasant experiences can drive design choices.
- Curvilinear design elements are favoured.

- For more feminine cultures aesthetic approaches should communicate artistry, while in more masculine ones, such as in Developer nations, signalling performance is more desirable (Jordan, 2000).
- Environmental responsibility is important.
- As Augustin (2018) reports, “An archetypal workplace for Coordinators would feature shared work areas, as is the case with Developers, but for Coordinators the ‘rooms’ of colleagues would be smaller with co-located groups more carefully managed to produce pleasant at-work experiences.”

Collective, not tough, high power distance countries include Chile, Indonesia, Peru, Portugal, Russia and Turkey. South Korea and Taiwan are collectivistic, not tough, low power distance countries. The new model presented in this paper customises spaces for Coordinator nations based on organisational culture type present (clan, adhocracy, market, and hierarchy; Cameron and Quinn, 2006).

Coordinator – Clan Combinations. This is a tight pairing focused on optimising employees’ lives (although all commercial enterprises need enough income to survive). In Coordinator-Clan combinations artistry can tie to quality-of-life. Design plans developed to benefit all support core requirements and will not be changed without considerable internal discussion. Clan cultures value socialising, making common spaces for interacting important elements of workplaces. Zerella and colleagues (2017) share that “visual access, physical proximity and workstation equality are related to behaviours valued within clan culture styles, including communication, collaboration, teamwork, relationships and non-hierarchical behaviour.” Members of clan cultures are likely to value participating in the design process.

Coordinator – Adhocracy Combinations. This combination can work well as long as all agree on how workplace design can support creativity; quality-of-life/pleasant work areas are desirable as they contribute to creativity. For this pairing, preferred design elements will be slightly more rectilinear than in other Coordinator combinations.

Coordinator – Market Combinations. In this situation, all will go well when all participants concur on how design can support “winning” professional objectives. For this pairing, preferred design elements will be noticeably more rectilinear than in other Coordinator combinations.

Coordinator – Hierarchy Combinations. With this combination, there can be significant disagreements about whether workplace elements/amenities should be allocated based on their potential to make working life more pleasant or based on a more regimented system for decision-making that includes factors such as role within the organisation.

5 MODEL VALIDATION

This model is based on research published in peer-reviewed journals/sources and has been validated using methods outlined by Zeisel (2006). The outcomes of countless applications support it.

6 CONCLUSION

National and organisational culture influence how people experience and use workplaces. Research findings published in the peer-reviewed press on national culture-appropriate design, organisational-culture consistent design, and on the ties between workplace design and knowledge worker wellbeing and performance, were synthesised to develop a comprehensive model of culture(s)-right workplace design. It can be used to guide the development of workplaces that optimise wellbeing and professional performance and also by researchers.

REFERENCES

- Ackerman, J., Nocera, C., Bargh, J. (2010), "Incidental haptic sensations influence social judgments and decisions", *Science*, 328, 5986, 1712-1715.
- Augustin, S. (2018), "Culture-Right workplace design", in Nenonen, S., Salmisto, A., Danivska, V. (Eds.), *Book of full papers, TWR 2018, Transdisciplinary Workplace Research Conference, Tampere, Finland*, Transdisciplinary Workplace Research Network, Tampere, Finland, pp. 62-80.
- Cameron, K., Quinn, R. (2006), *Diagnosing and Changing Organisational Culture*, Jossey-Bass, San Francisco, CA.
- Choi, J., Chang, Y., Lee, K., Chang, J. (2016), "The effect of perceived warmth on positive judgement", *Journal of Consumer Marketing*, 33, 4, 235-244.
- De Mooij, M., Hofstede, G. (2002), "Convergence and divergence in consumer behaviour: Implications for international retailing", *Journal of Retailing*, 78, 61-69.
- De Mooij, M., Hofstede, G. (2011), "Cross-Cultural consumer behaviour: A review of research findings", *Journal of International Consumer Marketing*, 23, 181-192.
- Fleming, M., Guldenmund, F. (2015), "Organisational culture." Boehm-Davis, D., F. Durso, F., Lee, J. (Eds.) *APA Handbook of Human Systems Integration*. American Psychological Association, Washington, DC, 589-604.
- Ghoshal, G., Boatwright, P. (2016), "Curvature from all angles", Batra, R., Seifert, C., Brei, D. (Eds.), *The Psychology of Design*, Routledge, New York, NY, 91-106.
- Gifford, R. (2014), *Environmental Psychology, Fifth Edition*, Optimal Books, Colville, WA.
- Grenness, T. (2015), "Culture matters: Space and leadership in a cross-cultural perspective", Ropo, A., Salovaara, P., Sauer, E., De Paoli, D (Eds.), *Leadership in Spaces and Places*, Edward Elgar Publishing, Northampton, MA, 199-214.
- Hofstede, G., Hofstede, G., Minkov, M. (2010), *Cultures and Organisations*, McGraw Hill, New York, NY.
- Jordan, P. (2000), *Designing Pleasurable Products*, Taylor and Francis, New York, NY.
- Peponis, J., Bafna, S., Bajaj, R., Bromberg, J., Congdon, C., Rashid, M., Warmels, S., Zhang, Y., Zimring, C. (2007), "Designing space to support knowledge work", *Environment and Behaviour*, 39, 6, 815-840.
- Schein, E. (1990), "Organisational culture", *American Psychologist*, 45, 2, 109-119.
- Valdez, P., Mehrabian, A. (1994), "Effects of colour on emotions", *Journal of Experimental Psychology: General*, 123, 4, 394-409.
- Veitch, J. (2012), "Work environments", Clayton, S. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology*, Oxford University Press, New York, NY, 248-275.
- Wells, M., Thelan, L., Ruark, J. (2007), "Workplace personalization and organisational culture: Does your workplace reflect you or your company?", *Environment and Behaviour*, 30, 5, 616-634.
- West, A., Wind, Y. (2007), "Putting the organisation on wheels: Workplace design at SEI", *California Management Review*, 49, 2, 138 - 153.
- Zeisel, J. (2006), *Inquiry By Design*, Norton, New York, NY.
- Zerella, S., von Treuer, K., Albrecht, S. (2017), "The influence of office layout features on employee perception of organisational culture", *Journal of Environmental Psychology*, 54, 1-10.
- Zhang, Y., Feick, L., Price, L. (2006), "The impact of self-construal on aesthetic preference for angular versus rounded shapes", *Personality and Social Psychology Bulletin*, 32, 6, 794-805.

In search for current design solutions supporting outdoor office work. Exploratory approach through customising a photo analysis

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ABSTRACT

Working outdoors is an emerging, sparsely-studied phenomenon in knowledge work. Office tasks have traditionally been considered to belong to indoor environments. The worldwide pandemic of COVID-19 has increased and changed attitudes towards multi-locational working. Outdoor environments seem to be one optional location when approaching the phenomenon through photographs posted to visual discovery engines. The aim of this exploratory study is to develop the application of journalistic photo analysis to advance the understanding of outdoor environments further in the framework of architectural design research on knowledge work environments. Places used for outdoor knowledge work are approached through defining outdoor and semi-outdoor environments in the context of the built environment. In addition to building envelopes, the adaptation to thermal and physical environments is included in the premises of this definition. The photographs of outdoor knowledge workplaces are studied through photo analysis. The existing press photograph analysis is customised to be used for analysing photo reportage type journalistic photographs about places of outdoor knowledge work. For the outline of the study, it was necessary to clarify what may be considered as places of outdoor knowledge work in the built environment by applying the existing definitions of outdoor and semi-outdoor spaces. The first phase customisation of the existing journalistic photo analysis to the Press Photograph Story Analysis for Places of Outdoor Knowledge Work (PPSA-pOKW) is also considered as a finding of this study.

Keywords

Outdoor knowledge work, Outdoor reading, Outdoor and Semi-outdoor environments, Physical design solutions, Architectural Design Research

1 RATIONALE

Knowledge work has traditionally been considered to belong to indoor environments. Even the environments of multilocational work tend to be indoors (e.g., home office, cafes, coworking spaces). In this context, working outdoors is an emerging, sparsely-studied phenomenon. There is no established definition of the concept of outdoor knowledge work in work environmental research. It may refer to various work activities (e.g., walking meetings, outdoor computer work), outdoor activities during breaks (breaks, transitions), and working in outdoor environments, such as outdoors of the workplace, home, and leisure home or in their immediate vicinity, or outdoor environments specifically designed for outdoor working. Working outdoors has become technologically and socially possible due to increasingly flexible, autonomous and multilocational working. There have been weak signals of its attractiveness and promotion even before (Telenor Sverige AB, 9.8.2016; The New York Times, 15.1.2019) and as a result of the Coronavirus crisis (Dufva & Rowley 2022). Societal megatrends such as the pandemic, the multiplication of knowledge work, interest in well-being, and the demands of sustainable development are creating pressure to transform the structures of working and living, including the physical work environment. Working outdoors itself has been studied in only a few studies (e.g., Petersson Troije 2021; Plambech & Van Den Bosch 2015), most of which only concern walking meetings (e.g., Bälter et al., 2018). Consequently, there is no established definition of the spatial solution for an outdoor workplace. Still, it seems that knowledge workers use outdoor environments as part of remote working. Our aim is to approach the prevailing situation through developing visual analysis of the non-academic visual material published about design solutions, either designed for outdoor knowledge working or just used for outdoor office purposes. We have recognised that places and ways of outdoor work have raised interest in popular media as in visual discovery engines such as Pinterest, where people share, in a non-professional or non-academic context, their own images and ideas or images from other media such as blogs, magazines and suppliers' commercial webpages. However, we are aware of the limitations concerning the collected data, since the visual discovery engines are based on algorithms by using artificial intelligence and machine learning with complex internal logic (Liu et al., 2017) including commercial interests (Lo et al., 2016). Still, we were interested in exploring the places of outdoor knowledge work through analysing the found images. The visual analysis method, based on existing press photograph analysis methodology (Kedra 2013), formed the basis to customise it to the outdoor knowledge work - architectural context. The architectural expertise was combined with knowledge on work environments aiming to understand the affecting phenomena, such as outdoor thermal control. In addition to elaborating the visual analysis methodology and criteria, we need to define what is considered to be an outdoor environment to clarify what to include in this explorative study.

2 DEFINING OUTDOOR AND SEMI-OUTDOOR ENVIRONMENTS

In the building design framework, it is relevant to define the outdoor environment in relation to the indoor environment being the typical place for knowledge work. In a technical context, indoor environment is well defined through the energy performance of buildings i.e., indoor environmental quality (IEQ) (BS ISO 17772-1:2017). It seems relevant to assume that those indoor environments not fulfilling the set standards of IEQ may be considered as outdoor environments. This standard does not specify design methods but gives input parameters to the design of building envelope, heating, cooling, ventilation, and lighting, of which building envelope is also an essential part of the physical built structure in architecture. Building envelope is defined as the physical separator between the conditioned and unconditioned environment of a building, including the resistance to air, water, heat (e.g., Cleveland et al.,

2009), light, and noise transfer (e.g., Syed, 2012). According to this definition, all spaces starting from (i.e., bordered to) the immediate vicinity of the building facade may be considered to be outdoor spaces. Thus, an outdoor space may be partially protected by walls of a building or sheltered by cantilever or canopy of a building. An outdoor space may also be under the open sky, for example, on the roof terrace of a building or totally apart from any building. Being under an open sky outdoor space may be partially sheltered or offering protection from weather. The vicinity of the building brings into discussion the definition of semi-outdoor environments. Instead of choosing building envelope as a common nominator, they may be seen in relation to thermal environments, where they fall between the categories of indoor and outdoor environments (Nakano & Tanabe, 2020). An indoor environment provides controlled thermal comfort, whereas in an outdoor environment occupants need to adjust themselves to achieve thermal comfort, clothing adjustment being one of the principal forms of behavioural adaptation (Nakano & Tanabe, 2020; Nikolopoulou & Steemers, 2003). Nakano & Tanabe (2020) emphasise that in semi-outdoor spaces the degree of environmental control may range from simple shading to moderate air conditioning (open cafes, terraces, arcades, atriums, train stations) where people are likely to expect an environment that is different from indoors. The semi-outdoor environment defined through thermal environment does not exclude closed spaces providing protection from weather but lacking stable thermal control. Thereby structures enclosing a semi-outdoor environment may have a solid building envelope, but the qualities of it does not fulfil the required standards to maintain the stable thermal indoor climate.

3 ADAPTATION TO THE ENVIRONMENT

Although outdoor environments for knowledge work are only sparsely studied, the prerequisite factors of what constitutes a good work environment (e.g., Vischer, 2007, 2008) are, in our view, a relevant starting point also for conceptualizing outdoor working. In an ideal case, the environment supports the work-related goals and activities of a worker through physical, functional, and psychological comfort (Vischer, 2007). A good fit between the person and work environment is related to higher satisfaction and better productivity (Edwards et al., 1998). Hypothetically, the attractiveness and increased use of outdoor environments could be related to such settings providing a higher variety of environmental resources and options, increasing the chances that an individual is able to create a work environment that meets his/her work-related and personal needs. In this study, we focus on the physical aspects of the work environment as functional and particularly psychological dimensions of the environment are more difficult to evaluate from photographs. Generally, some prerequisites of different outdoor work activities can already be recognised (Petersson Troije et al., 2021). The conditions required for concentrated work (e.g., reading) are a place comfortable enough to sit down, with sufficient weather protection (e.g., rain, wind, direct sunlight/glare, temperature) and protection from the unwished-for feeling of being watched from behind (Petersson Troije et al., 2020). Architectural solutions can facilitate working in outdoor and semi-outdoor environments. Therefore, it is meaningful to understand the features of thermal conditions and aspects of adaptation to the outdoor environment. The thermal environment is being used to define the concept of semi-outdoor environments. However, knowledge of thermal comfort and the means to adapt on it lay grounds to understand how to facilitate the adaptation by spatial and technical solutions, although not all factors are possible to deduce from the photographs or their captions. Nikolopoulou and Steemers (2003) define thermal adaptation as the gradual decrease of the organism's response to repeated exposure to a stimulus, involving all the actions that make them better suited to survive in such an environment. In the context of thermal comfort, this may involve all the processes which people go through to improve the fit between the

environment and their requirements. Although Nakano & Tanabe (2020) refer to Nikolopoulou and Steemers (2003) in their approach to considering the concept of adaptation effective, they reference Brager and de Dear's (1998) thermal adaptation classification including behavioural, physiological, and psychological processes, instead of Nikolopoulou and Steemers's (2003) division to physical, physiological and psychological processes. Brager and de Dear's (1998) behavioural adaptation includes a personal adjustment of clothing, activity, posture, or selection of environment, however the interaction with the environment is not indicated implicitly as in Nikolopoulou and Steemers's (2003) physical adaptation divided into reactive and interactive adaptation. Reactive adaptation refers to personal changes, altering one's clothing level, posture or position, or metabolic heat (consumption of hot or cool drinks). In interactive adaptation, people make changes to their environment to improve their comfort conditions (opening window, turning thermostat, opening parasol, etc.). (Nikolopoulou & Steemers, 2003) Both forms of adaptation have interesting linkages to some key concepts of work environmental research such as, the role of environmental control and personalization in supporting worker satisfaction (Vischer, 2007). On the other hand, excessive or unsuccessful attempts of physical adaptation can be seen as indicators of environmental stress and an unsupportive work environment (Vischer, 2007). In the photos the furniture is seen, implicating the possible reactive adaptation i.e., the possibility to choose posture and position in the space. The possibility for interactive adaption is often mentioned in captions or in other textual information related to the images. In the current research, physiological adaptation in the context of thermal environment (physiological acclimatisation) is not seen as having central importance when extreme environments are not under inspection (Nakano & Tanabe, 2020; Nikolopoulou and Steemers, 2003). However, considering cold weather, the Nordic countries have a long and distinct tradition of second home tourism where more than half of the population has access to them. Together with the tradition of outdoor recreation (Müller 2007), people are used to operating year-round outside also in cold seasons. Long-term physiological adaptation might have importance concerning geographic location. Contents concerning psychological adaptation are not possible to analyse from images. However, we considered it to be a valuable piece of background information in the interpretation phase of the photo analysis to advance understanding of the affecting immaterial factors. Nikolopoulou and Steemers (2003) name six important aspects meaningful in psychological adaptation: *naturalness*, *expectations*, *experience*, *time of exposure*, *perceived control*, and *environmental stimulation*. *Naturalness* indicates that wide changes of the physical environment are tolerated (Griffiths et al., 1987) when all climatic changes occur naturally. *Expectations* about what the environment should be like (instead of being) influence people's perceptions (also Nakano & Tanabe, 2020). *Experience* directly affects people's expectations and can be differentiated in the short- and long-term, and adaptation levels are established as functions of past exposure (Wohlwill 1998). Concerning *exposure-time* Nikolopoulou and Steemers (2003) report that exposure to discomfort is not viewed negatively if the individual anticipates that it is short-lived. Generally, unless exposure to discomfort is threatening to the living organism, tolerance to the thermal environment is great. Nikolopoulou and Steemers (2003) assume that sensitivity to the cold is greater than to heat, however this might also be a matter of the naturalness, experience, and even long-term acclimatisation, for example, native Nordic people. Nikolopoulou and Steemers (2003) continue, that *perceived control* plays an important role in tolerating wide variations. They claim that is widely acknowledged that people, having their own choice to expose themselves to certain conditions, become more tolerant to the thermal environment. They point out that it is increasingly believed that *environmental stimulation* is preferred, whereas a static environment becomes intolerable. According to the present IEQ norms (e.g., BS ISO 17772-1:2017) the stable conditions are considered as the desired state.

Microclimate and *adaptivity* are also intertwined. Walton et al. (2007) have developed a comfort index that measures adaptivity in outdoor spaces. They have reported gustiness and wind speed as being the most important in determining user satisfaction. They emphasise the importance of microclimatic factors for the comfort in the outdoor space (Walton et al., 2007; Zacharias et al., 2001). Facilitating people's possibilities to protect themselves from the weather, including exposure to gusts and wind speed, are essential parts of architectural design and the qualities of the built environment in general Walton et al. (2007) emphasise. A microclimate is not visible in the analysed photos; however, it is possible to deduce the visible structures that might mitigate the climatic conditions.

4 APPLYING JOURNALISTIC PHOTO ANALYSIS TO IMAGES OF OUTDOOR KNOWLEDGE WORK

Photo analysis belongs to qualitative research enabling one to increase the overall understanding, in our case, of the quality, characteristics and meanings of the places people prefer to use as voluntarily chosen outdoor places for knowledge work. We identified the visual discovery engines' journalistic photo type as photo reportage by using the criteria for classification in categories of *content*, *context*, *layout*, *number of photographs* and *dominant function* (Kedra, 2016; Wolny-Zmorzyński, 2007, 2010). In the original criteria, the content was defined as everyday life situations. However, we focused on photos where the *content* was about places designed or used for outdoor and semi-outdoor knowledge work. The rest of the classification criteria did not need modification from the original (Kedra 2016). Photo reportage type journalistic images are considered to be visual communication and, therefore, we applied the Press Photograph Story Analysis (PPSA) by Kedra (2013): *sender*, *message*, *code*, *context*, *contact* and *receiver*. In our model, the *sender* is not only the photographer, but may be the person who posted the photograph, or commercial supplier who purchased a specific type of photo. The *message* is also in our model the image. In our case, the *receiver* is a professional architect designer and work environment researcher, instead of a person in general. The *contact* was not included in Kedra's (2013) model, because mass-mediated communication always involves a spatial and social distance between the participants (e.g., Kedra, 2013; McQuail, 1997). We included contact information of the photograph's location referring to either website address/-s as virtual location (to find the image later), a keyword as a content-wise contact information and geographic location of the photo's content (if available) to support the interpretation of the thematic grouping. We kept the *context* as it was in the original model (Kedra, 2013) focusing on the caption as a central element of the page context in photography reception (e.g., Müller, Kappas, & Olk, 2012), but also considering texts beyond caption, if additional information was provided. Kedra (2013) refers to Barthes (1977) to explain *code* in press photography: image is not the reality but at least it is a perfect analogon. In the PPSA model, the *denotative part* is an analogon. In our model, the denotative part is looked at with architect design researcher's expertise combined with the understanding of knowledge work environment researcher and, therefore, the field specific features are recognised. In Kedra's PPSA model (2013) the *connotative part* is a sign that requires an interpretant, the *receiver* since the photographic code provides the receiver's intertextual connotations. According to Barrett (2006), we make meaningful connections between what we see and experience in a photograph and what else we have seen and experienced. The *additional question* in the original PPSA model (Kedra (2013) was developed for the learning process purposes, but also to provide a summary for the analysis. The additional question was also encouraged to be formulated according to the specific research topic, as we did by asking *What theme does the press photograph story communicate (of the outdoor or semi-outdoor workplace)?* Our aim was also to be able to thematise the findings of the analysis.

In the model for analysing these photo reportage images, the data was divided into thematic sections relating to the PPSA model by Kedra (2013): *Denotation* (denotation-sender, denotation-message and context, denotation-receiver), *Connotation* (connotation-sender, connotation-message and code, connotation-receiver) and *Additional questions* (Fig. 1). The analysed features were customised according to the content and relevance applicable to the outdoor knowledge work context. Figure 2 presents, in detail, the characteristics and examples (descriptions) of the modified PPSA model outlined in Figure 1. From now on this modified PPSA model is called the Press Photograph Story Analysis for Places of Outdoor Knowledge Work (PPSA-pOKW).

Figure 1. The table follows the structuring to Denotation-Connotation-Additional questions as the original Press Photograph Story Analysis (PPSA) by Kedra (2013), but the themes were modified to fit the topic of outdoor knowledge work.

Structure by Kedra (2013), content modified by the authors.		
Denotation-sender	Denotation-message & context	Denotation-receiver
Photographer's selection: Photo (location, techniques), Scenery (environment, protection and enclosure, materials, furniture), Characters (persons, clothing), Framing (surroundings), Lighting (natural, artificial, season)	Information from the caption or text if the photo is part of an article (insulation, IEQ, accessories).	Architectural analysis of character's possibilities to: Physical adaptation (reactive and interactive).
Connotation-sender	Connotation-sender & code	Connotation-receiver
Sender's relation to presented story (private sender, commercial sender, content-wise relation).	Connotations to: Other environments (office, home, garden, recreational), Architectural (style or approach).	Architectural assumptions: Atmosphere ("great day"), Seating position (exposure to sun), View, Protection from unwanted looks from behind.
Additional questions		
What theme does the press photograph story communicate?		

Figure 2. The table presents in detail the characteristics and examples (descriptions) of the modified PPSA model outlined in Figure 1.

Characteristics	Examples (descriptions)
Denotation (analogon i.e., analogue to reality)	
Photograph	Location* (Keyword/-s, Website address/-s, Geographic location), Techniques (Black & white, Colour, Rendering), Rendering was not included to the original model.
Scenery	Type of environment (designed for work Y/N), Means and level of protection and enclosure (number of horizontal/vertical structures), Exterior character (form, shape), Materials (exterior and interior), Furniture (designed for outdoor work, for indoor work, not for work)
Characters	Person working Y/N, Other person/-s Y/N, Other persons working Y/N, Light clothes (for indoor use), Warm clothes (for outdoor use), Hat (covering head, providing shade, for cold weather)
Framing	Surroundings (Natural, Garden, Courtyard, Urban with/without greenery, Other?)
Lighting	Natural (sunny (glare), partly cloudy, cloudy, no natural light), Artificial (visible lighting fixture/-s Y/N, location of lighting fixtures), Season (Spring/Summer (tones of vegetation), Autumn (colours), Winter (snow)).
Caption	Insulation (Wall/-s, Ceiling, Floor), IEQ (Heating, Air Conditioning, Lighting), Accessories (Curtains, Blinds, Electrically dimmed glasses), Other?
Physical adaptation	Reactive adaptation (Nikolopoulou & Steemers, 2003): Position (change seats/position Y/N), Posture (change posture Y/N: sitting, standing, informal position) Interactive adaptation (Nikolopoulou & Steemers, 2003): Possibility for personalising the workplace Y/N (affect formation of shadow, affect level of intimacy), Other?
Connotation (require interpretant)	
Sender's relation to presented story (and characters)	Private sender (Own photograph, Someone else's shared photograph, Other)
	Commercial sender (Product supplier, Service supplier, Magazine, Other)
	Content-wise relation, indicate?
Connotations	Office environments, Home environments, Garden environments, Recreational environments
	Architectural style or approach
Assumptions	Atmosphere ("Great day" to be outside: Strongly agree, Agree, Neutral, Disagree, Strongly disagree, Can't assume) according to Comfort Scale by Walton et al. (2007)

	Seating position (How exposed the worker was/would be in relation to the sun: Facing, Turned against, Side on, Partially shaded, Fully shaded, Can't assume) modified from (original: exposure to the wind) Comfort Scale by Walton et al. (2007), View (when working, optional)
	Protection from the unwished-for feeling of being watched from behind (Petersson Troije 2020)
Additional questions (to summarise the message)	
What theme does the press photograph story communicate (of the outdoor or semi-outdoor workplace)?	

5 REMARKS ON TEST-STUDY OF THE ANALYSIS TOOL

In parallel with gathering the material for the test-study, we were able to test and improve the analysis tool PPSA-pOKW further. Data was collected from Pinterest's English pages and about fifty of them were tested with the PPSA-pOKW analysis tool. The subjects of the photos were mainly from the UK or northern continental Europe. The photographs were collected by using keywords referring to outdoor work. It was noteworthy that there was not an established wording to name places for outdoor knowledge work. We started the search with the keyword *outdoor office*. The posted photos often included the original website where the photo was found and called with other terms. These synonyms enabled us to extend the search by also using other keywords. The photographs were placed in an online canvas tool Miro to enable arranging the photos and to make the preliminary thematic grouping by their exterior character easier. The first remarks of the test-study are presented here briefly.

Pods. An outdoor *Pod*, also called *Outdoor Office Pod*, *Outdoor Office Phone Booth*, *Small Office Pod*, *Micropod* or *Garden Work Hub*.

In general, these Pods form a similar group (character and looks) as the Pods in the indoor work environments, except *Garden Work Hubs* resembling regular garden sheds furnished to serve as workplaces. In indoor offices, in solo use Pods are meant to offer places for work tasks requiring concentration, preventing worker from acoustic or visual distractions, or protecting the others from the disturbing noise the solo worker inside the Pod is creating (e.g., video meetings and phone calls). Outdoors, it is less probable that the solo worker would cause any disturbance to someone else, but, instead, one needs sufficient protection from the weather. However, the outdoor Pods do not take advantage of the transitional zone between the interior and exterior space around it.

Sheds. An outdoor *Shed*, called *Shed Home Office*, *Backyard Office Shed* or *She-Shed* was typically an existing garden shed or summerhouse that was taken into use for knowledge work. In windowless garden sheds the only natural light would enter the interior by keeping the door open. The summerhouses usually had many windows thereby the glare would be more of a challenge than the lack of natural light. The interior and furnishing were more home or garden-like than the Pod interiors' office atmosphere. Some of these shed photos were from suppliers' catalogues, however also many of them were seemingly modified by the private people themselves.

Studios. One group of outdoor workplaces are the unique *Backyard Studio* being designed by architects to a specific client. These Studios are small in size, usually including a desk for one or two people. Their architecture is ambitious although the used materials are simple and inexpensive. The given reasons for the building project were the need for more room because of a growing family, running a home office, willingness to stay in the area where housing prices are known to be high.

Sunrooms. *Sunroom Offices* form a group of outdoor workplaces indicating how existing semi-outdoor spaces in detached houses or townhouses are re-occupied as spaces for office work. These mainly glass-metal structured spaces demonstrate how rooms not having fully insulated building envelopes and lacking continuous stable IEQ are still used as, at least, temporary workplaces.

Greenhouse. Converted *Greenhouse Office* represented one thematic group where existing building type was utilised for the purposes of outdoor knowledge work, instead of growing plants. The greenhouse provided a wind shelter with plenty of light. In the photos greenhouses were placed to a half-shadow created by trees foliage. The challenge seemed to be still to prevent glare and to balance with the thermal climate.

6 CONCLUSIONS

The environments of multi-locational knowledge work tend to be indoors. The context of working outdoors is an emerging and little studied phenomenon especially in the context of the built environment. Working outdoors has become technologically and socially possible in multi-locational knowledge work. We had identified interest in places of outdoor office work in popular media like the visual discovery engine Pinterest. Therefore, we were interested in exploring the places of outdoor knowledge work through photo analysis to understand their manifestations further. In this paper, the aim was to modify the existing journalistic photo analysis to be applicable to analyse the photographs of outdoor knowledge workplaces. In addition, in the context of built environment the definition of outdoor and semi-outdoor needed clarification to outline the material to be analysed. In our view, outdoors and semi-outdoors may also mean an enclosed and protected space, and not only open skies environments without protection from the weather. The building envelope separates the conditioned indoor environment from the unconditioned outdoor environment. In the built environment an outdoor space may be partially protected by walls or other parts of the building, it may also be under the open sky or totally apart from any building. Being under an open sky outdoor space may be sheltered with light structure or provide the occupants other types of protection from weather. In outdoor spaces the thermal adaptation is largely the occupant's responsibility adjusted mainly with clothing adaptation. In semi-outdoor spaces, the degree of environmental control is broader, varying from simple shading to moderate air conditioning where people are likely to expect an environment differing from indoors. The thermal environment of semi-outdoor spaces does not exclude enclosed spaces providing protection from the weather but lacking stable thermal control as indoors. From now on we consider both outdoor and semi-outdoor environments as possible places of outdoor knowledge work. Thermal control in semi-outdoor environments is related to strategies on how people adapt to the surrounding thermal climate. Especially interesting was the structuring of the physical adaptation of reactive and interactive adaptation. The reactive adaptation included personal changes, altering one's clothing level and posture or position, of which the latter ones are possible to facilitate with choices of design solutions. The interactive adaptation comprises the changes people make to their environment to improve the comfort conditions, which have, interestingly, a linkage to the ideas of control and personalisation – key concepts from work environmental psychology – supporting worker's sense of environmental satisfaction. In addition, physiological and psychological adaptation provide valuable background knowledge for architectural design researchers about occupants' relation to being in outdoor or semi-outdoor environments. It would be rewarding to study these themes further, together with an interdisciplinary context. The Press Photograph Story Analysis (PPSA) by Kedra (2013) provided solid ground for modifications consisting of six elements: sender, message, code, context, contact and receiver. We customised this model to fit the outdoor knowledge work environment photographs, separate from the original approach, that was not substance dependent. Only the message remained unchanged, referring to the image. The sender was expanded from a photographer to a person posting the photograph and to the commercial supplier. The receiver was considered an architect design researcher and work environment researcher. Unlike in the original PPSA model, the contact information was included: the photograph's location, a keyword as a content-

wise contact and geographic location of the photo's content to support thematic grouping. The context in the original model referring to the caption was extended to also include the other clarifying textual contents. With code, the model was structured into two, *denotation* being analogue to the reality shown in the photograph and to *connotation* requiring an interpretant, the receiver, supporting the systematic analysis. In the original PPSA model, the third element was the *additional question* to provide a summary for the analysis, and to thematise the findings. The modified version of the PPSA analysis model by Kedra (2013) was called Press Photograph Story Analysis for Places of Outdoor Knowledge Work (PPSA-pOKW). In the test-study, the PPSA-pOKW seem to provide a thorough tool to produce rich descriptive analysis of the found photographs, however being too long to present in the article. In further use, it needs to be developed to support the thematic grouping phase, especially when analysing broad amounts of photographs. The gathered data for the test study purposes was too narrow and one-sided to provide a reliable outcome of the ways or places of outdoor knowledge work. However, we were able to find examples of a specific kind of office work activities and places for knowledge work to consider that the phenomena of working outside is broader than considered in the earlier studies. We are planning to also test the PPSA-pOKW with larger quantities from other gathered data to be able to develop the thematic groups to typologies and convert them to a numeric form. Thereby, this quantified qualitative data could be analysed statistically together with other quantitative data such as location specific data.

REFERENCES

- Barrett, T. (2006). Interpretation. In L. Warren (Ed.), *Encyclopedia of 20th century photography*, vol. 2, 803-806. New York: Routledge.
- Barthes, R. (1977). *Image-Music-Text* (S. Heath, Trans.). London: Fontana.
- Bälter, O., Hedin, B., Tobiasson, H., & Toivanen, S. (2018). Walking outdoors during seminars improved perceived seminar quality and sense of well-being among participants. *International journal of environmental research and public health*, 15(2), 303.
- Brager, G. S., and de Dear, R. J. (1998). Thermal adaptation in the built environment: a literature review. *Energy Build.* 27, 83–96. doi: 10.1016/S0378- 7788(97)00053-4
- BS ISO 17772-1:2017. Energy performance of buildings -- Indoor environmental quality -- Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings. International Organization for Standardization, Geneva, Switzerland (2017).
- Cleveland, C.J., and Morris, C.G. (2009). *Dictionary of Energy*. Expanded Edition. Burlington: Elsevier.
- Dufva, M. & Rowley, C. (2022). Heikot signaalit 2022 – tarinoita tulevaisuuksista. *Sitran selvityksiä* 200. https://media.sitra.fi/2022/01/03083506/sitra_heikot_signaalit_2022_tarinoita-tulevaisuuksista.pdf (Accessed 16.12.2021)
- Edwards, J., Caplan, R., & Harrison, R. (1998). Person-environment fit theory: Conceptual foundations, empirical evidence, and directions for future research. In C. Cooper (Ed.). *Theories of organizational stress*. Oxford: Oxford University Press.
- Griffiths I. D., Huber J. W., and Baillie A. P. (1987) Integrating the environment. In *Proceedings of the 1987 European conference on architecture*, Steemers T. C. and Palz W. (Eds.), Kluwer Academic Publishers for the Commission of the European Communities, Netherlands.
- Humphreys, M. A., and Nicol, J. F. (1998). Understanding the adaptive approach to thermal comfort. *ASHRAE Trans.* 104, 991–1004.

- Jakobson, R. (1960). Closing statements: Linguistics and poetics. In T. A. Sebeok, *Style in language* (pp. 350-377). Cambridge: MIT Press.
- Kedra, J. (2016). Enhancing visual literacy through interpretation of photogenres: toward a genre typology of journalistic photographs, *Journal of Media Practice*, 17:1, 28-47, DOI: 10.1080/14682753.2016.1159451
- Kedra, J. (2013). To See More: A Model for Press Photograph Story Analysis. *Journal of Visual Literacy* 32(1), 27-50.
- Liu, D. C., Rogers, S., Shiau, R., Kislyuk, D., Ma, K. C., Zhong, Z., Liu, J. and Jing, Y. (2017, April). Related pins at pinterest: The evolution of a real-world recommender system. In *Proceedings of the 26th international conference on world wide web companion* (pp. 583-592).
- Lo, C., Frankowski, D. and Leskovec, J. (2016). Understanding Behaviors that Lead to Purchasing: A Case Study of Pinterest. In *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD '16)*. Association for Computing Machinery, New York, NY, USA, 531–540. <https://doi.org/10.1145/2939672.2939729>
- McQuail, D. (1997). *Audience analysis*. London: Sage. doi:10.4135/9781452233406
- Müller, D. K. (2007). Second homes in the Nordic countries: Between common heritage and exclusive commodity. *Scandinavian Journal of Hospitality and Tourism*, 7(3), pp. 193–201. doi:10.1080/1502250701300272
- Müller, M. G., Kappas, A., & Olk, B. (2012). Perceiving press photography: A new integrative model, combining iconology with psychophysiological and eye-tracking methods. *Visual Communication*, 11(3), 307-328. doi:10.1177/1470357212446410
- Nakano J and Tanabe S (2020). Thermal Adaptation and Comfort Zones in Urban Semi-Outdoor Environments. *Front. Built Environ.* 6:34. doi: 10.3389/fbuil.2020.00034
- Nikolopoulou, M., and Steemers, K. (2003). Thermal comfort and psychological adaptation as a guide for designing urban spaces. *Energy Build.* 35, 95–101. doi: 10.1016/S0378-7788(02)00084-1
- Petersson Troije, C., Jensen, E.L., Stenfors, C., Bodin Danielsson, C., Hoff, E., Mårtensson, F. & Toivanen S (2021) Outdoor Office Work – An Interactive Research Project Showing the Way Out. *Frontiers in Psychology*, 12:636091. doi: 10.3389/fpsyg.2021.636091
- Plambech, T., & Van Den Bosch, C. C. K. (2015). The impact of nature on creativity—A study among Danish creative professionals. *Urban Forestry & Urban Greening*, 14(2), 255-263.
- Syed, A. (2012). *Advanced building technologies for sustainability*. Hoboken, N.J.: John Wiley & Sons, Inc. doi.org/10.1002/ep.11911.
- Telenor Sverige AB. (9.8.2016). Jobba dig friskare på Sveriges första mobila utomhuskontor. Press release. https://www.mynewsdesk.com/se/telenor_ab/pressreleases/jobba-dig-friskare-paa-sveriges-foersta-mobilautomhuskontor1512552?utm_source=rss&utm_medium=rss&utm_campaign=Subscription&utm_content=pressrelease (Accessed 16.12.2021)
- The New York Times (15.1.2019), toim. Jane Margolies. The Next Frontier in Office Space? The Outdoors. <https://www.nytimes.com/2019/01/15/business/office-buildings-nature-biophilia.html> (Accessed 16.12.2021)
- Vischer, J. C. (2008). Towards an environmental psychology of workspace: how people are affected by environments for work. *Architectural science review*, 51(2), 97-108.
- Vischer, J. C. (2007). The effects of the physical environment on job performance: towards a theoretical model of workspace stress. *Stress and health: Journal of the International Society for the Investigation of Stress*, 23(3), 175-184.

- Wolny-Zmorzyński, K. (2007). Fotograficzne gatunki dziennikarskie (Journalistic photographic genres). Warsaw: Wydawnictwa Akademickie i Profesjonalne.
- Wolny-Zmorzyński, K. (2010). Jaka informacja? Rzecz o percepcji fotografii dziennikarskiej (What information? About the perception of journalistic photography). Cracow: Wydawnictwo Uniwersytetu Jagiellońskiego.
- Walton, D., Dravitzki, V. and Donn, M. (2007) The relative influence of wind, sunlight and temperature on user comfort in urban outdoor spaces. *Engineering, Building and Environment*. DOI:10.1016/J.BUILDENV.2006.08.004
- Wohlwill, J.F. Human adaptation to levels of environmental stimulation, *Human Ecology* 2(2) (1998).
- Zacharias, J., Stathopoulos, T., and Wu, H. (2001). Microclimate and downtown open space activity. *Environment and Behaviour* 2001; 33(2):296 315.

SESSION 3B: NEW WORKING SPACES AND STRATEGIES

Why are companies using coworking spaces? An exploratory study on “corporate coworking” trends in Italy

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ABSTRACT

In the last few years, workplaces have been experiencing huge changes due to the globalisation of work, as well as to the spread of COVID-19. In this scenario, coworking spaces are facing interesting transformations. Prior to the pandemic there were already early signs indicating that major global companies were moving their workforces into coworking spaces. In Italy, most coworkings have experienced an increase in employees from both the public and private sectors. Today, as the pandemic becomes more controlled and company employees are gradually returning to their offices, both large and small firms are finding that by using coworkings they can save money, develop connections, and gain access to new professional communities. Through a qualitative study based in Italy, the present contribution provides a first exploratory analysis of how company and coworking space management and coworkers are experiencing this phenomenon. More specifically, the aims of the study are to explore which meanings and possible challenges the “coworking experience” has for companies and their employees; which psychosocial and organisational impact this phenomenon has on employees and HR management practices; how the “corporate coworking” approach relates to the broader changes workplaces are facing nowadays. To address these aims, interpretive semi-structured interviews were conducted with 10 coworking managers (from different coworking companies); 9 HR managers (from companies already using coworking), and 11 coworkers belonging to private enterprises. Results show several challenges and even contradictions related to corporate coworking. On the one hand, managers and employees declare interest and openness to the idea and appreciate coworking utilities more than the opportunities of developing new communities and collaborative networks. On the other hand, concerns related to “cultural losses” and to a possible decrease of employee commitment have emerged. Implications for research and practice are therefore discussed and critically posed.

Keywords

Workplaces, Coworking spaces, New normal, COVID-19, HR management.

1 THEORETICAL FRAMEWORK

The phenomenon of coworking began in the early 2000s in the United States, underlining its collaborative potential in promoting social changes in the labour market and the introduction of the values of “accessibility, openness, sustainability, community and collaboration” (Ivaldi, Galuppo, Calvanese & Scaratti, 2020). By accessibility it was meant that the coworking space had to be as inclusive as possible, warm and welcoming. By openness authors referred to a frame of mind that should be open to new ideas, different points of view, and a willingness to change and learn. The value of sustainability, when referring to coworking, meant making sure that one's businesses and community were structured in such a way that they could constantly be nurtured by a well-balanced give-and-take, in a way that allowed the community to persist (Opencoworking.org). Community was for the movement the most important value and also a factor considered as central to the success of a coworking space. Coworking should be not a service, which one buys, but a two-way relationship, in which community members benefited and contributed equally. Collaboration within coworking spaces was finally understood as trust, sharing, give-take relationship between people and with the community as a whole (Spinuzzi et al., 2018). Coworking started as a new way of organising for independent professionals, permitting them to work into a social and organisational structure (Josef and Back, 2018). In recent years, however, several medium-sized or big companies, and even global enterprises, started allocating employees or teams in collaborative spaces, temporarily or on an ongoing basis (Roth & Mirchandani, 2016). These started using coworking in ways that were somehow different from the openness and collaborative ideals of the beginnings (Roth & Mirchandani, 2016). The aim of the corporate choice in fact seemed to be driven by obtaining tangible and intangible benefits from the coworking space (PwC Italy 2021). Coworking strategies seemed to reduce real estate costs and provide greater flexibility in space management, for example when a team increased or downsized. However, some risks started to emerge: companies reported to not have the freedom to modify the office to reflect the values of their organisation, to maintain a strong and shared culture. Another risk was that employees in a coworking space could develop closer relationships with employees from other companies rather than building a collaborative bond in their company. These opportunities, but also threats, emerged during the COVID-19 emergency even more explicitly, when remote working was adopted as a preferable or mandatory method. The pandemic period changed coworking spaces even further. A research by ALCHEMA in collaboration with PwC (2021) reported for instance that sociality and community building among coworkers, normally considered a key value, started to be perceived as a threat during the pandemic months. Nevertheless, it was noted an increase in coworkers coming from small and big enterprises: the 37% of the spaces interviewed, in particular the larger ones, (> 20 seats), declared a greater increase of employees of private companies from the beginning of the pandemic (Pais, Manzo and Gerosa, 2021). It also emerged that the employees began to rent workstations individually, subsequently convincing their companies to cover the costs. The interviewed coworking spaces declared that they had received increasing requests from companies for workstations and / or private offices. Nowadays, we are thus seeing a new trend, according to which coworking spaces are trying to attract companies and their employees, as a significant opportunity for their future, while, on the other side, more and more companies seem interested in the “coworking format” (PwC Italy 2021). However, some of the foundational values of the coworking phenomenon, appear in this trend at risk. Are we facing a new era in approaching coworking? How the coworking “spirit” can meet corporates’ needs, and which new “culture of coworking” is being shaped by this meeting?

2 THE RESEARCH

From the research described above, it has been shown that for years coworking spaces have emerged as concrete phenomena linked to values such as accessibility, openness, sustainability, community and collaboration (Ivaldi, Galuppo, Calvanese & Scaratti, 2020). Before the Covid pandemic, companies thought they could take advantage of these values and other emerging advantages such as spatial, temporal and even economic flexibility of this phenomenon (PwC, 2021). Previous research has identified advantages and possible risks of this phenomenon, often limiting research to a single point of view. Moreover, the pandemic spread represented another critical turning point, pushing even further companies' interests into the "coworking format", with unprecedented effects on the coworking phenomenon and on its original ideals. This study therefore arises from the need to bridge these gaps, and to explore from different points of views how and why companies are now recurring to coworking. Through a qualitative study based in Italy the present contribution provides a first exploration about how coworking managers, coworkers and corporates represent and experiment this phenomenon. How has been corporate coworking used by its users during the Covid pandemic? What are its related challenges and contradictions? The aims of the study are to explore which meanings and possible challenges the "coworking experience" has for companies and their employees; which psychosocial and organisational impact this phenomenon has on employees and HR management practices; and how the "corporate coworking" approach relates to the broader changes workplaces are facing nowadays. It's worth noting that in literature there are different definitions of corporate coworking. Sometime corporate coworking is mainly defined as inhouse coworking within the same corporate and regular coworking spaces, that are open to individuals, SME, entrepreneurs and employees of multinationals. In other studies these spaces are not called corporate coworking spaces because coworking spaces are defined as inhouse coworking within the same corporation. (Gauger, Voll & Pfnür, 2022; Heinzl, Georgiades & Engstler 2021). In this study corporate coworking will be defined without this distinction: a phenomenon of use by small, medium and large companies of coworking spaces, both internal or external spaces of companies, and hybrid offices built by supporting the values of accessibility, openness, sustainability, community and collaboration. The research started in January 2021 and ended in June 2021, exploring corporate coworking from several points of view. The project had different but complementary objectives and the analysis was done in two parallel phases. The first phase was focussed on the exploration of the coworking experience. In this first phase, managers/ curators of different coworkings and "corporate co workers" belonging to small and medium-sized enterprises were interviewed. The second phase, parallel to the first, investigated the corporate coworking phenomenon from the enterprises' point of view, interviewing HR managers, who either had or not used coworking for their employees. This phase allowed a deeper understanding of the meanings assigned to the work environment and how these meanings could be maintained, transformed, or even adapted to new agile working methods, through the use of coworking spaces. To address these aims, interpretive semi-structured interviews were conducted via Teams. Interviews were focussed on the meaning associated with the coworking space/experience, the reasons for its use, threats and opportunities, current and future challenges.

3 SAMPLE

Overall 35 people were interviewed: 10 coworking managers, 11 corporate coworkers, 9 HR professionals (3 users and 6 non users of coworking), a professional in Real Estate and one in Change Management. Then, three other professionals, 3 key informants, were listened to as experts on some relevant topics of research. They are been listened because they have given another vision about coworking experience: one is the founder of "Italian coworkings" blog;

another is a HR professional of a famous international community of companies and the third is a Innovation Manager of a Italian digital company who collaborated with the coworking space “Talent Garden”. The sample was constructed with a logic of maximum variability, covering the evidence of the phenomenon and obtaining an adequate number of cases. Many of the participants were contacted through LinkedIn messages. The participants were contacted aiming to collect data from three main targets: coworking spaces, coworkers, companies, both located in coworking spaces, and not located in coworking spaces. A thematic analysis approach was followed (Braun and Clarke, 2006). This analysis allows to unit material by similar topic and it’s a necessary coding when you want to find all the data concerning a particular aspect of the experience studied. Following an initial thematic analysis on each interview, for each target, the categories and subsequent themes that emerged were compared and integrated, defining convergences and divergences with respect to their content. During this process of organising the data, the original transcripts were continually re-analyzed to ensure that the themes were representative of the views of the participants. The identified codes were then aggregated into clusters of themes that are discussed in the following sections.

Figure 1. Example of identified codes

- NEW CHALLENGES**

 - *New visions of the coworking space:*
 - *Single spaces;*
 - *Shared spaces;*
 - *Flexible offices; ...*
 - *New visions of the office:*
 - *Differences from the past;*
 - *New workplace design; ...*
 - *Organizational challenges:*
 - *Company culture;*
 - *Socialization;*
 - *Membership; ...*
 - *New concepts:*
 - *Nearworking;*
 - *Membership;*
 - *Flexible offices; ...*

4 RESULTS

The results were organised by identifying some core themes: new needs and motives emerging from the pandemic; the meanings of “coworking” and possible corporate coworking formats; challenges and contradictions of corporate coworkings. Here below is a brief description of each theme.

4.1 COVID-19 pandemic: new needs and new users’ motives

Interviews show how COVID-19 has partially changed workers’ needs and attitudes towards their workplaces. As discussed above, interviews have confirmed the increase of company employees as new users of coworking spaces. The main needs associated with coworking demands were those of flexibility and sustainability. In terms of flexibility, some interviewees described coworkings as places allowing greater flexibility in terms of working time and space. Here, coworking seems to represent a new solution to a changing/fluctuant “demand” of space that companies or single employees have. The idea here is that flexible offices, and not shared workspaces, are nowadays needed by many enterprises and remote workers and coworkings represents an increasing and satisfactory answer. Most HR managers confirmed this second representation, by emphasising the conception of coworking as an offer of workspace’s

utilities, a way of optimising space/time and costs of work rather than promoting collaboration and networking.

“We want to allow the company to be where it is needed, with the space it needs and with the costs it needs” (Coworking Manager_5).

In terms of sustainability, results showed that many employers required to coworking due to a strong sense of isolation and to the necessity to “re-set” the boundaries between the work and the family/private sphere and to gain higher work-life sustainability. This need seems so strong that many interviewees declared they paid personally for their workstation, without any financial reimbursement from the companies. This aspect was confirmed by all the HR managers: before and during the COVID-19 pandemic, none of the 7 companies interviewed provided a refund to those who had decided to work from a coworking station (refund not given for different reasons). Here a challenge emerges: although the increasing request of coworking, the economic sustainability of this choice might be at stake. In order to meet the new demand, however, coworking spaces have started several marketing campaigns to attract new clients, by offering for instance flexible memberships for corporates’ workers. On the other hand some companies have started to handle this demand of flexibility and sustainability by rethinking their workspaces. The effect of these initiatives, however, are still uncertain and to be explored. *“(The name of a company) closed its offices in Milan telling all their employees that they did not trust the measures taken and were afraid of running into problems. We have had so many executives, managers in order not to work from home, but precisely because it was difficult to work from home, not for everyone it is viable, they signed a membership contract of association to our network so they came every day. They were employees of companies who, however, paid in order not to work at home, out of their own pocket, to work in our spaces.”* (Manager of a coworking_5)

“Lately we have expanded our audience, turning more to people like this who therefore come because they are neighbours, they can reach coworking on foot or by bicycle and maybe they work for multinationals, with sectors and companies that have nothing to do with us, but however, in this case we are useful because we are a space that turns out to be a service of the neighbourhood, right now that we are closed at home with smart working and maybe precisely, struggling” (Manager of a coworking_8).

4.2 Meanings and formats of corporate coworking

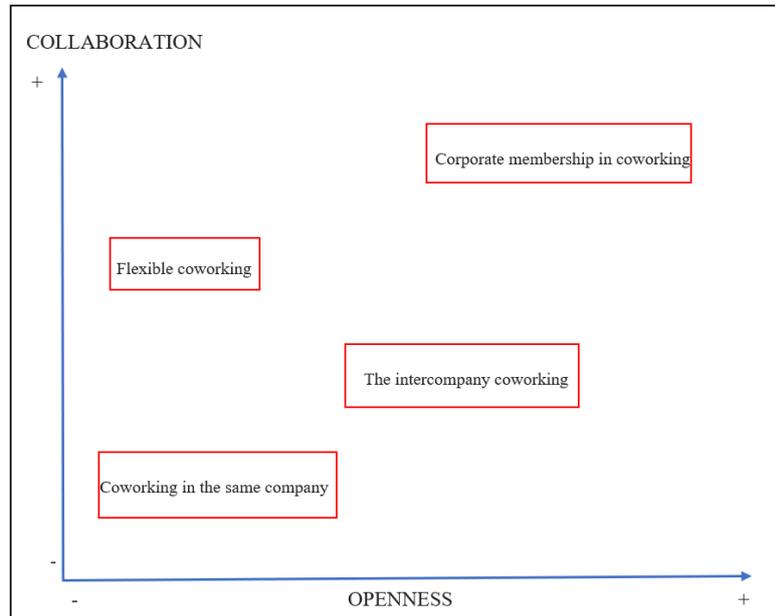
From the interviews to the three targets, corporate coworking experience seems associated with different needs: sustainability, flexibility and sociality, have been the most used words for coworkers and managers to describe their experience. However, not all the coworking experiences met these needs in the same way. As a matter of fact, the interviews revealed that coworking experiences varied a lot in terms of collaboration and openness. In terms of collaboration, for some interviewees, coworking represents an agora where it is possible to exchange experiences, competences, and interests.

“It is a place where if you say something people will listen to you and if you walk down the corridor there is probably something they are talking about that interests you. So it is a place to exploit, but it is an amplifier, where it is potentially easy to create collaborations and find value” (Key informant_1)

For others, however, coworking is still a set of commodities and utilities that can be shared by different workers, but without any other implication in terms of networking or collaboration. In terms of openness, interviewees reported that coworking allowed either higher or lower cultural and organisational “boundary crossing” experiences. Openness indicates whether the corporate boundaries were intended as open and porous, and how much exposure to other cultures and symbols was allowed vs. controlled in the coworking experience. Openness and

collaboration represent two “conceptual” axes according to which different (and also new) formats for the corporate coworking emerge (see Figure 2).

Figure 2. Corporate coworking formats and their positioning



1. Coworking between the offices of the same company (WORK HUB) (low openness, low collaboration). This experience is positioned at low levels of openness and low levels of collaboration. Large companies, with multiple offices in Italy and beyond, are thinking about giving their employees the possibility to work in all company locations, in line with the concept of networking. Here coworking represents a new type of “open” space within the same company, without any other idea of collaboration and sharing. Companies are not open enough to externalise their “spaces” or to send their workforce out of their physical boundaries, neither they encourage collaboration among their employees through the coworking experience.

“With respect to the agreement, we have thought in the future to provide for a coworking mode between our offices. I live in Viale Certosa and the office is in San Babila, if I have a (company name) office closest to it I book it and go there. These are the arguments we are making today” (HR Manager_7)

2. The intercompany coworking (medium openness, medium collaboration). This experience represents a medium openness and medium collaboration idea, and appears as an innovative and emerging use of “corporate coworking” spaces. This idea defines coworking as a creative space where support, collaboration and relationships are generated in an inter-organizational context where companies decide to work together to create innovation in the same field. This choice for companies means opening to new organisational cultures, but also in a controlled way. Some interviewees describe here cases of companies’ consortia reorganising their spaces to give their employees and other freelance professionals the opportunity to work in the same place and share competences, within specific and guided projects of inter-organizational contamination.

“In fact, we are participating in an experimentation with ELIS in which the point is not so much to have and stay in a coworking location, but to understand how together with other companies it is possible to replicate or otherwise rethink the logics that allow to have the same results in

terms of interpersonal relationships, exchange of experiences and also in terms of corporate identity and so on” (HR Manager_4)

3. The flex office (high/medium openness, low collaboration). This experience is positioned at a medium level of openness, but low levels of collaboration. Coworking here represents a “flexible office”, that companies can rent and use within a large Business Centre, according to their needs and demands. As companies downsize or enlarge, or open new sites in new regions, also for meeting the needs of an increasing remote workforce, coworking represents a quick and low-cost answer. In this experience there is less cultural control by the companies and more openness, but is not a decision with the aim to create new collaborations and sharing new ideas, but only to rent a flexible space.

“[Name of a coworking space] is a place, a network of workplaces. It is a set of centres in various parts of Italy, in Milan in particular and is a network of workplaces, that is, places where one goes to work, that is, places where people go to carry out their professional activity. This activity can be carried out in offices, as a coworking station or for a meeting, videoconference. Depending on the facets that the work can take, it responds to the need to be, as it were, the complete solution in this sense. It is the answer to the question, where can I work today?” (Coworking Manager_2)

4. Coworking with membership with coworking spaces (high openness, high collaboration). This use of corporate coworking seems to maximise openness and collaboration. Here corporate coworking emerges from several interviews as a possibility some companies are thinking about but have not already implemented. This idea resembles the intercompany coworking one, integrated with a more openness and more courage to share, meet and create a multicultural environment with less control by the company. Since in this case companies rent coworking spaces and send their workforce with the specific aim to encourage idea sharing and professional development. Even though companies are contemplating this possibility, none of the interviewees have shown a substantial investment in this direction, although some coworkers and managers declare their interest in this option.

“The company might say I make a contract with Copernico and then my employees go to the Copernico closest to their residence or to their needs on that day. If I have to take my son to school, I go to the closest Copernico. This is a project that if we could complete it would surely be successful. Difficult for companies to define but very useful, because it means bringing work to a distance that allows me not to take an hour of public transport. This is the main need, the fact of reaching it by car, therefore clearly in the suburbs.” (Manager of a coworking_3)

4.3 New challenges for companies, employees and coworking spaces

The coworking formats described in the interviews show how a new and hybrid approach to the workplace is emerging, based on the possibility given to employees to work in the company headquarters, in smaller offices, in coworking or even from home. The emerging model is in some cases a hybrid place between corporate and non-corporate workspaces. Many companies have in fact chosen to leave part of their traditional offices, investing in spaces spread across the country and guaranteeing their workforce with the possibility to continue working from home or from these spaces. For medium-large companies the possibility to open up to corporate coworking has also emerged as conceivable, but not as an alternative to the maintenance of their own company headquarters. This topic appears as a meaningful point for employees and managers. The workplace is described not only as a physical place, but it is a space where workers encounter values, culture, and therefore develop a sense of belonging. Workplaces are sites that companies customise, based on their culture and symbols. The relationship between space, sense of belonging and brand identity is confirmed by those who, as HR managers, have managed and / or have lived the experience of corporate coworking. A coworking space can be customised in a limited manner, and this makes it more difficult to create a brand identity

and a strong belonging to the company. For this reason, it is necessary to pay the right attention to these aspects. On an individual level, the pandemic has changed professional identities, breaking down the divisions of different roles and blurring boundaries between work, private life, family...that, before the pandemic, were strictly kept apart and separate. If the Covid pandemic has pushed many employees to rethink their work/life balance, finding in coworkings a possible answer, for companies there is much more concern for the difficult challenges they see, such as learning to manage people at a distance, managing communication and continuing to build social capital, despite the decreased physical presence. For the organisations, therefore, the need emerges to maintain and find new ways of creating a sense of belonging and transmitting corporate values through a hybrid solution that can provide for the right balance between proximity and distance, presence and remote working.

“So the previous perspective is reversed: if before the space was a comfortable place to carry out their tasks 8 hours a day for the whole week, now the question is how do we ensure that our people have the spaces cut in the right way and organised well to be able to promote their collaboration?” (Real Estate and Facilities professional_1)

“You can give all the flexibility you want, but then you have to give synchronisation rules because teamwork is always fundamental. So to create a balanced mix between the two, especially for the company but above all for the manager” (HR Manager_7)

“A mixed formula, where the workplace does not necessarily have to be the physical headquarters of the company, but establishing opportunities for meetings between colleagues and teams is healthy to maintain a balance of sociability that is sacred in the working dimension. So in my opinion, with balance and rationality, you can maintain a dimension disconnected from the workplace, while always keeping in mind that the dimension of culture and values is the central aspect of the organisation and therefore providing for moments of aggregation is essential” (Coworker_10)

5 DISCUSSION & CONCLUSIONS

The COVID-19 pandemic has influenced and changed, either temporarily or permanently, the way of working and living in the workspace. Aims of the present study were to provide a first exploration of the meanings and possible challenges that the “coworking experience” had for companies and their employees during the pandemic, also related to the broader changes workplaces are facing nowadays. Results have shown several interesting challenges in this regard. First, all the interviewees declared an increase in the “coworking demand” of many employees, triggered by the experience of remote/home working, and aimed at “reconfiguring” the work/life boundaries, avoiding isolation, and gaining more flexibility. This demand was grounded in the need for more comfort and autonomy, more socialisation, more psychosocial sustainability, guaranteed by a better work - life interface. From their point of view, corporates and coworking organisations have replied by rethinking their spaces and proposing different “coworking formats”, sustaining openness and collaboration at different levels. On the one hand, however, some of the cited formats (the flex office; the coworking within the same company), don’t seem to show any meaningful innovation, since they resemble a traditional idea of “flexible open space”. They promote flexibility and more sustainable working conditions, but they challenge other foundational values of the coworking: collaboration, and openness to new cultures and opportunities appear in these formats highly limited. Other formats, on the other hand, (intercompany coworking – company coworking membership) seem closer to the coworking foundational values, and present co-working as a new “HR management strategy” based on collaborative networking and circles of innovation (Busacca, 2019). Only a few interviewees, unfortunately, report these latter strategic investments. In most cases coworking seem more a “tactical” benefit for increasing workers’ (short term?)

satisfaction, rather than a means for renewing the relational and professional environment where people meet, contaminate each other, develop an open mindset, renew their cultural background and finally are offered new opportunities for inter-professional and inter-organizational learning. HR managers, in particular, seem more than worried by a “radical” coworking option, since such a collaboration and workplace openness might bring to a loss in corporate control of the “symbolic and relational knowledge” embedded in the socio-material dimensions of everyday working life. The risk, well underlined by the research results, is here that companies engage in a positive but tactical storytelling of coworking, but at the same time overlook (or explicitly discard) the new approach required in dealing with collaborative and open workplaces. For the organisations, embracing coworking without depowering its openness and collaborative nature means entering a strategic and cultural change, where hybridization of work means not only gaining more time, space and economic flexibility, but most of all accessing new forms of power and control flexibility, for managing people through higher degrees of distance and freedom. Considering inter-professional and inter-organizational learning as a strategic asset and finding new ways of leading hybrid teams are in this regard key levers for “moving” from the most traditional to the most innovative coworking formats. From the research and the explicit results, limits can also be delineated from which new research ideas can be drawn. As emerged from the results, the possibility of "Coworking with membership with coworking spaces" emerged, for example, only as a possible idea, but none of the professionals interviewed showed a real investment in this opportunity. This gap, in the present research, has not been particularly deepened, for this reason a future analysis may be necessary. Furthermore, the construct of collaboration and networking could be further investigated with respect to the 3 points of view questioned, in particular in the period following COVID-19. The path is still open, and the way corporate coworking experience has been reported by its protagonists contributes to highlighting its complexity and its contradictions. How managers, workforce and organisations will handle them, represents a promising theme to be further explored in the future.

REFERENCES

- Braun, V., Clarke, V. (2006), *Using thematic analysis in psychology*, Qual. Res. Psychol. 3, 77-101, available at: 10.1191/1478088706qp063oa
- Busacca, M. (2019), “I coworking: anello emergente nella catena di produzione del valore. I coworking: anello emergente nella catena di produzione del valore”, 125-142.
- Gauger, F., Voll, K., Pfnür, A. (2022), *Corporate Coworking Spaces-Determinants of Work Satisfaction in Future Workspaces*, Die Unternehmung, 76(1), 65.
- Heinzel, V., Georgiades, S. and Engstler, M. (2021), “Corporate coworking - a catalyst for collaboration, creativity, and innovation in the flexible workplace”, *The Flexible Workplace*, Springer, Cham, 141-154.
- Ianeva, M., Ciobanu, R., Lai, C. (2021), *The New Physical Territories of Digital Activity. Digital Transformations in the Challenge of Activity and Work: Understanding and Supporting Technological Changes*, 3, 141-154.
- Ivaldi, S., Galuppo, L., Calvanese, E., Scaratti, G. (2020), *Coworking space as a practised place between welfare working and managerial challenges*, Journal of Workplace Learning.
- Josef, B., Back, A. (2018), “Coworking as a new innovation scenario from the perspective of mature organisations” in (Ed.), *The 6th International OFEL Conference on Governance, Management and Entrepreneurship. New Business Models and Institutional Entrepreneurs: Leading Disruptive Change, April 13-14, 2018, Dubrovnik, Croatia, Zagreb*: Governance Research and Development Centre (CIRU), 491-507.

- O'Rourke, G. A. (2021), "Workplace strategy: a new workplace model", *Asia Pacific Journal of Human Resources*, 59(4), 554-566.
- Orel, M., Dvouletý, O. (2020), "Transformative changes and developments of the coworking model: A narrative review", *Technological progress, inequality and entrepreneurship*, 9.27.
- Osservatorio Smart Working (2020), Smart Working: il futuro del lavoro oltre l'emergenza, paper presented at Osservatorio Smart Working meeting, November 3, 2020, Italy.
- Pais, I., Manzo, C. and Alessandro, G. (2021), Il lavoro condiviso: la trasformazione degli spazi di coworking durante l'emergenza COVID-19.
- PwC and ALCHEMA (2021), "Spazi di coworking in Italia", paper presented at online event Le nuove forme di organizzazione del lavoro: il ruolo dei coworking. Presentazione della ricerca sugli spazi di coworking in Italia: caratteristiche del mercato e analisi dei benefici materiali e immateriali per le imprese, January 27, 2021, Italy, available at: <https://www.youtube.com/watch?v=rdFlbN-HrnE>
- Roth, K., Mirchandani, N. (2016), "The rise of co-working: a growing workplace movement", *Corporate Real Estate Journal*, 5(4), 314-328.
- Spinuzzi, C., Bodrozic, Z., Scaratti, G., Ivaldi, S. (2018), "Coworking is about Community: but what is 'Community' in Coworking?", *Journal of Business and Technical Communications*, 33(2).

Creating a coworking space: motivations and sustainability after the COVID-19 crisis

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ABSTRACT

This paper focuses on the creators of CSs. The aim is to present in a first part their motivations to create a CS before the COVID-19 crisis and in a second part the difficulties encountered by CSs creators during the COVID-19 crisis. The amount of research dealing with CSs has increased enormously since the 2010s in both the human and social sciences. However, as yet few studies have looked at CSs from the perspective of creators of CWs. Our aim is to fill this gap by studying the motivations, both professional and personal, to create a CS before the COVID-19 crisis and how they have dealt with the COVID-19 crisis. The results presented are based on a qualitative survey conducted amongst the creators of CSs in the Auvergne-Rhône-Alpes region of France and a questionnaire survey sent to them after the COVID-19 crisis. Our results show that the motivations for creating a CS are very different for each creator and are part of both professional and personal projects. These creators recognise that they have been strongly impacted by the COVID-19 crisis, in particular by the closing obligations imposed during the lockdowns in France. Even if their situation does not seem to have returned to normal, many elements lead them to believe in coworking's future: the arrival of new coworkers, the diversification of their profile, the development of remote work and the limits encountered by home-based telework. We have established a typology of the creators of CSs based on their motivations to create a CS and we have produced accurate data about the impact of the COVID-19 crisis on CSs (duration of the closure, evolution of coworkers's number and profile, etc.).

Keywords

Coworking spaces, Creator, COVID-19 crisis.

1 INTRODUCTION

Coworking spaces (CSs) first appeared in San Francisco in 2005 and the phenomenon has grown enormously over the last 15 years. The variety of players behind their creation has proliferated, and includes companies, associations, start-ups and hotel chains. Their locations have changed and include global metropolises, medium-sized cities, suburban and rural areas. Their financing methods have changed too and include both public and private sectors, and they have attracted the interest of a greater range of disciplines, including management sciences, sociology, anthropology, geography and urban planning. Under these conditions, it is not straightforward to give a single definition of CSs. In this paper we shall think of them as intermediate places between the home and the workplace, whose main activity is to provide their users with a workspace that includes shared services and encourages collaboration. This definition is based on the combination of three criteria: the idea of a third place (Oldenburg 1989), specialisation on the work function and the importance of the collective dimension. In

the literature on CWs, a lot of research has been done on the users of CWs in order to know their profiles, their motivations, their way of working, etc. But few studies have looked at CSs from the perspective of creators of CWs (Krauss and Tremblay 2019; Lejoux et al. 2019). Our aim is to fill this gap by focusing on the creators of CSs in the Auvergne-Rhône-Alpes region of France. In the first part, we will study their motivations, both professional and personal, to create a CS before the COVID-19 crisis. In a second part, we will see how they have dealt with the COVID-19 crisis (closure, evolution of coworkers' number and profile, etc.) and if they are confident or not in the sustainability of their business in the short and mid-terms.

2 LITERATURE REVIEW

The amount of research dealing with CSs has increased enormously since the 2010s in both the human and social sciences (Akhavan 2021; Flipo and Lejoux 2020; Orel et al. 2021). Four main lines of research have been pursued: the CSs as workplaces, the ways of working in a CS, the users of CSs, the geographical context of CSs. The first line of research has identified the characteristics of CSs in order to define them and distinguish between them and other forms of work organisation (traditional offices, etc.). Numerous typologies of CSs have been drawn up on the basis of a variety of criteria (Akhavan 2021; Boboc et al. 2014; Brown 2017; Liefoghe et al. 2013; Mariotti et al. 2017; Perrin and Aguiléra 2017; Spinuzzi 2012). The second line of research has focused on the collaborative practices that are developing in these spaces in order to see to whether and to what extent they could lead to new forms of value creation and innovation transfer (see in particular Capdevila 2016; Fabbri and Charue-Duboc 2016; Gill et al. 2019; Scaillerez and Tremblay 2016; Suire 2013). The third line of research has sought to discover the identity of the coworkers and why they embraced this new way of organising work (see in particular Akhavan 2021; Avdikos and Kalogerisis 2017; Blein 2017; Brown 2017; Spinuzzi 2012; van de Koevering 2017). Finally, the fourth line of research has focused on the analysis of the geographical context of CSs by looking at their effects on their immediate environment, in both urban and rural areas (Mariotti et al. 2021). However, as yet few studies have looked at CSs from the perspective of creators of CWs (Krauss and Tremblay 2019; Lejoux et al. 2019). Our aim is to fill this gap by studying the motivations, both professional and personal, to create a CS before the COVID-19 crisis. In this purpose, we have reconstructed the occupational trajectories of the founders (career path, values, interest in this mode of work organisation, etc.), the history of the creation of the CS (goals, values, definition of coworking, partners, choice of location, planned changes, etc.) and its mode of operation (legal status, mode of financing, services offered, etc.). But the creation of CSs has been disrupted by the COVID-19 crisis. This change in context raises many questions about the sustainability of this new way of organising work. Three elements may have weakened the position of the creators of CSs. The first is related to the consequences of the lockdown measures. In France, these resulted in a general encouragement to telework from home during the three lockdown periods: from 17 March to 11 May 2020, from 30 October to 15 December 2020, and from 3 April to 3 May 2021. The second element is about the implementation of sanitary and physical distancing measures, which were particularly unsuitable in these spaces designed to facilitate exchanges and collaboration through the sharing of offices and convivial areas (kitchen area, lounge area, etc.). Finally, the third element is linked to the economic crisis, which could have weakened the economic situation of the self-employed and led them to cancel their CS membership. While it is still difficult to assess the impact of the COVID-19 crisis on the sustainability of CSs, recent works suggest that this impact may be limited (Leducq, 2021). The health crisis has provided the first opportunity for a large-scale trial of teleworking from home. It has highlighted the need to limit some unnecessary travel by means of videoconferencing. It has brought to the fore questions about the quality of the living environment as a result of the

rejection of metropolises and the urban exodus during the confinements. These elements could be favourable to the creation of CSs, especially in rural areas (Manzini Ceinar and Mariotti, 2021). According to some authors, the hypothesis of a relocation of CSs and coworkers from the centre of metropolises to rural areas should not be underestimated (Mariotti and Di Matteo, 2022). For example, the share of teleworkers outside metropolitan areas has massively increased in Italy (Mariotti et al., 2021) but also in remote parts of the UK like South West England and Wales (Bosworth et al., 2021). In this context, it seems important to ask the creators of CSs what they think about the situation.

3 METHODOLOGY

The results presented in this article are based on a project funded by the French National Research Agency from 2018 to 2021. It was conducted in the Auvergne-Rhône-Alpes (AURA) region of France. In 2018, this region had 7.9 million inhabitants, including 3.7 million workers, making it the second most populated region in France. One advantage of the AURA region is that it allows us to study CSs that are located in a variety of areas: metropolises, medium-sized cities, and small towns that act as centres in rural areas. In this paper, our results draw on two types of materials: semi-directive interviews with the creators of CSs conducted before the COVID-19 crisis (3.1), a questionnaire survey conducted among the creators of CWs after the COVID-19 crisis (3.2).

3.1 A qualitative survey conducted among the creators of CSs before the COVID-19 crisis

In order to better understand the motivations to create a CS, we conducted a series of semi-directive interviews with 26 creators of CSs in the AURA region of France. These CSs were selected to obtain a sample with a maximum degree of diversity in order to have the most comprehensive view possible. We applied three criteria to ensure this diversity: the location (the centre of a metropolis, the suburbs of a metropolis, a medium-sized town or city, a small town or a rural area); the type of CS (independent or part of a chain); and finally, the type of finance (private or public). Most of the interviews were conducted with the creators of the CSs, apart from two that were conducted with the current managers, as the founders had left the CS some years earlier. The face-to-face semi-directive interviews, which lasted one and a half hours, were intended to reconstruct the occupational trajectories of the founders (career path, values, interest in this mode of work organisation, etc.), the history of the creation of the CS (goals, values, definition of coworking, partners, choice of location, planned changes, etc.), its mode of operation (legal status, mode of financing, services offered, etc.). These elements have allowed us to draw up a typology of the creators of CSs according to their professional and personal motivations.

3.2 A questionnaire survey conducted among the creators of CSs after the COVID-19 crisis

In order to assess the impact of the COVID-19 crisis on the CSs located in the AURA region of France, we conducted a survey towards creators of CSs in December 2021. This consisted of sending an online questionnaire to the 168 CSs that we had identified in 2021. We received 95 responses, i.e. a response rate of 56%. The questionnaire aimed to understand how the creators of CSs had experienced the health crisis. They were asked questions about their eventual closure, the duration of the closure, and the measures that had the greatest impact on them (work-related travel restrictions, curfew, ban on receiving the public, health and physical distancing measures, etc.). It then aimed to identify the impact of the health crisis on the situation of their CS by asking them about their loss of income (cancellation of subscriptions, inability to rent CS, etc.), about changes in the number and profile of coworkers (employees, self-employed, etc.) and about their current situation (stable, growing, fragile, etc.). Finally, a

series of questions sought to find out how the creators of CS envisage the future of coworking (degree of confidence, elements that could encourage the practice of coworking, etc.). The collected data were then input and processed using a descriptive statistics approach based on an initial flat analysis.

4 WHY CREATE A COWORKING SPACE?

The analysis of the semi-structured interviews enabled us to establish a typology of the creators of CSs according to their professional and personal motivations. Through the analysis of the speeches tracing the history of the creation of the space, its mode of operation, the occupational trajectories of the founders and the values to which they are attached, we have identified four states of mind according to the creators: Business coworking, Opportunity coworking, Friendship coworking and Anchoring coworking.

Business coworking. In this first case, the motivation for creating a CS is primarily professional: it is an entrepreneurial project. The creators, who are "serial entrepreneurs", are seeking to carry out a business project built around the access to a professional network. To promote this professional network, the creators refer to the pioneering values of coworking, particularly the community. The community is used as the brand image of the CS and becomes a commercial argument for attracting users. The creators organise numerous events because these events are the "product" offered to coworkers to improve their professional network. In order to develop this professional network, either the creators of these CSs specialise in a sector of activity (media, image, digital, etc.) or they develop a chain of CSs. Although this type of CS is very present in the centre of metropolises, it is also found in medium-sized cities and even small cities.

Opportunity coworking. In this second case, the motivations for creating a CS are also professional, but unlike the previous case, the CS does not constitute the core of the entrepreneurial project. It is only a secondary activity. The creators of these CSs want to make profitable premises that have become too large for their main activity. Beyond the financial benefits, they appreciate the opportunity to exchange with entrepreneurs from other sectors of activity. Their interest in these exchanges is only motivated by intellectual curiosity, they do not expect business opportunities. In these spaces, few events are organised and the work environments remain very traditional, but very qualitative (laser printer, video conference rooms, etc.). The creators seek to attract users who need a temporary workplace. These CSs are mainly located in the centre or suburban areas of metropolises and in medium-sized cities.

Friendship coworking. In this third case, the motivations for creating a CS are personal. These creators want to break social isolation and re-establish a boundary between family and professional life (Flipo and Ortar, 2020). These creators, who are used to working from home, are looking for sociability and conviviality (having a coffee and chatting with colleagues, lunch together, etc.) while having an adapted work environment. In these CSs, few events are organised, as collective time is mostly informal. The creators stress certain values such as benevolence and discussion in professional relationships and the utilitarian dimension of the social network is not valued, even rejected. The search for profit and a financial return are not their priorities. They only wish to meet the current expenses of the CS, which from their point of view are not very high. This detachment can also be explained by the fact that most creators of CSs continue to have a main activity that provides them with a regular income. Created on the initiative of one or more people, this type of CS is mainly found in small cities or in the suburban areas of metropolises and often benefits from the support of local authorities.

Anchoring coworking. In this fourth case, the motivations for creating a CS are both personal and professional. The creation of a CS is a way of achieving life projects which involve residential and/or occupational mobility. These creators attach great importance to the quality

of the living environment and the meaning of their work, which explains why such a large proportion of them are in the process of making a career change following a redundancy or a resignation. For them, creating a CS is the starting point of a new life project. The creators of these CSs wish, through the organisation of events, to develop a community that goes beyond the strict framework of the CS and extends to local actors (local authorities, companies, associations, inhabitants). The aim may be to develop neighbourhood life in the centre of a metropolis, to participate in the redevelopment of a station district in medium-sized cities or to create a new facility in rural areas. Our results show that the motivations for creating a CS are very different for each creator and are part of both professional and personal projects. How did these creators experience the COVID-19 crisis and to what extent did it call into question their project?

5 HOW TO DEAL WITH THE COVID-19 CRISIS?

The creation of CSs has been disrupted by the COVID-19 crisis. This change in context raises many questions about the sustainability of the position of the creators of CSs. An online survey of creators of CS in the AURA region allowed us to better understand how they had dealt with the COVID-19 crisis. The first impact of the COVID-19 crisis is related to the closure of CSs. In the AURA region of France, CSs were strongly affected: 67% of the creators have been obliged to close their CS. But the duration of closure was very different according to the CS: it varied from 15 days to 8 months. The second impact of the COVID-19 crisis refers to measures which have disrupted the functioning of CSs. The ban on journeys between home and work and the obligation to close places open to the public appear to be the two measures that have had the greatest impact on the CSs: 41% of them consider that they have had a very high negative impact. The introduction of sanitary measures and physical distancing within the premises does not seem to have disrupted the functioning of the CSs, since 31% of them consider that the impact was moderately high. Finally, the introduction of a curfew seems to have had little impact on the CSs. The third impact is financial. Surprisingly, for the creators, cancellation of subscriptions had a moderate impact. It is the impossibility of renting meeting rooms to companies that has caused a significant drop in CSs income: 59% of the creators consider that it has had a high or very high impact. Cancellation of subscriptions had a lesser, but not negligible, impact: 43% of CSs felt that it had a high to very high impact. Finally, a part of the questionnaire aimed at collecting the opinion of the creators of CSs on the perspectives of their CS and coworking in general. With the health situation improvements, 82% of them notice the arrival of new coworkers. New profiles are emerging amongst coworkers, with the presence of teachers and students in particular. According to the creators, the status of these new coworkers is different: 33% of the creators declare that these new coworkers are both employees and self-employed, 25% that they are mainly self-employed and 20% that they are mainly employees. If these elements suggest that the CSs have demonstrated their sustainability, all is not yet achieved. When asked about the current situation of their CS, one third of the creators describe it as “growing”, one third as “back to normal” and one third as “fragile”. 86% of the creators of CSs are confident in the future of coworking. There are two reasons for this optimism. The first one is the better acceptance by companies of telework, linked to its large-scale experimentation during the health crisis, which could be favourable to CSs. 61% of the CSs creators consider that it will have a high to very high impact. The second reason is the awareness of the limits of home-based telework (social isolation, lack of separation between family and professional life): 62% of the creators of the CSs consider that it will have a high to very high impact.

6 CONCLUSION

Through the example of the AURA region of France, our results show that the motivations for creating a CS are very different for each creator and rely on both professional and personal projects. We have identified four states of mind according to the creators: Business coworking, Opportunity coworking, Friendship coworking and Anchoring coworking. These creators recognise that they have been strongly impacted by the COVID-19 crisis, in particular by the closure imposed during the lockdowns in France. Even if their situation does not seem to have returned to normal, many elements encourage them to believe in the future of coworking: the arrival of new coworkers, the diversification of their profile, the development of remote work and the limits encountered by home-based telework.

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REFERENCES

- Akhavan, M. (2021), “Third Places for Work : A Multidisciplinary Review of the Literature on Coworking Spaces and Maker Spaces”, *New Workplaces--Location Patterns, Urban Effects and Development Trajectories: A Worldwide Investigation*, Cham: Springer, 13–32
- Avdikos, V., Kalogeresis, A. (2017), “Socio-economic profile and working conditions of freelancers in co-working spaces and work collectives: evidence from the design sector in Greece”, *Area*, 49 (1), 35–42, accessed at <https://rgs-ibg.onlinelibrary.wiley.com/doi/abs/10.1111/area.12279>
- Blein, A. (2017), *L'émergence du coworking dans l'offre immobilière d'entreprise en Ile-de-France : Un service relationnel coproduit par ses utilisateurs*, Thèse de doctorat en architecture et aménagement de l'espace, Champs-sur-Marne : Université Paris Est
- Boboc, A., Bouchareb, K., Deruelle, V. (2014), “Le coworking : un dispositif pour sortir de l'isolement?”, *SociologieS*, accessed at <https://journals.openedition.org/sociologies/4873>
- Bosworth, G., Whalley, J., Füzi, A., et al. (2021), Rural coworking: “It's becoming contagious”. *Regions*. DOI: 10.1080/13673882.2021.00001096.
- Brown, J. (2017), “Curating the “Third Place”? Coworking and the mediation of creativity.”, *Geoforum*, 82, 112–126, accessed at <https://doi-org.inshs.bib.cnrs.fr/10.1016/j.geoforum.2017.04.006>
- Capdevila, I. (2016), “A typology spaces of open innovation based on different modes of innovation and motivations for participation.”, *Gestion 2000*, 33(4), 93–115, accessed at https://doi-org.inshs.bib.cnrs.fr/10.3917/g2000.333.0093#xd_co_f=MmE4NzEwYjktYWE2Mi00OWJkLTgzMjUtMTQwOWI1OTNhODMw~.
- Fabbri, J., Charue-Duboc, F. (2016), “Coworking spaces: New open innovation intermediaries?”, *Revue française de gestion*, 254, 163–180, accessed at <https://doi.org/10.3166/rfg.2016.00007>
- Flipo, A., Lejoux, P. (2020), “Les dimensions sociales et spatiales du coworking : un état de l'art.”, *EspacesTemps.net Revue électronique des sciences humaines et sociales*, accessed at <https://www.espacestemp.net/articles/les-dimensions-sociales-et-spatiales-du-coworking-un-etat-de-lart>
- Flipo, A., Ortar, N. (2020), Séparer les espaces pour maîtriser le temps: La reconstruction des barrières temporelles et spatiales entre vie privée et vie professionnelle par le coworking. *Temporalités* (31–32). DOI: 10.4000/temporalites.7712.
- Gandini, A. (2015), The rise of coworking spaces: a literature review. *Ephemera : Theory and Politics in Organisation* 15(1): 193–205.

- Gill, R., Pratt, A. C., Tarek, V.E. (2019), *Creative Hubs in Question*, New York: Springer Berlin Heidelberg
- Krauss, G., Tremblay, D.-G. (2019), *Tiers-Lieux. Travailler et Entreprendre Sur Les Territoires*, Rennes: Presses Universitaires de Rennes
- Leducq, D. (2021), Les espaces de coworking : des instruments de résilience territoriale pour l'après-Covid ? *Netcom. Réseaux, communication et territoires* (35–1/2). 35–1/2. Netcom Association. DOI: 10.4000/netcom.5677.
- Lejoux, P., Flipo, A., Ortar, N., et al. (2019), “Coworking, a Way to Achieve Sustainable Mobility? Designing an Interdisciplinary Research Project.”, *Sustainability*, 11(24), accessed at <https://doi.org/10.3390/su11247161>
- Liefoghe, C., Mahieu, C., David, M. (2013), *Les espaces de coworking : Nouveaux lieux ? Nouveaux liens ? Nouvelle économie ?*, Lille: MESHs
- Manzini Ceinar, I., Mariotti, I. (2021), The Effects of COVID-19 on Coworking Spaces: Patterns and Future Trends. In: *New Workplaces. Location Patterns, Urban Effects and Development Trajectories*. Cham, Switzerland: Springer, pp. 277–297.
- Mariotti, I., Di Matteo, D. (2022), Are Coworkers in the Italian Peripheral Areas Performing Better? A Counterfactual Analysis. *Sustainability* 14(1): 550. DOI: 10.3390/su14010550.
- Mariotti, I., Akhavan, M., Di Matteo, D. (2021), The Geography of Coworking Spaces and the Effects on the Urban Context: Are Pole Areas Gaining? In: *New Workplaces. Location Patterns, Urban Effects and Development Trajectories*. Cham, Switzerland: Springer Nature, pp. 169–194.
- Mariotti, I., Pacchi, C., Vita, S.D. (2017), “Co-working Spaces in Milan: Location Patterns and Urban Effects. ”, *Journal of Urban Technology*, 24 (3), 47–66, accessed at <https://doi-org.inshs.bib.cnrs.fr/10.1080/10630732.2017.1311556>
- Orel, M., Dvoulety, O., Ratten, V. (2021), *The Flexible Workplace: Coworking and Other Modern Workplace Transformations*, Cham: Springer.
- Perrin, J., Aguiléra, A. (2017), “Stratégies et enjeux de la localisation d’espaces de travail temporaires dans six grandes gares françaises. Une nouvelle offre de tiers-lieu de travail ? ”, *Territoire en mouvement Revue de géographie et aménagement. Territory in movement Journal of geography and planning*, 34, accessed at <https://doi-org.inshs.bib.cnrs.fr/10.4000/tem.3876>
- Scaillerez, A., Tremblay, D.-G. (2016), “Les espaces de coworking : les avantages du partage.”, *Gestion*, 41 (2), 90–92, accessed at : <https://www.cairn.info/revue-gestion-2016-2-page-90.htm>
- Spinuzzi, C. (2012), “Working Alone Together: Coworking as Emergent Collaborative Activity.”, *Journal of Business and Technical Communication*, 26 (4), 399–441.
- Suire, R. (2013), *Innovation, espaces de co-working et tiers-lieux: entre conformisme et créativité (Innovation, Co-Working and Third Places: Between Conformism and Creativity)*, NY: Social Science Research Network.
- Van de Koevering, J. (2017), *The preferred characteristics of coworking spaces. The relation between user characteristics and preferred coworking space characteristics : an attribute based choice experiment*, Eindhoven : University of Technology.

New Work Communities: from the Fordist Office to the Worksphere 4.0

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ABSTRACT

The organisational models orchestrated by Management Science for tertiary work and the spatial typologies in which it was carried out have been definitively challenged by the recent pandemic. From the pyramidal hierarchy that prevailed during the 20th century, we have moved to matrix-type and network-based management. Since the end of the 19th century, offices have seen a proliferation of environments such as the cellular office, the open space, the *Bürolandschaft*, the combi-office and the networking office. Each of these has proved revolutionary in its way, but none has become overriding the others. The most recent transformations of the workplace, accelerated by the COVID-19 pandemic, date back to the financial crisis of 2008, as well as to the use of information technology, which opened up new scenarios permeated by spatial and digital delocalisation. It is now necessary to investigate the new diffuse geography of workspaces: from traditional offices reconfigured to meet different spatial and organisational needs to co-working offices, from bars, hotel rooms, co-living spaces, public waiting rooms to the private home. In this extended vision, terms such as *territory* and *community* acquire a new value, becoming places of affirmation of the individual's existence, of everyday life and of economic and public interests. Another "worksphere" seems no longer defined only by the physical office but expressed by the set of social, psychological and economic conditions, the technological tools, and the places in which people work. This geography of spaces grows within a vision of a city of proximity, where workplaces seek to maximise relationships between colleagues and enhance the workplace within. Architects and office designers have the task of creating inclusive frames for the post-pandemic workplace.

Keywords

Molecular office, Social & relational infrastructure, Virtual communities, Atomised office.

1 INTRODUCTION¹²

The socio-economic impact of the COVID-19 contagion has altered the conformation and performative arrangements of metropolitan cities and their socio-economic cohorts. In the sphere of immaterial work – with which the tertiary sector and service companies are identified – new hygienic norms, different managerial organisations, and other spatial arrangements of the places of production must respond to the changed existential conditions. The pandemic has definitively challenged the organisational models orchestrated by Management Science for tertiary work and, consequently, the spatial typologies in which it was carried out during the

¹² This essay is the result of a collaboration between the authors, but for academic competitions the Introduction and the paragraph "Spatial mediations and social questions" should be ascribed to Imma Forino, while the the paragraph "New Virtual Community: The Atomised Office" and the Conclusion and should be ascribed to Michela Bassanelli.

last few decades. As far as the former is concerned, there has been a shift from the pyramidal hierarchy that prevailed during the Fordist 20th century, to the matrix-type management, and then to the network-based management of the post-Fordist era (Fontana 1981; Allen & Henn 2007). As far as workplaces are concerned, from the end of the 19th century to the present day, there have been various arrangements such as the cellular office, the open space, the *Bürolandschaft*, the combi-office and the networking office (Forino 2011). None of these typologies has become dominant over the others, but rather they have alternated with each other, even coexisting in the same office, thus showing how work's interiors can be fluid and adaptable to the needs of companies, managers and employees. The most recent transformations of offices, then accelerated by the effects of the pandemic, can be traced back to the global financial crisis of 2008, as well as to the almost total use of information technology. The consequent corporate delaying has corresponded to the rotation or elimination of desks, not only understood as the "place of work" but also as physical locations where work is carried out (Forino 2013, 15). Preconceived by Gaetano Pesce in a well-known office project (Chiat/Day TBWA, New York 1994-95), the *deskless* office has been adopted in many service companies, also thanks to the increased mobility of workers (Forino 2016). On the other hand, the improved quality and speed of information technologies, and in particular the adoption of wireless connectivity, have enabled valuable forms of telework, but have also ensured that ubiquitous workers and freelancers can operate in places other than offices, such as bars, libraries, hotel rooms, airport and railway station waiting rooms, or in the co-working offices, the shared offices for limited time use that now dot every city. Finally, if the relationship between the latter and the workplace had in the past clear physical boundaries and was regulated by a synchronic temporality according to the usual 9 a.m.-5 p.m. timetable, that relationship has gradually dissolved not only in the reciprocal spatial and formal influences between workplaces and the city but also according to an agitated elasticity of time and place, which in the current era of flexible production and accumulation has ended up transforming itself into a prevailing *chronophagy*, which compresses the hours as well as the spaces (Paolucci 2003). This paper presents an overview of the development from the traditional workplace to a community space that integrates different functions such as work, care, socialisation etc. The research pursued not through a quantitative and data analysis approach but through literature review and "research by design" with case studies in order to define a view of working spaces in the future.

2 COMMUNITY AS MOLECULAR OFFICE

It is not easy to imagine the near future of the workplace at a time when the effects of the virus and its variants are still so heavily affecting human lives, nor are the prospects clear for other global health emergencies that may await humanity in the third millennium. In the immediate future, service companies have recalibrated their offices in terms of social responsibility for people's health and wellbeing, spacing desks more widely, equipping environments with physical distance signs and personal sanitation devices, and directing the flow of employees unidirectionally towards lobbies, corridors and lifts. On the other hand, in the post-pandemic era, it is very likely that remote first, the priority choice to carry out work remotely, will shape the future of many companies (especially private ones) and their employees, provided that the former offer the latter a truly efficient technology, i.e. one that allows effective connections to the web wherever they are. In this perspective, the office could remain a physical place for meeting and sharing, reduced in size and management costs, but still necessary for the corporate culture that binds employees to a company. At the same time, new customs will have to be designed concerning a different work culture, to be followed by other types of space which, halfway between the home and the city, can offer additional places to work. Among the

customs to be reconsidered there is above all the relationship between people's professional tasks and their care and/or domestic activities, since in Italy the Welfare State does not support the difficult existential balance – in particular of women or, more generally, of those who take on the greatest care responsibilities in the family – of those who work and personally take care of children, sick or elderly relatives, as well as the management of the home. If the problem is obvious for those who work in a physical office, the issue remains the same for remote workers who, through adherence to smart working, are at home. Only then will it be possible to imagine a different type of office, somewhere between the “central” office of the company and the home, or decentralising work towards “the places of life” (Bonomi 2021, 41). Avoiding the burden on workers' home environments, the presence of a “molecular office,” located on the ground floor of buildings in the city, could be an important factor. The presence of a molecular office, located on the ground floor of residential buildings in the neighbourhood in which one lives, would reduce daily commuting, foster social relations of proximity (also by occupying the many commercial spaces emptied by the economic crisis) and offer the essential benefits of working such as fast web connection, technical equipment, ergonomic workstations paid for by companies or, for the self-employed, with the contribution of a minimal expense. At the same time, such a place should offer itself as a kind of “social infrastructure” (Saraceno 2021, 31), which partially supports people engaged not only in their profession but also in care and domestic activities, for example by hosting a crèche, a kitchen and a place to meet and share lunch, a laundry, an after-school room with the possibility of a teacher on hand and, also, counting on home healthcare services that can be booked on the spot. It would also be a “relational infrastructure,” because it would not refer to the employees of a single company, but would also be open (like the previous Co-working Offices) to independents, who would take advantage of the practice facilities as well as the opportunities for relations with other professionals. In other words, it would be a question of collectivising or semi-collectivizing certain tasks that generally fall on the shoulders of a single-family member, especially if divorced or single, with the essential economic contribution of the state for public employees or the self-employed or companies for private ones. The molecular office would therefore perform a support function for workers, in addition to the practical one of hosting their workstation, also provided on a rotating basis. For the spatial project of such a place, the typologies of the “democratic office” offered by anthropological structuralism applied to architecture could be reviewed (Forino 2019, 130), or more private corners for the necessary concentration could alternate with small meeting rooms, taking up the spatial typology of the combi-office (Sjöman 1977, 22), a hybrid solution of spatial organisation that mediates between the open plan (Kaufmann-Buhler 2021) and the cubicles (Saval 2014) (the latter no longer appropriate during health emergencies). For the arrangement of accessory services, which are indispensable for reconciling private and professional life, one could instead look at the many examples of collectivization of family activities experimented between the end of the 19th and the beginning of the 20th century, which – updated to meet current needs and deprived of the demagogic extremism that had characterised some of them – still offer interesting food for thought on the conformation of spaces. Decomposing the office as a *unicum* to reconfigure it through spatial, relational and support “fragments,” or in multiple workplaces arranged punctually in the basement of buildings, means outlining a new urban landscape, as porous as it is adaptable to the continuous metamorphosis of work and workers' lives, accelerated by the pandemic process. On the other hand, it can promote greater social integration, reactivate neighbourhood economies, and include the most fragile people or those with limited financial resources.

3 NEW VIRTUAL COMMUNITY: THE ATOMISED OFFICE

The shift from the traditional *workplace* to the post-pandemic *worksphere* is part of a de-structured idea of the office that represents a new ecosystem composed by physical and virtual spaces, but also of experiential relationships, linked by an increasingly high-performance technological infrastructure (Pelloni, 2020). Due to the COVID-19 pandemic and the frequent, but necessary, requests to reduce social interactions, *smart working* seems to increase more and more in the composite working landscape, also through legislation that is trying to define its rules and behaviours¹³. A research, carried out by Willis Towers Watson¹⁴ on a sample of Italian companies, estimates that in two years only 42% of employees will work in the traditional office and shows that the hybrid model will be the most commonly used. On the one hand, the recent experiment in forced *tele-working*, erroneously defined as *smart working*, has proved its effectiveness in terms of reducing contagion thanks to its mass application, which has made it increasingly visible and feasible for businesses. On the other hand, during the first lockdown, revealed a difficulty of management due to the coexistence of work and family activities, and of unclear time limits, which often decreed its defeat compared to “traditional” work. Informal *smart working* practices existed before the pandemic; indeed, working from home was the norm for many, especially women (Burchi 2014). These have set up other spaces within the home to deal with a different way of working that combines professionalism, skills, and family needs, but also an economic necessity. The private living space will remain for many people a place to carry out their work alongside other household activities, for which they will need to adopt a reformulation of time and space. Within the complex work system that has been configured for some years beyond the factory (Bonomi 2021) or the office, the home plays a substantial role as a place of production rooted in its territory, in line with the “hyper-industry of everyday life” (Bedani, Ioannilli 2020) that places the subject at the centre of the capital. The term “industry” refers not so much to a specific sector of the economy as to a way of organising work activity. In this sense, *hyper-industry* becomes an isomorphic extension of certain modes in every sphere of daily life, thanks to the increasing digitalisation of society¹⁵⁴. To understand this phenomenon, it is necessary to consider the metamorphosis of capitalism towards what is now called the “neo-industrial cycle” – which includes the centrality of “reproduction” (Alquati 2021) – and the penetration of new technologies into the domestic and working landscape, starting in the 1970s. The technological infrastructure is the tool that extended the productive field to social and personal life and that caused the transition of the house into a medial environment, starting from a dematerialisation of the exterior shell (Colomina 1996) to the complete intrusion of *technoramas*¹⁶⁵ (Appadurai 1986) into the interior spaces. In the Eighties, some Italian designers and architects anticipated the effects by designing prototypes of hyper-connected homes of the future. Andrea Branzi created the “Casa telecomandata” (remote-controlled house) where a man, sitting on a triclinium in the centre of the living room, controls objects and connections thanks to the network without moving

¹³ The first legislation on smart working was introduced by Law No. 81/2017, art. 18 and sg. After an in-depth discussion with the social partners promoted by the Italian Minister of Labour and Social Policies, the “National Protocol on smart working” in the private sector was signed on 7 December 2021, supplementing the previous law and preparing guidelines for collective agreements on the subject.

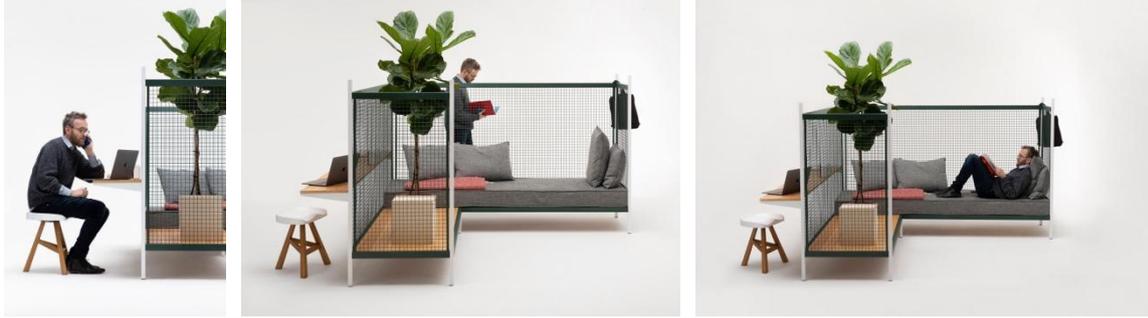
¹⁴ The Benefit Trends Survey 2021-2022 was carried out on a sample of Italian companies representing about 155,000 employees.

¹⁵⁴ In Alquati’s “model” (2021), the “hyper-proletarian” condition is formed by a new craftsmanship, arising from being networked, and the increase in a range of previously unworked activities that can be traced back to every aspect of human life.

¹⁶⁵ *Technoramas* are one of the five scenarios (Ethnorama, Mediorama, Financierama, Ideorama) that philosopher Appadurai (1986) identifies in his Theory of Cultural and Global Flows, linked to the movement of technologies.

(Triennale di Milano, 1986). In the same Exhibition, Denis Santachiara designed the “Casa terminale” (terminal house) inhabited by Ines, a talking domestic robot, an antecedent of *Alexa* or *Google Home*, symbolising the transition from the purely technological issue to the emotional and psychological one that these machines can implement in everyday life. Tomás Maldonado instead highlights critical issues and possible social repercussions, reporting that in the year 1964, the governor of California, Jerry Brown, proposed as a possible solution to planetary sustainability the shifting of work, especially office work, to the home: “it would be nothing less than to pulverise office work into as many workplaces as there are employees’ homes” (Maldonado 1970, 91-92). On the other hand, the Argentine designer questions the social role and consequent aberration of this type of work dynamics, which would lead to oppressive isolation and even higher forms of control (Federici 1975). The lockdown experienced recently, however, has been very different from that of previous pandemics, such as the Spanish flu (1918) and the plague (1630) precisely because of the role of technologies in our lives (Silverstone, Hirsch, Morley, 1992), which contributed to the creation of social virtual communities as support for fragile populations and the preservation of otherwise unworkable community dynamics. In the workplace, video calls on several platforms such as Teams, Zoom or Meet have facilitated contacts, even if virtual, with colleagues, family and friends. In a conception of life *onlife*, where being connected is now an integral part of our everyday life, and which takes place in the infosphere, where “what is real is informational and what is informational is real” (Floridi 2014, 41), it is necessary to identify new strategies for a different structuring of everyday life and quality time that reduce the sense of isolation and estrangement. The binary concepts (inside/outside, public/private, inside/outside, day/night), which defined the way of life before the development of pervasive technologies and infrastructures, have lost their primary meaning. Thanks to the domestic voyeurism there has been a transformation of the private sphere into public space, through the placement of workstations in areas of the home normally used for other activities. The home has become a device, just like the sets of the theatrical machine, where small alterations, mobile, hybrid and transformable spaces permit the use of rooms to be optimised according to needs. A solution for those who have to combine production activities in their homes could be to create “rooms within rooms”, small living environments where they can isolate themselves to work (Forino 2001), such as Ronan and Erwan Bouroullec’s “Joyn” system (Vitra 2002) or the recent “Grid” system produced by the design duo for Established & Sons company (2019-2020), or to organise new spaces using modular furniture such as Jack Brandsma’s “SpareSpace” system (2008). On the other hand, if used with the right detachment, technologies can contribute to the formation of communities, creating virtual rooms that bring co-workers together, alleviating the weight of loneliness (Georgiou 2020). As was the case during the first lockdown, spontaneous phenomena of digital solidarity have multiplied; in this sense, new forms of sociability allow domestic workers to feel part of the activities of their neighbourhood, even if in virtual form, and could help to nurture a neighbourhood “publicness”.

Figure 1. Grid System, by Ronan and Erwan Bouroullec for Established & Sons company, 2019-2020



4 CONCLUSION: SPATIAL AND SOCIAL ALTERATIONS FOR NEW WORKSPACES

The future of work will be increasingly hybrid: alongside collaborative activities at the *Hub Quarters*, there will be virtual activities at home, in molecular offices, co-working spaces or other small local offices, created specifically to decentralise work. If technology is able to enhance the feeling of belonging to a community, even if virtually, intellectual and bodily exchange is still an essential element of the working world, as many people have pointed out in recent months. The traditional *workplace* will become a space where colleagues can meet and co-design, through spatial solutions that will see an increase in semi-enclosed areas dedicated to collective activities, allowing more groups to collaborate, and meeting rooms of different sizes. In addition, headquarters will integrate spaces to enhance employee well-being, including play, video and fitness rooms, outdoor seating areas and bars. Recently, several office furniture companies are promoting environments that reflect the *club* typology - identified many years ago by office planner Francis Duffy (1997) - such as Herman Miller's *Clubhouse* system (2021) and Vitra's *Club Office* system (2021).

Figure 2. Clubhouse, by Herman Miller, 2021



Figure 3. Club Office, by Vitra, 2021



What is noticeable in the territorial effects of an increasingly hybrid system is the formation of a constellation of different urban polarities, no longer defined by the centre-periphery movement, but by networked systems moving to different nodes as theorised in Archizoom's *No Stop City* (1970). The disaggregation of the factory system into local or domestic locations will allow a *re-territorialisation* in the neighbourhood space of activities concerning work, home, care and primary consumption. The development of a sense of community as a social construction will become fundamental to overcome the risk of polycentrism of creating closed, introverted systems incapable of making links (Bonomi 2021). The molecular office located on the ground floors of residential buildings can complement the sense of isolation generated by *smart working*, i.e. where the transition from a "virtual working inside" to a "real collective outside" can take place, and where neighbourly knowledge and new daily rituals can be developed. If the office of the future will leverage the advances of technology with the creation of applications such as *workrooms* (where avatars will interact as in the real office recreating common gestures through the use of visors), the community network can, instead, act as a tool to save the body, considered as a *cyborg* (Braidotti 1995), and the mind from possible "schizoid drifts" (Chicchi 2012). A hybrid way of working has many points in its favour: it reduces travel costs and pollution, improves lifestyles – time and energy savings for commuters –, offers new opportunities for social cohesion, and limits the costs of running a workplace. In the near future it is very likely that we will see a destructuring of many environments – not only workplaces but also hospitals and care centres – towards a diffusion and pulverisation of activities in homes and local offices, which could contribute to a newfound sense of community and a different configuration of welfare systems. It will be necessary to identify spatial and relational solutions that allow a *work-life balance*, which prevents the risk of *burnout*. To conclude, phenomena of deconstruction and infrastructuralisation – already theorised by Radical culture during the 1970s – could contribute a different design vision in terms of inclusion, not only in spatial terms but also concerning gender issues.

REFERENCES

- Allen, T.J., Henn, G.W. (2007), *The Organisation and Architecture of Innovation: Managing the Flow of Technology*, Butterworth-Heinemann, Amsterdam, Boston et al.
- Alquati, R. (2021), *Sulla riproduzione della capacità umana vivente*, Derive Approdi, Rome.
- Appadurai, A. (Ed.) (1986), *The Social Life of Things: Commodities in Cultural Perspective*, New York: Cambridge University Press.
- Bedani, F., Ioannilli, F. (2020), *Un cane in chiesa: Militanza, categorie e con ricerca di Romano Alquati*, Derive Approdi, Rome.

- Bonomi, A. (2021), "Introduzione: La vita sociale messa al lavoro nelle piattaforme", in Id. (Ed.), *Oltre le mura dell'impresa: Vivere, abitare, lavorare nelle piattaforme territoriali*, DeriveApprodi, Rome, 15-53.
- Braidotti, R. (1995), "La molteplicità: un'etica per la nostra epoca, oppure meglio cyborg che dea", in Haraway, D. (Ed.), *Manifesto Cyborg: Donne, tecnologie e biopolitiche del corpo*, Feltrinelli, Milan, 9-38.
- Burchi, S. (2014), *Ripartire da casa: Lavori e reti dallo spazio domestico*, FrancoAngeli, Milan.
- Chicchi, F. (2012), *Soggettività smarrita: Sulle retoriche del capitalismo*, Mondadori, Milan.
- Colomina, B. (1997), *Privacy and Publicity: Modern Architecture as Mass Media*, The MIT Press, Cambridge & London.
- Duffy, F. (1997), *The New Office*, Conran Octopus, London.
- Federici, S. (1975), *Wages Against Housework*, Falling Wall Press, Bristol.
- Floridi, L. (2014), *The Fourth Revolution: How the Infosphere is Reshaping Human Reality*, Oxford University Press, Oxford.
- Fontana, F. (1999), *Il sistema organizzativo aziendale* (1981), FrancoAngeli, Milan.
- Forino, I. (2001), *L'interno nell'interno: Una fenomenologia dell'arredamento*, Alinea, Florence.
- Forino, I. (2011), *Uffici: Interni arredi oggetti*, Einaudi, Turin.
- Forino, I. (2013), "Come cambia l'ufficio ai tempi dell'austerità: Save space=Save money", *Il Giornale dell'Architettura*, n. 113: 15.
- Forino, I. (2016), "Moving Figures (on Changing Backgrounds)", in Basso Peressut, L., Forino, I., Leveratto, J. (Eds.), *Wandering in Knowledge: Inclusive Spaces for Culture in an Age of Global Nomadism*, Maggioli, Santarcangelo di Romagna, 25-32.
- Forino, I. (2019), "The City/Office Hybridization and the Inclusive Workspace: Paradigms from the Fifties to the Contemporary Age", in Scullica, F., Elgani, E. (Eds.), *Living, Working, and Travelling: New Processes of Hybridization for the Space of Hospitality and Work*, FrancoAngeli, Milan, 129-138.
- Georgiou, M. (2020), "The Politics of Public Space: Myria Georgiou", *The Politics of Public Space*, no. 2: 21-58.
- Kaufmann-Buhler, J. (2021), *Open Plan: A Design History of the American Office*, London-New York-Oxford-New Delhi-Sydney, Bloomsbury.
- Maldonado, T. (1970), *La speranza progettuale*, Einaudi, Turin.
- Paolucci, G. (2003), "Il potere della velocità: L'accelerazione della vita sociale nella città contemporanea", in Ead. (Ed.) *Cronofagia: La contrazione del tempo e dello spazio nell'era della globalizzazione*, Angelo Guerini e Associati, Milan, 13-31.
- Pelloni, O. (Ed.) (2020), *Il futuro della work sphere: Ieri oggi e domani*, Il Prisma, Milan.
- Saraceno, C. (2021), "Lavoro, prima viene la dignità", *la Repubblica*, May, 29: 31.
- Saval, N. (2014), *Cubed: A Secret History of the Workplace*, New York, Doubleday.
- Silverstone, R., Hirsch, E., Morley D. (1992), "Information and communication technologies and the moral economy of the household", in Silverstone, R., Hirsch, E. (Eds.), *Consuming Technologies: Media and Information in Domestic Spaces*, Routledge, London.
- Sjöman, S. (1977), "80-talets kontor: En idéskiss", *Form*, vol. 73, no. 575, January: 22.

SESSION 3C: SALUTOGENIC APPROACHES

The Well-being Effects of Biophilic Design in Workplaces: A Value-Based Approach

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ABSTRACT

Biophilic design aims to create places where occupants connect with the natural environment. In the context of workplaces, there has been growing interest in these design strategies as they have been demonstrated to have a strong association with employees' wellbeing. Extensive research has shown its restorative and stimulating effects on people's emotions and life satisfaction, however, biophilic design is still being seen as an expenditure rather than an investment. Evidencing good quality spatial and environmental design with a tangible financial proxy can become a driver to aid commercial decision-making; it is vital that investors can understand the co-benefits of these design strategies in the briefing and budget planning stage. This paper explores ways to *link* the economic value to the benefits of biophilic design. It investigates the potential of monetising well-being outcomes with Social Value methodologies. Although this conference paper is not able to provide a detailed account of how the valuation is developed and calculated, it presents the steps to generate monetised value from a real-world study and discusses the challenges and opportunities for future studies. Using a case study approach, this paper presents how spatial designers can evidence and communicate the benefits of biophilia. This pilot study is part of a doctoral research project at Loughborough University. An adapted version of the *Flourish Framework* is used to demonstrate the value of Well-being by design through data collected from interviews, questionnaires, and various sensors at the PLP Studio, London. The results agree with previous research that biophilic scenarios, both subjective and objective, improve well-being compared to a non-biophilic workplace setting. The research further investigated how Well-being Value can be informed by questionnaires and the potential of real-time sensor measurements. Applying Well-being Valuation demonstrates that indoor greenery and views out may have boosted positive emotions and yielded a higher Well-being Value. Qualitative data further revealed the positive emotions the visual connections with plants have on the participants and this indicates why multi-sensory design is so important. The discussion explores the potential of value mapping using sensor technology as a data source. The preliminary insights gained from this study can support designers to make a stronger business case for biophilic design, by aligning *non-tangible* well-

being benefits to a set of monetised values with a robust methodology that commercial decision-makers can comprehend.

Keywords

Workplace well-being, Flourish, Value, Holistic approach, Biophilic design and technology.

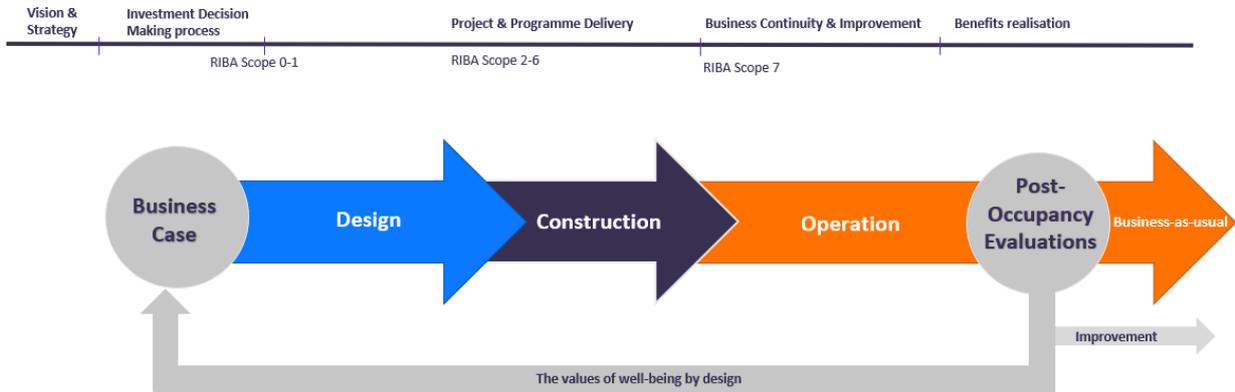
1 INTRODUCTION

Biophilia means ‘love of life’(Fromm, 1974). It describes humans’ innate tendency to seek connections with nature and other forms of life; Wilson (1984) refers to this affiliation as ‘a deep and complicated process in mental development. There is extensive evidence that affirms biophilic design¹⁷ has positive effects on perceived attention, creativity, productivity, and stress reduction (Allen et al., 2015; Ayuso Sanchez et al., 2018; Kalantari & Shepley, 2020), however, it is still seen as a luxury in workplace design (Heerwagen et al., 2012). Given that 90% of an average organisation’s spending is on people via their salary (UKGBC, 2016; 2020b); biophilic design can potentially generate a large return on investment from a small increase in employees’ performance (Arteaga, 2018). These strategies can be relatively low-cost investments, such as introducing living plants and applying a natural colour palette to the interior design, and the well-being effects on people can be impactful. However, little is known about the ‘true’ value of designing for well-being, referred to here as Well-being Value(Brey, 2015; Pritchard et al., 2019). The misconception of Well-being Value is not due to a lack of evidence of the benefits of biophilic design, but rather the complexity of defining human-centric outcomes, or Key Performance Indicators (KPIs) of particular biophilic design strategies. These ‘people-centric’ KPIs are often difficult to capture and justify due to the multifaceted relationships between people and place (Soliño-Fernandez et al., 2019; Xue et al., 2019). Capturing these values through Post-Occupancy Evaluation (POE) feedback shares a significant overlap with the concept of Social Value (SV) (Watson et al., 2016a). Monetising the value of designing for well-being with a holistic approach¹⁸ is an emerging research area in the built environment (McCarthy, 2018). To the best of the researchers’ knowledge, previous research has not explored linking these values with biophilic design strategies. A credible and transferable method to apply monetised values would benefit the commercial decision-making process. The ability to communicate tangible benefits may support a business case for biophilic design if they are available in the budget planning stage. As extensive studies have demonstrated that biophilic design contributes to the well-being of people; this study does not focus on affirming this positive association. It aims to 1) further explore a means to evidence the economic benefits of biophilic design with a real-world case study and 2) identify the constraints and opportunities of value-based frameworks. It investigates the benefits of mental well-being through a POE project.

¹⁷ Biophilic design creates direct and indirect experiences of nature, it also includes four-dimensional spatial experiences of nature (Kellert, 2018a). Browning and Ryan(2020) summarise these multi-sensory experiences into 15 Patterns of Biophilic Design.

¹⁸ A holistic approach of design value considers the social and health, environmental and economic well-being (Samuel, 2019), it may also include functional, cultural and heritage values (Callway et al., 2019)

Figure 1. Closing the loop: Sustainable and well-being developments require a system (holistic) approach to evidence and communicate the whole-life impacts of a development



1.1 Value frameworks in practice

This review gives an update on applying Well-being Value in practice. A value-based approach to decision making associated with the new economic paradigm - the Well-being Economy (Anielski, 2018). It aims to ‘create a virtuous circle in which people’s well-being drives economic prosperity, stability and resilience’(OECD, 2019), not merely a measurement of economic growth using Gross Domestic Products (GDP) as a single metric. In the context of the built environment, impact assessments of social and environmental sustainability mostly focus on sustainable procurement and construction activities (UKGBC, 2021), capturing the impact of design is less developed (RIBA, 2020b). POE offers an opportunity to create this virtuous circle of well-being; it typically collects subjective and objective measurements of people and places. However, POE is still not an embedded practice in the building procurement process (Durosaiye et al., 2019), other scholars echo that POE requires a clearer value proposition with more forward-thinking and not merely a retrospective exercise (Hay et al., 2018; Li et al., 2018; Zimmerman & Martin, 2001). These may imply that a value-based approach to well-being that enables real-time insight may give designers and investors more incentives to conduct a POE. The BCO’s Wellness Matters report (2018) found that businesses often ask ‘What is the business case for sustainability and well-being? Why do they matter?’. Demonstrating the value of design quality and its association with people’s well-being is crucial in the budget planning stage, as monetising well-being outcomes may support a stronger Cost and Benefits Analysis (CBA). However, not every well-being outcome has a monetary value, as ‘off-the-shelf’ predefined values are still under development and do not cover a wide range of topics currently (Lindsay et al., 2021a). Taken together, these studies support the notion that capital investment is tangible while well-being outcomes are often not conclusive. The benefits may not be immediately apparent, and the outcomes are often not quantified in the same way. For example, there are indirect economic benefits of well-being because it affects health (well-being of an individual), and healthy people make fewer demands on the health service (benefits to society) (Pencheon, 2015). Whilst proving that the benefits outweigh the cost is a key factor in making a business case (HM Treasury, 2020), it is also important to acknowledge that well-being generates complex outcomes that relate to each other closely, this complexity may cause overclaiming and double-counting if the POE is not planned carefully. The process of linking design quality to a monetised value is beneficial but can be technically challenging in practice; it requires the use of financial proxies and modifying them for an application that is relevant to the context (Watson & Whitley, 2017). For example, according to the Social Value Bank (Trotter, 2014), a view out to nature could potentially be equivalent to £36,776 per person per year if the improvement of life satisfaction can be linked to the

introduction of a new window¹⁹. To apply this as an outcome of well-being by design, this assumption is only valid if the designer can verify that the window intervention is a significant factor that contributes to the increase of life satisfaction through a pre and post-occupancy evaluation. The challenge is that perceived well-being can be influenced by many external and internal factors over time (Seppälä et al., 2012). Three considerations can be brought into play to respond to this challenge. Firstly, it is important to include *attribution*²⁰ in the survey, so that designers can identify to what extent their spatial design affects occupants' wellbeing. Attribution is a counterfactual measure of how much of the impact is caused by the intervention in question, rather than other factors. Secondly, take into account what would have happened regardless of the intervention, deadweight is also a counterfactual measure that can be used to adjust the outcomes (Dancer, 2008). The UK Government provides some suggested deadweight measures to be subtracted for each proxy (Homes & Communities Agency, 2014). Thirdly, to avoid over claiming of time, Watson (2017) suggested that time spent in the physical workplace is a critical factor. For example, 50% deduction of Well-being Value if an employee only works 2.5 days a week. To avoid overclaiming, mapping Well-being Value requires designers to understand these considerations (Samuel & Hatleskog, 2020), to determine how attribution, deadweight and time spent are integrated into the design of POE's data collection and analysis. Most POEs start by gathering six to 12 months of data after the practical completion of a project (Oseland, 2018). To maximise the effect of the design outcomes from the first-year data, a whole-life approach can be considered to manifest a longer-term impact (Benoit-Norris, 2013). For example, a POE case study of two student accommodation buildings demonstrated that a total of £1.18 million of social value²¹ was generated in the first year; the value was accrued to an individual as a result of increased social interaction or from living next to open spaces. The final impact figure used a 20-year lifetime; it accumulated to a total of £17.9 million. Although the study did not disclose the capital cost, applying this whole-life approach puts forward a much more compelling case by presenting the outcomes from an asset life perspective to incentivise Well-being Value. Whilst previous studies indicate that evidencing well-being by design with tangible outcomes is crucial when making a business case (UKGBC, 2016; Arteaga, 2018; Samuel, 2019), prompting the ethical or moral sentiment toward well-being is perhaps equally important (Anielski, 2018). This may suggest that combining narratives from individuals and quantifiable value outcomes in POEs can support commercial decision making²² towards a human-centric approach to design. No previous study has attempted to quantify the impact of biophilic design quality using the Social Value methodologies, such as the association with the value of design and financial proxies. This pilot project is part of a doctoral research study at Loughborough University; it aims to address the research gap by exploring methods that apply to workplace well-being using real-world scenarios and developing a more comprehensive approach to POE. The pilot project was

¹⁹ The sensory experience of daylight and views is essential to our health and well-being (Heschong, 2021)

²⁰ Attribution can be calculated as a percentage i.e. the proportion of the outcome that is attributable to the organisation?' or 'How much do you feel your responses in this section are due to the biophilic design (rather than other factors)?'. (Samuel, 2020)

²¹ The value was based on the data collected from telephone consultations with stakeholders and bespoke POE questionnaires (HLM, 2020).

²² Carney (2021) suggests that economic, environmental, and social values are becoming blurred in the commercial decision making

sponsored by the British Council for Offices (BCO) and was carried out in collaboration with the PLP Architects (Clements-Croome & Chan, 2021).

1.2 Limitations

The pilot study was conducted during the pandemic lockdown, social distancing had to be observed. Since the research does not challenge whether biophilic design is good for well-being or not, but questions the way how benefits can be demonstrated, only one subject was invited to participate in each workplace scenario. The working from home guideline further restricted the study period to four days. Social Value calculation is not described in detail due to the word limit, however, the steps to generate monetised values and references are provided.

2 METHODS: EXPERIMENT DESIGN

There is no *one-size-fits-all* approach to conducting a POE (Hay et al., 2018), RIBA's Social Value Toolkit (2020) suggests that a variety of formats should be considered to ensure that nobody is excluded from the data collection process (RIBA, 2020b). For example, online surveys often capture subjective satisfaction from a larger sample group. Similarly, face-to-face interviews gather subjective opinions, and direct contact may be more time-consuming but can be more effective in obtaining personal feelings than an online survey format in some occasions (Zhang et al., 2017). This indicates that POE requires a pragmatic philosophical stance. In the context of a value-based approach to POE, the selection of methods is mainly driven by two factors: 1) 'what's worked for the context, and 2) whether a robustly tested financial proxy for specific KPIs is available (Fujiwara & Dass, 2021). These proxies are usually predefined by recognised Social Value banks²³; some of them are already associated with multi-scale questions, and therefore ready to be applied for a POE subjective survey (HACT, 2016). A real-world pilot study was used to investigate a value-based approach to POE, through which a range of qualitative and quantitative data was collected. The study adopted an established psychological well-being questionnaire, the Warwick Edinburgh Mental Wellbeing Scale²⁴ (WEMWS) to assess the general life satisfaction of the participants (Tennant et al. 2007). The scale is associated with a large Social Value bank (HACT, 2018). It has been widely adopted in the UK and therefore was chosen as the most appropriate scale to evaluate subjective well-being. Table 1 demonstrates the subjective and objective nature of POE data concerning value mapping. This well-being scale measured the steady-state of life satisfaction; transient state emotions²⁵ toward a spatial experience were logged instantly through a wearable (Glasgow et al., 2019) or self-reported diary (Adamsson et al., 2018). The Valence & Arousal scale²⁶ (Bradley 1994) was included in the diaries, they allowed the participants to record their perceptions about their workplaces twice a day. Objective measurements of the Indoor Environmental Quality (IEQ) were measured from the building

²³ A recognised Social Value bank in the UK embraces government best-practice methodologies (HM Treasury, 2020), the financial proxies associated with a Social Value can be predefined in many ways, including Well-being Valuation, SRoI and other methodologies

²⁴ The WEMWS is designed to measure long-term personal well-being rather than the well-being experienced due to design for a specific time period (Watson, 2017). It is recognised by the UK Government's Treasury Green Book (Lindsay et al., 2021b).

²⁵ Emotions are a class of brief feelings (Ekman, 2016; Ekman & Rosenberg, 1997)

²⁶ The Valence & Arousal scale has been widely applied in many studies for emotion recognition (Brown et al., 2011; Matlovic et al., 2016; Smedt & Menschaert, 2012). Valence is the level of pleasantness, it's being measured from negative to positive. Arousal is the level of autonomic activation and ranges from calm to excited (Bradley & Lang, 1994)

level to understand the real-time environmental conditions. Wearable sensors provide continuous tracking of posture, step counts, heart rate and sleep quality as part of the objective parameters from the people level, however, no known financial proxy is linked to these physiological outcomes. Therefore, this paper focuses on the quantitative subjective wellbeing outcomes collected from questionnaire surveys, findings from wearables and IEQ sensors are discussed in the BCO's report: Use of Wearables in the Office (Clements-Croome & Chan, 2021).

Table 1. Data collection methods and their associations with monetised well-being and environmental value (✔ Established financial proxies are available, ⊖ financial proxies are not available yet)

Data Collection	Quantitative or Qualitative	Objective or Subjective	Frequency	Well-being Value	Environmental Value
IEQ Sensors (Air quality, thermal, light & sound)	Quantitative	Objective	Real-time		⊖
Wearables Sensors (Mental and physical well-being)	Quantitative	Objective	Real-time	⊖	
Questionnaire (WEMWS and bespoke questions)	Quantitative	Subjective (steady-state)	One-off	✔	✔
Diary (valence & arousal)	Mainly quantitative	Subjective (transient state)	Twice a day	⊖	
Interviews	Qualitative and qualitative	Subjective	One-off	-	-

The pilot study adopted the Flourish Framework²⁷ (Clements-Croome, 2019; 2020) to gain deeper insight into the value outcomes by understanding multi-sensory experience. The framework appraises how the subjective and objective parameters of a design (top two quadrants) may impact people in terms of feelings, cognitive functions, and economic outcomes (bottom two quadrants).

2.1 Participants and tools

The study involved one participant in each environmental scenario, conducting their usual computer-based work at PLP Architects' studio in Central London. Regular monitoring of their physiological changes, subjective feelings and the IEQ (CO₂, temperature and humidity, light and noise level) were taken during the four-day study period. Three males and one female between the age group of 25 to 40 years old, volunteered to participate. All of the participants were healthy adults and self-declared with no illness. The participants were each equipped with a Fitbit Inspire 2 fitness wristband and an Upright Go 2 posture tracker. Their background environments were continuously monitored through an Airthings Wave Plus IEQ sensor.

2.2 Scenarios

Three different physical environments were introduced to the participants to spend their working day throughout the study. The scenarios were designed to represent non-biophilic and various biophilic environments. There were two key variables (indoor green and views out), changes were kept to a minimum to avoid too many environmental stimuli being introduced to participants:

²⁷ The Flourish Framework is a well-being model for design and operation. It brings together objective and subjective environmental factors which have an impact on people's feelings and economic factors. Transient conditions, as well as steady-state conditions, are taken into account. The concept can be embedded into a model which can be used in initial design and planning besides at the POE stage.

- **Scenario 1:** a cubicle-like workspace, i.e., a non-biophilic environment with no views out (windows with blinds). The participant was referred to as P1.
- **Scenario 2:** a standard open-plan workspace, i.e., it had minimal biophilic elements in the existing workplace, such as small potted plants and views out from half-height view windows (the cill height is approximately 1 metre). This scenario represents a typical workplace; the participant was referred to as P2.
- **Scenario 3&4:** two biophilic workspaces (direct and indirect visual connection). More biophilic elements were applied to these two workplaces i.e. green potted plants with lush foliage (Fjeld et al., 1998) was introduced to the workstations, and some are coloured plants (Elsadek & Liu, 2020) and aromatic (Arslan et al., 2018). The participants were relocated next to a full-height window with dual aspect views out; they were referred to as P3 and P4.

Figure 3. From left to right-Cubicle-like scenario (P1), open-plan scenario (P2) and biophilic scenarios (P3 & P4)



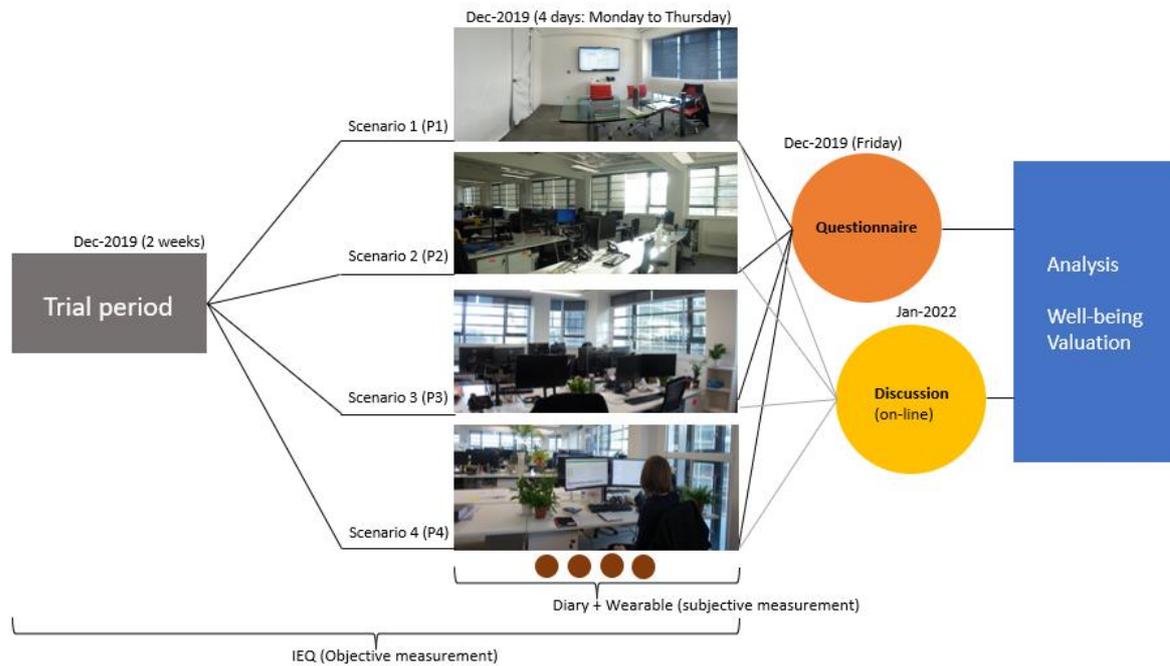
2.3 Experiment procedure

Prior to commencing the study, a trial period was conducted to ensure the sensors were calibrated to the natural settings, the participants received an explanation of the project. Each of the four participants was assigned to a scenario for a week from Monday to Thursday, they were invited to complete a questionnaire on Friday to evaluate their perceived life satisfaction using WEMWBS²⁸'s seven questions (HACT, 2018). Their instant emotions (Bradley & Lang, 1994) were captured in the diary²⁹ twice a day, in the morning and afternoon. Physiological changes were collected from the wristband throughout the experimental period. The participants were then invited to a group discussion at the end of the 4-day study about their individual experiences and wearable technology.

²⁸ WEMWBS refers to the Warwick-Edinburgh Mental Well-Being Scale (Tennant et al., 2007)

²⁹ The diary included two questions about Valence and Arousal: 'how positive or negative do you feel now?', 'how excited or bored do you feel now?'. It adopted the Self-Assessment Manikin's visual scale (Bradley & Lang, 1994) to report instant emotion. The diary contained a free-writing space to capture any thoughts the participants may have about their workplace.

Figure 4. The project timeline of the 4-day pilot study



3 RESULTS

Overall, the diary results indicate that the participant of the P4 biophilic scenario logged more positive emotions than other scenarios over the 4-day experiment. The P1 open-plan and the P3 biophilic scenario received a mixture of positive and neutral emotion entries, while the P2 cubical-like workplace received mostly neutral to negative emotions. Table 2 shows the mean value of the duration of the experiment; it presents the perceptual outcomes in green (mostly positive), light green (positive), yellow (neutral), orange (negative) and red (mostly negative). It illustrates the transient state of emotion changes in the morning, afternoon, and days of the week. The WEMWBS life satisfaction score was collected at the end of the week through a subjective survey. Further analysis of the score shows that the steady-state well-being of participants generally aligned with the result of the instant emotion logs; it found that the biophilic and open plan scenarios had higher well-being scores than the cubical scenario. Referring to the objective measurement from the wearable (the Fitbit waistband and Upright Go), interestingly, the participant in the cubical scenario experienced no negative impact on the physical activeness and posture. Taking the objective and subjective parameters together, it suggests that the cubical scenario affected the participant's emotions negatively despite that the indoor environmental quality remained mostly in the comfort zone. The diaries revealed that the cubical-like environment was perceived as 'physically isolated' and expressed complaints concerning the aesthetic of the room. The participants in the P3 biophilic scenario believed the environment did not change their social interaction behaviours, but 'the presence of plants positively affected the mood'.

Table 2. Illustrates the transient state of emotion changes in the morning, afternoon, and days of the week. The table displays the mean value of the duration of the experiment; it presents the perceptual outcomes in green (mostly positive), light green (positive), yellow (neutral), orange (negative) and red (mostly negative)

	Scenario 4: Biophilic (P4)				Scenario 3: Biophilic (P3)				Scenario 2: Cubicle (P2)				Scenario 1: Open Plan (P1)			
	Monday	Tue	Wed	Thu	Monday	Tue	Wed	Thu	Monday	Tue	Wed	Thu	Monday	Tue	Wed	Thu
Valence (Morning)	Green	Green	Green	Green	Orange	Light Green	Green	Yellow	Yellow	Orange	Yellow	Yellow	Green	Orange	Green	Yellow
Valence (Afternoon)	Green	Green	Green	Green	Light Green	Light Green	Orange	White	Red	Yellow	Yellow	Yellow	Green	Green	Green	Green

3.1 GENERATING THE VALUE OF WELL-BEING BY DESIGN IN PRACTICE

A wellbeing valuation approach was applied to monetise the WEMWBS life satisfaction score into a financial proxy for each of the scenarios (HACT, 2018). The purpose of translating these scores into monetised values is to create alignment with current commercial decision making, which may increase more awareness of the well-being and environmental impacts, not merely the economic value (Carney, 2021). The initial value reaffirms that the open-plan (£25k per person per year) and the biophilic scenarios (£18 and £25k) obtained higher scores while the cubicle scenario had the lowest overall well-being score (£12k). The next step was to identify how the spatial interventions had contributed to the Well-being Value. The impact considers the attribution and the cost to deliver the biophilic strategies; participants were asked to indicate whether their positive feelings were related to the workplace design, rather than other factors. The scores of this attribution question were then used to adjust the initial value from the survey. The cost of the plants was deducted, assuming that the interventions would last for one year. The final result shows the net well-being impact of each scenario. What stands out in this final net value is that the biophilic scenarios generated more than double the Well-being Value (£13-14k per person per year) compared to the non-biophilic cubical scenario (£6K). Although this is an indicative amount as it is not a direct financial gain to the organisation, the co-benefits of well-being represent the value proposition to an employee (Maccagnan et al., 2019). For example, Well-being Value can be used as part of the Corporate Social Responsibility (CSR) management and reporting. This finding offers an incentive for an organisation to embrace a more human-centric biophilic workplace for its employees and clients.

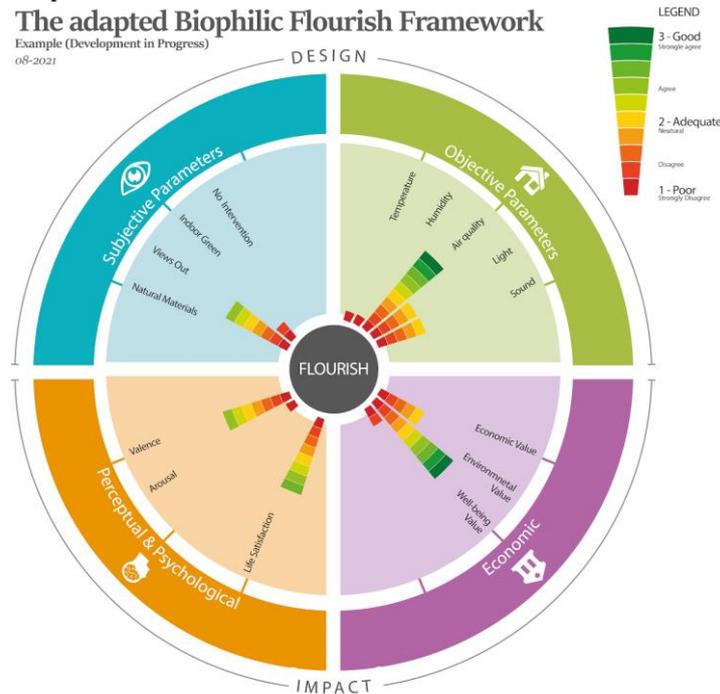
Table 3. Demonstration of the steps to generate the value of well-being by design

Steps to generate monetised value	Methods	Methods			
		P4 Biophilic	P3 Biophilic	P2 Cubicle	P1 Open Plan
1 POE Survey Well-being Impact Score	The Warwick-Edinburgh Mental Well-being Scale (WEMWBS)	20	29	18	30
2 Apply financial proxy	Well-being Valuation (HACT & Simetrica)	£18,000	£25,000	£12,000	£25,000
3 Adjust for deadweight & attribution	Attribution* (%)	80%	50%	50%	50%
4 Deduct initial cost	Minus the total costs to deliver the intervention	£100	£100	£0	£0
=	Net Well-being Value (1st year)	£14,000	£13,000	£6,000	£13,000

While the value monetisation condenses the design outcomes into four figures, the adapted Flourish Framework (Clements-Croome 2020) intends to present the richness of the POE findings on a circular dashboard in the figures below. Although the pilot study was shorter than intended, the information provides an insight into how workplace settings influence an

individual's well-being outcomes (impact) against the subjective and objective parameters (design). For example, the scenarios display that the physical well-being of both participants is comparable but the biophilic scenarios have much more positive steady and transient well-being scores than the cubical setting. This reveals that the indoor plants and the view out may contribute to the perception of the individuals.

Figure 5. The adapted biophilic Flourish Framework is used to present POE findings, it is intended to be an interactive tool and is still under development. The circular diagram is an example of how design and impact data can be presented



4 DISCUSSION

The pilot study raises the possibility that a more human-focused value-based approach can be used to demonstrate the benefits of well-being to support a stronger business case. Although this study does not aim to affirm the positive association between biophilic design and the well-being of people³⁰, it demonstrates that Well-being Value can be employed to capture specific design outcomes. It is important to recognise that sensory and psychological reactions are difficult to quantify but designers must attempt to understand these impacts through pre and post occupancy evaluations. This pilot study warrants further investigation into the methodological and technological challenges in practice.

4.1 Methodological opportunities and challenges

The study illustrated that Well-being Valuation can be applied to establish non-financial benefits of the quality of biophilic design, however, its application in practice is very limited. Social Value is still in its infancy stage in the built environment (UKGBC, 2020c). It is encouraging to have many evolving models³¹, but it is also difficult for designers to navigate

³⁰ The positive association between biophilic design and the well-being of people has been observed in previous studies extensively (Browning & Ryan, 2020; Gillis & Gatersleben, 2015; Kellert, 2018b)

³¹ These evolving models include the Wellbeing-adjusted Life Year (HM Treasury, 2020), National Social Value Measurement Framework (TOMs, 2012), the Social Return on Investment (SRoI) (Watson & Whitley, 2017) and others

and choose an appropriate method as there is no consensus on how to approach well-being by design (Arteaga, 2018). To robustly infer conclusions about the value of well-being from a POE, which is inherently subjective and personal, requires a credible set of financial proxies from existing value banks. The limitation is that there are no publicly available predefined proxies that have been developed specifically for the impact of design quality in relation to environmental characteristics (Ancona et al., 2022; WGBC, 2021). This implies that it will require an interim step to identify the levels of well-being concerning biophilic strategies in the context of workplaces.

4.2 Technological opportunities and challenges

This pilot project showed that wearable sensors have the potential to become an integral part of POEs. Wearables can inform workplace well-being on the building occupants-level (Clements-Croome & Chan, 2021), and the organisational level (Gartner, 2018). Capturing real-time biomarkers, instead of using retrospective surveys, may provide an objective dimension to the value-based approach. For example, it has long been known that brain signals and cortisol can be used for emotion recognition (Berger, 1929) or stress level identification (Kirschbaum et al., 1993), these techniques are becoming vital indicators to measure well-being continuously and non-invasively in real-world studies (Snow et al., 2019; Wang et al., 2022). The challenges are the robustness of physiological and emotional measurements in the built environment, it requires designers to have in-depth knowledge to operate and analyse those changes. Wearables can be costly; POEs are often conducted with a tight budget (RIBA, 2020a) and the ethical consideration of wearables will need to be addressed, however, the development of these technologies is emerging rapidly and becoming commercially viable to be used for personal health monitoring in the workplace (Maltseva, 2020). If wearables can be integrated into a comprehensive POE to create performance feedback, valuable insights can be gained by the design and construction industry as a learning tool.

5 CONCLUSION

This paper presents a pilot project to demonstrate the value of well-being by design, it uses a value-based approach to capture benefits through a POE. By using subjective measurements, and potentially objective real-time data, to create financial proxies of well-being. The pilot study demonstrates that it is viable to produce a set of value outcomes to support a business case for well-being. Although a POE process can be complex (RIBA, 2020a), the intended value outcome is being condensed into a single monetised figure. This outcome supports commercial decision-making by generating comparison between spatial scenarios.

6 NEXT STEP

This pilot study was constrained by the uncertainty of the physical workplace as it was conducted during the lockdown. To create a biophilic workplace, multi-sensory design strategies need to be properly considered for the specific context to be effective (Clements-Croome, 2020). The next step of this doctoral research will involve further investigation into the quality of a biophilic strategy, such as an immersive biophilic workplace that evokes multi-sensory experience (visual, audio, smell and taste) versus a typical workplace. Also, future studies will take more advantage of smart technology, it will explore the potential of using real-time data to generate a deeper understanding of the value of improved well-being and environment. Thirdly, they will involve the monetisation of environmental characteristics, it will aim to gain a deeper understanding of the value of good quality biophilic design. Instead of overall well-being, it is proposed to focus on the benefits of specific biophilic design patterns (Browning & Ryan, 2020), such as views out, indoor greenery and natural material and pattern.

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REFERENCES

- Adamsson, M., Laike, T., Morita, T. (2018), Seasonal Variation in Bright Daylight Exposure, Mood and Behaviour among a Group of Office Workers in Sweden. *Journal of Circadian Rhythms*, 16(1), 1–17. <https://doi.org/10.5334/jcr.153>
- Allen, J. G., MacNaughton, P., Laurent, J. G. C., Flanigan, S. S., Eitland, E. S., Spengler, J. D. (2015), Green Buildings and Health. In *Current environmental health reports*. <https://doi.org/10.1007/s40572-015-0063-y>
- Ancona, Z. H., Bagstad, K. J., Le, L., Semmens, D. J., Sherrouse, B. C., Murray, G., Cook, P. S., DiDonato, E. (2022), Spatial social value distributions for multiple user groups in a coastal national park. *Ocean & Coastal Management*, 222(June 2021), 106126. <https://doi.org/10.1016/j.ocecoaman.2022.106126>
- Anielski, M. (2018), *An Economy of Well-Being: Common-sense tools for building genuine wealth and Happiness*. New Society Publishers.
- Arslan, M., Kalaylioglu, Z., Ekren, E. (2018), Use of medicinal and aromatic plants in therapeutic gardens. *Indian Journal of Pharmaceutical Education and Research*, 52(4), S151–S154. <https://doi.org/10.5530/ijper.52.4s.92>
- Arteaga, B. (2018), Wellness Matters. *British Council for Offices (BCO)*, 91(1), 14–16. http://search.proquest.com.ezproxy.library.yorku.ca/docview/1018483389?accountid=15182%5Cnhttp://sfx.scholarsportal.info/york?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&sid=ProQ:ProQ:ericshell&atitle=Wellness+Matters&title=
- Ayuso Sanchez, J., Ikaga, T., Vega Sanchez, S. (2018), Quantitative improvement in workplace performance through biophilic design: A pilot experiment case study. *Energy and Buildings*, 177, 316–328. <https://doi.org/10.1016/j.enbuild.2018.07.065>
- Benoit-Norris, C. (2013), The Methodological Sheets for Sub - Categories in Social Life Cycle assessment (S-Lca). *Pre Publication- Version. The Methodological Sheets for Subcategories in Social Life Cycle Assessment (S-LCA)*. <https://doi.org/10.1007/978-1-4419-8825-6>
- Berger, H. (1929), EEG: Über das Elektrenkephalogramm des Menschen. *Archiv Für Psychiatrie Und Nervenkrankheiten*, 94(1), 16–60. <https://doi.org/10.1007/BF01835097>
- Bradley, M. M., Lang, P. J. (1994), Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behaviour Therapy and Experimental Psychiatry*, 25(1), 49–59. [https://doi.org/10.1016/0005-7916\(94\)90063-9](https://doi.org/10.1016/0005-7916(94)90063-9)
- Brey, P. (2015), Design for the Value of Human Well-Being. *Handbook of Ethics, Values, and Technological Design. Sources, Theory, Values and Application Domains*. Springer., 365–382.
- Brown, L., Grundlehner, B., Penders, J. (2011), Towards wireless emotional valence detection from EEG. *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*, 2188–2191. <https://doi.org/10.1109/IEMBS.2011.6090412>

- Browning, W. D., Ryan, C. O. (2020), *Nature Inside: A Biophilic Design Guide*. Routledge, RIBA Publication.
- Callway, R., Farrelly, L., Samuel, F. (2019), THE VALUE OF DESIGN AND THE ROLE OF ARCHITECTS. *Architects Council of Europe, March*.
- Carney, M. (2021), *Value(s) : building a better world for all*.
- Clements-Croome, D. (2020), Designing Buildings for People: Sustainable liveable architecture. In *The Crowood Press*.
- Clements-Croome, D., Chan, J. (2021), USE OF WEARABLES IN THE OFFICE. *BCO, April*.
- Clements-Croome, D., Turner, B., Pallaris, K. (2019), Flourishing workplaces: a multisensory approach to design and POE. *Intelligent Buildings International, January*.
<https://doi.org/10.1080/17508975.2019.1569491>
- Durosaiye, I. O., Hadjri, K., Liyanage, C. L. (2019), A critique of post-occupancy evaluation in the UK. *Journal of Housing and the Built Environment, 34(1)*, 345–352.
<https://doi.org/10.1007/s10901-019-09646-2>
- Ekman, P. (2016), *What Scientists Who Study Emotion Agree About*. *d*.
<https://doi.org/10.1177/1745691615596992>
- Elsadek, M., Liu, B. (2020), Effects of viewing flowering plants on employees' wellbeing in an office-like environment. *Indoor and Built Environment, 0(1239)*, 1–12.
<https://doi.org/10.1177/1420326X20942572>
- Fjeld, T., Veiersted, B., Sandvik, L., Riise, G., Levy, F. (1998), The Effect of Indoor Foliage Plants on Health and Discomfort Symptoms among Office Workers. *Indoor and Built Environment, 7(4)*, 204–209. <https://doi.org/10.1159/000024583>
- Flora Samuel (2019), Social Value Toolkit for Architecture Research Practice Leads 2019. *Research Practice Leads*.
- Fromm, E. (1974), The Anatomy of Human Destructiveness. *Contemporary Sociology, 3(6)*, 513. <https://doi.org/10.2307/2063568>
- Fujiwara, D., Dass, D. (2021), *Life Satisfaction in Discrete Choice Experiments*. 0–12.
- Gartner (2018), *Wearables Hold the Key to Connected Health Monitoring - Smarter With Gartner*. Gartner Research. <https://www.gartner.com/smarterwithgartner/wearables-hold-the-key-to-connected-health-monitoring/>
- Gillis, K., Gatersleben, B. (2015), A review of psychological literature on the health and wellbeing benefits of biophilic design. In *Buildings*.
<https://doi.org/10.3390/buildings5030948>
- Glasgow, T. E., Le, H. T. K., Scott Geller, E., Fan, Y., Hankey, S. (2019), How transport modes, the built and natural environments, and activities influence mood: A GPS smartphone app study. *Journal of Environmental Psychology, 66(May)*, 101345.
<https://doi.org/10.1016/j.jenvp.2019.101345>
- HACT (2016), *Social Value and Procurement. A Toolkit for Housing providers and Contractors*.
- HACT (2018), “Valuing Improvements in Mental Health.”
<http://www.hact.org.uk/sites/default/files/uploads/Project Proposals/WEMWBS Proposal.pdf>
- Hay, R., Samuel, F., Watson, K. J., Bradbury, S. (2018), Post-occupancy evaluation in architecture: experiences and perspectives from UK practice. *Building Research & Information, 46(6)*, 698–710. <https://doi.org/10.1080/09613218.2017.1314692>
- Heerwagen, J., Loftness, V., Painter, S. (2012), The Economics of Biophilia. *Terrapin Bright Green, LLC*, 1–40.
- Heschong, L. (2021), *Visual delight in architecture : daylight, vision, and view*. Routledge.
<https://www.routledge.com/Visual-Delight-in-Architecture-Daylight-Vision-and->

[View/Heschong/p/book/9780367563233](#)

- HLM (2020), *Social Impact Report for the University of St Andrews Halls of Residence* (Issue February).
- HM Treasury (2020), Central Government Guidance on Appraisal and Evaluation. In *The Green Book*.
- Homes & Communities Agency, U. G. (HCA) (2014), *Additionality Guide (4th Edition)*.
- Kalantari, S., & Shepley, M. (2020). Psychological and social impacts of high-rise buildings: a review of the post-occupancy evaluation literature. *Housing Studies*, 0(0), 1–30. <https://doi.org/10.1080/02673037.2020.1752630>
- Kellert, S. R. (2018a), Nature by design: The practice of biophilic design. *Nature by Design: The Practice of Biophilic Design*, 1–214.
- Kellert, S. R. (2018b), Nature by design: The practice of biophilic design. *Nature by Design: The Practice of Biophilic Design*, 1–214.
- Kirschbaum, C., Pirke, K. M., Hellhammer, D. H. (1993), The “Trier social stress test” - A tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*. <https://doi.org/10.1159/000119004>
- Li, P., Froese, T. M., Brager, G. (2018), Post-occupancy evaluation: State-of-the-art analysis and state-of-the-practice review. *Building and Environment*, 133(December 2017), 187–202. <https://doi.org/10.1016/j.buildenv.2018.02.024>
- Lindsay, C., Ball, P., Harper, M., Mussella, M., Lowe, J., Rowlatt, A. (2021a), *Wellbeing discussion paper: monetisation of life satisfaction effect sizes*. July.
- Lindsay, C., Ball, P., Harper, M., Mussella, M., Lowe, J., Rowlatt, A. (2021b), *Wellbeing Guidance for Appraisal :Supplementary Green Book Guidance*. July.
- Maltseva, K. (2020), Wearables in the workplace: The brave new world of employee engagement. *Business Horizons*, 63(4), 493–505. <https://doi.org/10.1016/j.bushor.2020.03.007>
- Margaret M., Bradley, P. J. L. (1994), MEASURING EMOTION: THE SELF-ASSESSMENT MANIKIN AND THE SEMANTIC DIFFERENTIAL. *Klinische Wochenschrift*, 68(13), 678–684. <https://doi.org/10.1007/BF01667016>
- Matlovic, T., Gaspar, P., Moro, R., Simko, J., Bielikova, M. (2016), Emotions detection using facial expressions recognition and EEG. *Proceedings - 11th International Workshop on Semantic and Social Media Adaptation and Personalization, SMAP 2016, October*, 18–23. <https://doi.org/10.1109/SMAP.2016.7753378>
- McCarthy, S. (2018), Social Value and Design of the Built Environment. *Supply Chain Sustainability School*, 54.
- OECD (2019), *The Economy of Well-Being - OECD*. The Organisation for Economic Co-operation and Development. <https://www.oecd.org/about/secretary-general/the-economy-of-well-being-iceland-september-2019.htm>
- Oseland, N. (2018), *Building Performance Evaluation, Chapter 2, From POE to BPE: The Next Era*. <https://doi.org/10.1007/978-3-319-56862-1>
- Pencheon, D. (2015), Making health care more sustainable: the case of the English NHS. *Public Health*, 129(10), 1335–1343. <https://doi.org/10.1016/J.PUHE.2015.08.010>
- Pritchard, I., Brindley, R., Schagemann, R., Samuel, F. (2019), *The Value of Design and the Role of Architects*. March.
- RIBA (2020a), Post occupancy evaluation: An essential tool to improve the built environment. In *architecture.com* <https://doi.org/10.4324/9780080518251>
- RIBA (2020b), *SOCIAL VALUE TOOLKIT for Architecture*.
- Samuel, F. (2020), *SOCIAL VALUE TOOLKIT for Architecture*.
- Samuel, F., Hatleskog, E. (2020), Why Social Value? *Architectural Design*, 90(4), 6–13.

- <https://doi.org/10.1002/ad.2584>
- Seppälä, A., Nykänen, P., Ruotsalainen, P. (2012), Development of personal wellness information model for pervasive healthcare. *Journal of Computer Networks and Communications*, 2012. <https://doi.org/10.1155/2012/596749>
- Smedt, T. De, Menschaert, L. (2012), *VALENCE: affective visualisation using EEG*. *VALENCE: affective visualisation using EEG*. 6268. <https://doi.org/10.1080/14626268.2012.719240>
- Snow, S., Boyson, A. S., Paas, K. H. W., Gough, H., King, M. F., Barlow, J., Noakes, C. J., Schraefel, M. C. (2019), Exploring the physiological, neurophysiological and cognitive performance effects of elevated carbon dioxide concentrations indoors. *Building and Environment*. <https://doi.org/10.1016/j.buildenv.2019.04.010>
- Taub, M., Lockhart, V., Clements-Croome, D. (2016), WEARABLES IN THE WORKPLACE. In *BCO* (Issue October).
- Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., Stewart-Brown, S. (2007), The Warwick-Edinburgh Mental Well-Being Scale. *Health and Quality Of*, 2007. <https://doi.org/10.1186/1477-7525-5-63>
- TOMs (2012), *The Social Value Portal*. July 2019, 1–14.
- Trotter, L. (2014), *Social Value Bank*. October.
- UK Green Building Council (2016), *Uk-Gbc Wellbeing Lab: Offices*. www.ukgbc.org
- UKGBC (2020a), *Delivering Social Value: Measurement* (Issue April).
- UKGBC (2020b), *Driving social value through real assets*. April.
- UKGBC (2020c), *Driving social value through real assets* (Issue April).
- UKGBC (2021), *Framework for Defining Social Value* (Issue February).
- Wang, B., Zhao, C., Wang, Z., Yang, K. A., Cheng, X., Liu, W., Yu, W., Lin, S., Zhao, Y., Cheung, K. M., Lin, H., Hojaiji, H., Weiss, P. S., Stojanović, M. N., Tomiyama, A. J., Andrews, A. M., Emaminejad, S. (2022), Wearable aptamer-field-effect transistor sensing system for noninvasive cortisol monitoring. *Science Advances*, 8(1), 1–16. <https://doi.org/10.1126/sciadv.abk0967>
- Watson, K. J. (2017), Developing wellbeing valuation practices in the built environment. *CIBSE ASHRAE Technical Symposium*, April, 1–12. https://www.researchgate.net/publication/318419242_Developing_wellbeing_valuation_practices_in_the_built_environment
- Watson, K. J., Whitley, T. (2017), Applying Social Return on Investment (SROI) to the built environment. *Building Research and Information*, 45(8), 875–891. <https://doi.org/10.1080/09613218.2016.1223486>
- WGBC (2021), *Beyond the business case: Why you can't afford NOT to invest in a sustainable built environment*.
- Wilson, O. E. (1984), *Biophilia*.
- Xue, F., Lau, S. S. Y., Gou, Z., Song, Y., Jiang, B. (2019), Incorporating biophilia into green building rating tools for promoting health and wellbeing. *Environmental Impact Assessment Review*. <https://doi.org/10.1016/j.eiar.2019.02.004>
- Zhang, X. C., Kuchinke, L., Woud, M. L., Velten, J., Margraf, J. (2017), Survey method matters: Online/offline questionnaires and face-to-face or telephone interviews differ. *Computers in Human Behaviour*, 71, 172–180. <https://doi.org/10.1016/j.chb.2017.02.006>
- Zimmerman, A., Martin, M. (2001), Post-occupancy evaluation: Benefits and barriers. *Building Research and Information*, 29(2), 168–174. <https://doi.org/10.1080/09613210010016857>

Flourishing the biophilic workplaces: a co-design toolkit

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ABSTRACT

Indoor Environmental Quality (IEQ) is a matter of significant concern for the health and well-being of workers and, in turn, their productivity. With this in mind, this paper presents a novel co-design toolkit aimed at improving the IEQ by facilitating the incorporation of the principles of Biophilic Design into the workplace design process. The Toolkit is based on the Flourish Wheel, a holistic model for evaluating and improving workplace-related health and well-being, which was used as a guide to develop the key elements of the co-design toolkit. The paper focuses on presenting the toolkit development process, its functionality and use options, and the study carried out to evaluate the Toolkit. The present study First relies on the Flourish wheel to create a Co-design toolkit that allows designers and architects to indicate their perspectives on improving open-plan workplaces. Due to the lack of using different design processes such as the Toolkit in explaining architecture theories, this study is the first of its kind to develop a co-design toolkit in architecture, which can be used to improve the design of workplaces in a way that affects their occupants positively. Second, it will help improve an office environment by means of the Biophilic Design design approach and bring the natural environment indoors. In this co-design study, participants interactively discuss and share their ideas, and the researcher collates and models the results in their desired direction. Four steps of cards conduct this; the activity guide which is designed to explain the aim and the process of the Toolkit for the user, then the flourish cards which has been created to evaluate the existing workplace environment and determine the main IEQ issues based on the flourish questions which has been divided into six categories; thermal comfort, indoor air quality, lighting environment, acoustics environment, spatial layout and the aesthetics in the workplace. After that, the Biophilic cards present a list of solutions with different user budgets based on the 14 patterns of Biophilic Design. Finally, the plants' cards; provide the participants with several potted plants and some tips on how they can be used inside the office environment to enhance the different IEQ factors affecting the occupants' wellness. This Toolkit would allow a researcher to conduct a co-study in two separate rounds virtually with 24 participants; from the design, architecture and built environment sectors. First, they could identify the role of the IEQ in an office environment and show how they affect the occupants' health, well-being and productivity. Next, they could propose recommendations for improving the environmental quality of the office using Biophilic design patterns.

Keywords

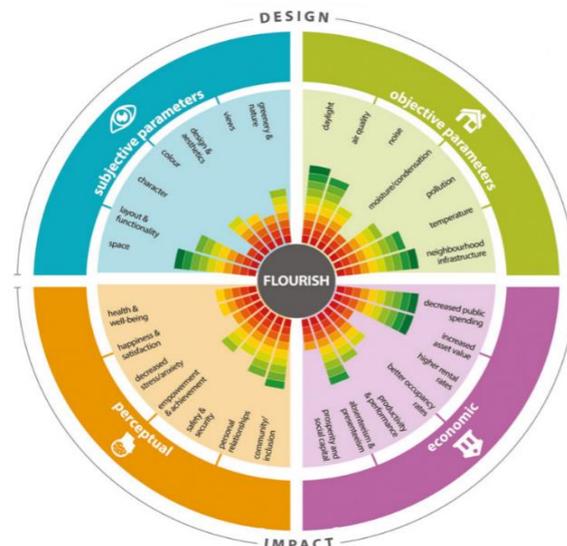
Indoor Environmental Quality (IEQ), Workplace design, Biophilic design, Co-design toolkit, Flourish Wheel.

1 INTRODUCTION

Considering that the modern lifestyle requires very long periods to be spent in the workplace, it is necessary to design workplace environments to minimise the negative impact of the

environmental features on the worker-occupants' health and well-being; at the same time, maximise their productivity. The relationship between Indoor Environmental Quality (IEQ) in the workplace and the worker-occupants' health, well-being and productivity are highly complex (Candido *et al.*, 2019). However, there is evidence that IEQ has a significant impact on workers in that it can either reduce or improve their health and well-being status and how productive they are in what they do (Abounaga, 2006; Clements-Croome, 2006 and 2020; Veitch *et al.*, 2008; Newsham, Mancini and Birt, 2009). An extensive strand of literature addresses the effects of IEQ on human comfort (see, for example, Bordass *et al.*, 2001; Tsushima, Tanabe and Utsumi, 2015; McCunn, Kim and Feracor, 2018), while another strand concerns its impacts on well-being (for example, MacKerron and Mourato, 2013; World Green Building Council, 2014). The literature on the link between IEQ and health, well-being and productivity usually focuses on five key environmental factors: 01) Thermal Comfort (Lan, Wargocki and Lian, 2011; Agarwal *et al.*, 2020); 02) Indoor Air Quality (Fisk, Black and Brunner, 2012; Mujan *et al.*, 2019), 03) Lighting Comfort (Alrubaih *et al.*, 2013; Han *et al.*, 2020), 04) Acoustic Comfort (Wong and Mui, 2006; Di Blasio *et al.*, 2019) and 05) Office Layout (Haynes *et al.*, 2009; Candido *et al.*, 2019). The Flourish Model, a model to evaluate the effects of IEQ on health, well-being and productivity was proposed and developed by Clements-Croome (2006, 2018); also: Clements-Croome, Turner and Pallaris, 2019 and Clements-Croome, 2020. The reasoning behind the Flourish Model is based on the work by Barrett and Barrett (2010) and Kim and De Dear (2013), which goes beyond the concept of workers' comfort—toward an ideal state of well-being and productivity, as described by Maslow (1943) and Seligmann, Diener and Biswas-Diener (2009). As such, the Flourish Model considers the relationship between people's feelings and their performance by addressing the emotional effects of IEQ (Clements-Croome, Turner and Pallaris, 2019). The emotional aspect complements the standard productivity factors of the ability, competence, motivation, amenities and the opportunities presented by support systems. The Flourish Model, represented visually by the Flourish Wheel shown in Figure 1, considers three layers of issues; the environmental factors featuring standard comfort health and safety guidelines for thermal comfort, noise, light and air quality. Then the people's perceptions and feelings in various environments as well as the economic impact, and finally, the sparkle or 'wow' layer, which includes factors such as access to views on nature, daylight, colour, image, layout and green space around the building, this can be shown in Figure 1.

Figure 1. The Flourish Wheel



Significant improvements to the workplace can be achieved by applying Biophilic Design, an architectural design approach incorporating different elements of the natural world into the human-made one and exploring the ecological alternatives in nature, not by mimicking natural forms but by recognising the rules governing such phenomena (Ramzy, 2015). The roots of Biophilic architecture lie in the Biophilic Design hypothesis, which argues that human health and well-being ought to be affiliated with nature on a biological basis (Kellert and Wilson, 1993). 14 Biophilic Design patterns can inform the architectural design of the built environment. These patterns were specified based on the research into cognitive, psychological and physiological responses to different environmental features, as presented in the report "14 Patterns of Biophilic Design: Improving Health and Well-Being in the Built Environment" by Browning, Ryan and Clancy (2014). As the most frequently cited, this publication is usually seen as the most relevant reference for Biophilic Design. Still, there are also a number of other related publications presenting similar and slightly different viewpoints.

2 THE BIOPHILIC CO-DESIGN TOOLKIT DEVELOPMENT PROCESS

The primary purpose of this paper is to present a novel co-design toolkit, which was developed to facilitate the collaborative design of workplace environments by promoting Biophilic Design. This Biophilic co-design toolkit aims to facilitate an improved IEQ by applying Biophilic Design features, thus improving the health, well-being and productivity of worker-occupants of the co-designed workplace environments. The novelty of the Toolkit stems from its unique focus on Biophilic Design; to the best of the authors' knowledge, there are no other Biophilic Design/co-design toolkits available to date. Another novelty of the Biophilic co-design toolkit is in its theoretical underpinning by the Flourish Model, which allows the Toolkit to be used to improve IEQ in the broadest possible sense, including catering for the emotional aspects. Co-design brings together a group of consumers, users, families, workers and(or), other stakeholders to design a product, service, experience or environment. The method facilitates an equal and reciprocal relationship between all stakeholders in the design process, enabling them to design in partnership with each other. Furthermore, planning, conceptualising and evaluating design solutions with people with experience with the problem means the final solution is more likely to meet the stakeholder needs (e.g. Roper *et al.* 2018). Steen (2013) explains that co-design can be understood as collaborative design thinking, joint inquiry and imagination, which brings together diverse people to explore and define issues and then develop and evaluate solutions. According to Happell and Scholz (2008), co-design is a process in which participants can share their experiences, discuss and negotiate their roles and interests and jointly bring about a positive change. A design toolkit can be applied in various design fields to facilitate the design process. The term toolkit refers to a set of tools arranged together in one place. The concept of the Toolkit is not new in design; using design toolkits is a consolidated practice employed increasingly often to overcome the lack of knowledge, methodology or practical tools for a range of design activities (Lockton, 2013). Wölfel and Merritt (2013) developed a panorama of card-based design toolkits and accordingly defined five design dimensions to classify them. Design toolkits can be distinguished by their intended use, scope, duration of use and placement within the design process, system and methodology, customisation and formal qualities. Cards have been a popular format for design toolkits because they are simple, tangible and easy to use. There are physical-only card-based design toolkits, such as IDEO's Method Cards, and digital online platforms with printable guide books such as the Design Kit³², which includes different toolkits that were released or endorsed by

³² <https://www.designkit.org/>

IDEO. Card-based design toolkits have been used as a standard way of disseminating design analysis insights and making the insights available in the design process. The research projects investigating their usefulness have found card-based toolkits very effective in facilitating the generation of ideas in design workshops (Roy and Warren, 2019; Vaajakallio and Mattelmäki, 2014). Cards are also seen as an effective vehicle for transferring knowledge from theory to practice (Deng, Antle and Neustaedter, 2014), arguably more beneficial than other media to help in the design process (e.g. Rothstein, 2012; Möller, 2014). The Biophilic co-design toolkit presented in this paper was developed in four steps. These steps were as follows:

1. Research the existing design toolkits and other resources related to the area of workplace design;
2. Define the vision, mission and concept of the Biophilic co-design toolkit, taking into account the requirements to incorporate the whole range of possible Biophilic design applications and the Flourish Model, represented by the Flourish Wheel;
3. Design the toolkit elements;
4. Evaluate the Toolkit with experts.

Under 02, it was decided that the Toolkit should be conceptualised to involve the five environmental factors and 14 Biophilic Design patterns as above. These conceptual elements were included to maximise the scope of the Toolkit in terms of its possible design applications. Designing a workplace means considering different levels of complexity. The design elements relate to worker-occupants, to each other and a broader range of internal and external conditions. Including the Flourish Model into its conceptual basis permits the Toolkit to manage this complexity.

3 THE BIOPHILIC CO-DESIGN TOOLKIT

Aiming to support designers and architects in improving the IEQ in indoor workplace environments, the Biophilic co-design toolkit offers a framework of relevant Biophilia-related topics and specific questions to help guide the workplace design process. The elements of the Toolkit highlight the key features, taking the design process through three stages to ensure the best possible outcome:

01) Activity Guide (Figure 2) explains how to perform design activities with the support of the Toolkit's components. In addition, the Activity Guide is an instructional resource to assist the toolkit users in reaching their design goals.

Figure 2. Activity Guide

1 Activity Guide

I WANT TO IMPROVE AN EXCISTING DESIGN

1. STARTING POINT: THE PROJECT BRIEF :

Re-designing projects start with obtaining plans, drawings and observations about the existed situation of the workplace.

You can use the *Flourish Cards* as a base to list your key requirements. Fill it in with Post-its to reflect and define a brief (e.g. define user needs, product features ...).

As a result, you can determine both the issues and the effective design solutions using the Biophilic cards

It is important that the brief key points are shared and agreed on -by clients and by the design team- in order to ensure that everyone has the same vison, goals and objectives.

01 Explore the IEQ Issues

02 Use Flourish Cards

03 Introduce Biophilia Patterns

2. EXAMPLE THE FLOURISH CARDS AND THE BIOPHILIC ANALYSIS CARDS:

FIRST ACTIVITY: CASE STUDY ANALYSIS

Analyze a case study with the flourish cards. As you are re-designing a workplace, explore the cards and try to select similar issues that is existing in your workplace.

SECOND ACTIVITY: BIOPHILIC ANALYSIS CARDS

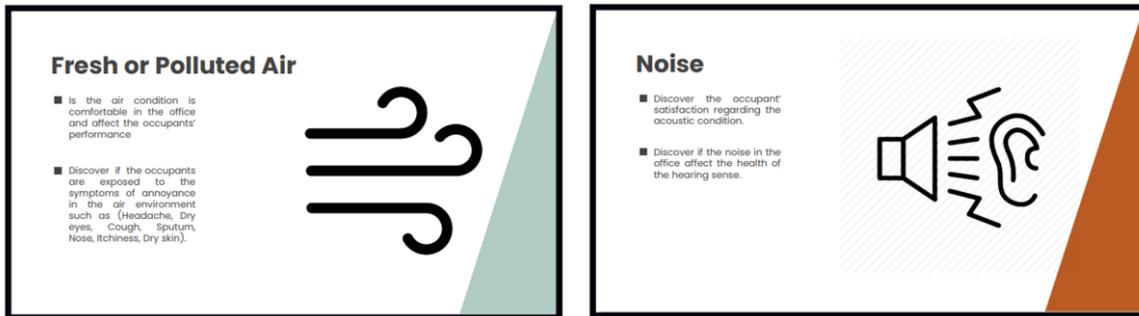
Sort the cards and select some relevant points (e.g. 5 cards). Place them on the table and brainstorm, focus on how these cards may be mixed and linked, to generate ideas.

Focus for on one area (e.g. Air quality) to select specific cards as priorities. Brainstorm on each card for a few minutes. Note down all ideas and solutions.

After defining your main issues, review the Biophilic Cards that will help you determining what is very important and what is less important based on the occupants' needs, and how this will affect their health well-being and productivity inside the office environment.

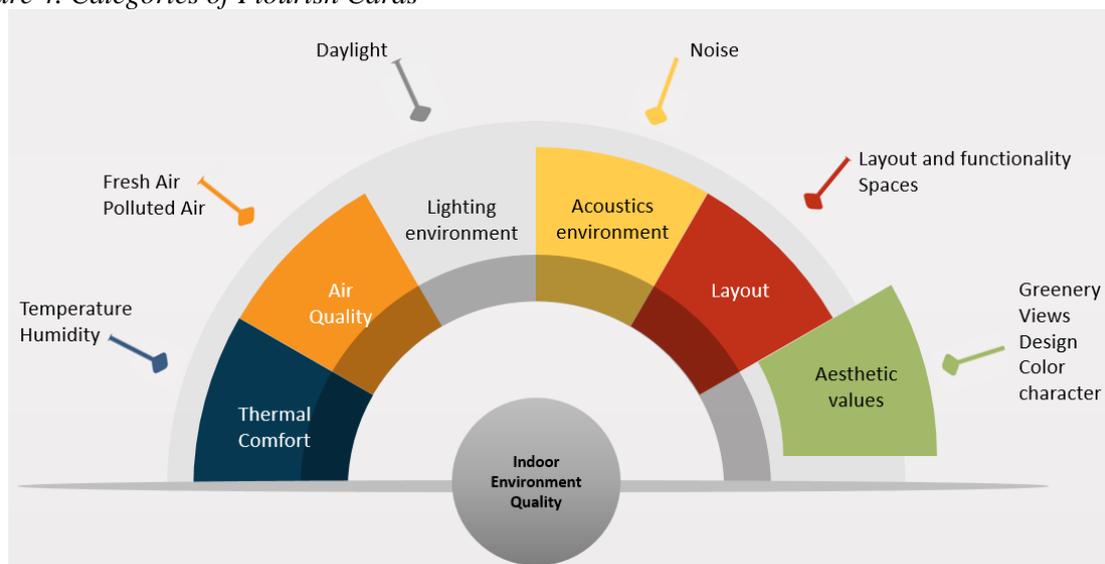
02) Flourish Cards (Figure 3) can be described as an expandable resource comprising 19 one-sided cards divided into six categories. The front of each card is different to show its distinct function. Each category introduces a related topic in its title and asks a critical question. It aims to allow for various workplace issues to be quickly explored. It is also recognisable by a colour/pattern code and identified by one in a sequence of numbers in the related category; this supports the structured use of the cards in combination with the other Toolkit features.

Figure 3. Examples of Flourish Cards



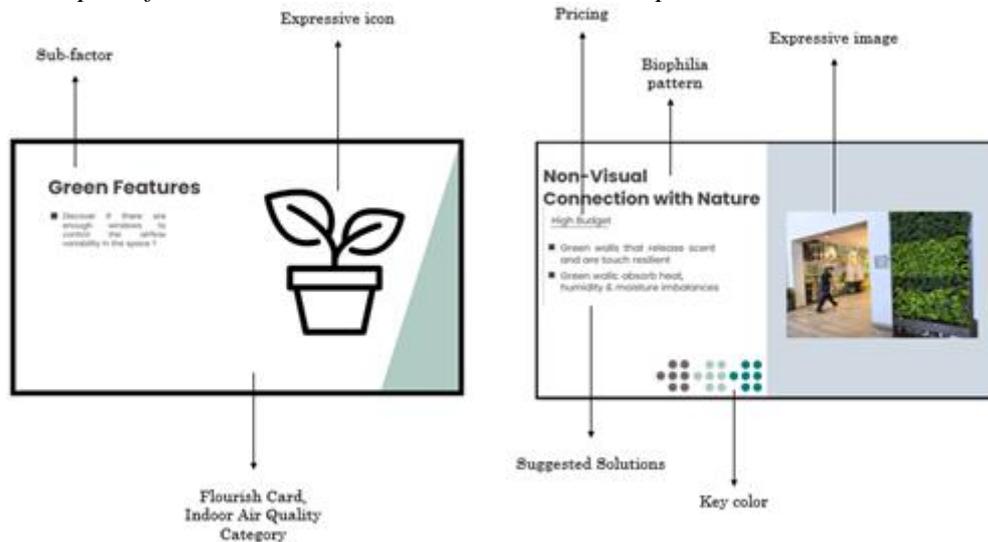
The six categories are 01) Thermal Comfort, 02) Indoor Air Quality, 03) Lighting Comfort, 04) Acoustic Comfort and 05) Office Layout, and 06) Aesthetics, as shown in Figure 4. Each category represents the key factors that need to be strategically enhanced and the point of view from which to analyse an office; the division into categories lets users see the question from several different perspectives. Moreover, the pricing section was added to encourage the designer to choose flexibly between no budget, low, medium or high budget after deciding the central issue in each one of the categories. The first five categories have been implemented based on the five critical environmental factors suggested by the literature above. The sixth additional category is a reference to the Flourish Wheel, and it covers the emotional aspects of IEQ and the factors that affect worker-occupants' productivity indirectly, such as the colour of the walls and other visual features, as well as the views and greenery to be seen in the office.

Figure 4. Categories of Flourish Cards



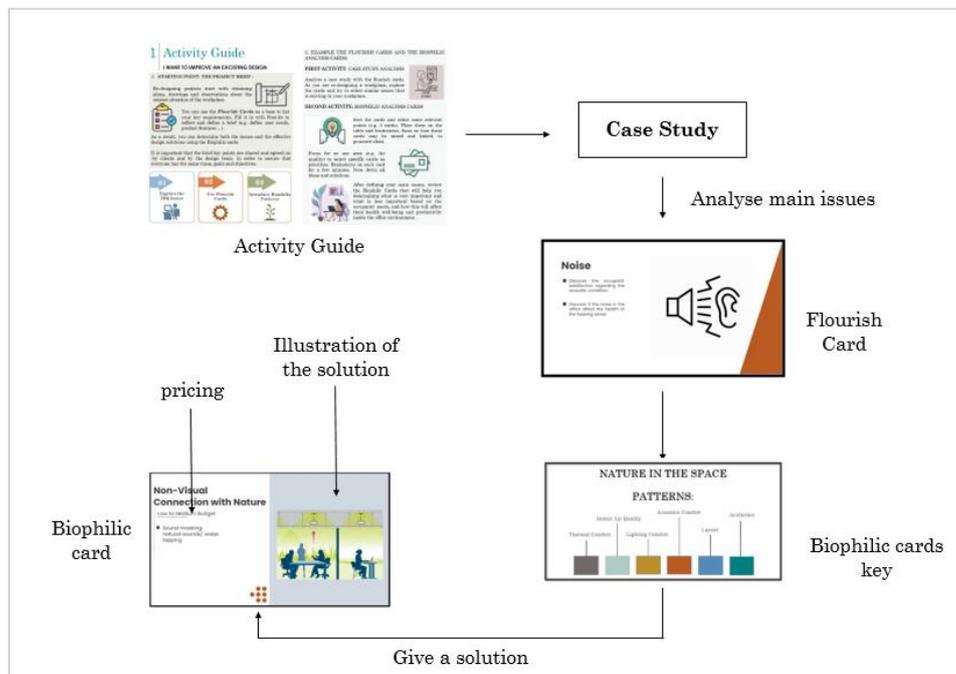
03) Biophilic Cards (Figure 5) are linked to the Flourish Cards, the Biophilic Analysis Cards are coloured, and there are 54 cards in total. They show a possible solution for many IEQ issues on the front side, illustrated by the image. The initial card also shows the colour key.

Figure 5. Examples of the relation between the Flourish and Biophilic Cards



The cards propose a research exercise. For example, once a relevant office that needs a Biophilic Design improvement is selected, or an office is designed "from scratch", the idea is to analyse it through the Flourish Cards. The Biophilic Cards can answer design questions considering the designers/architects' needs and expectations. Figure 6 shows the interactional flow of the Flourish and Biophilic cards.

Figure 6. The Interactional Flow



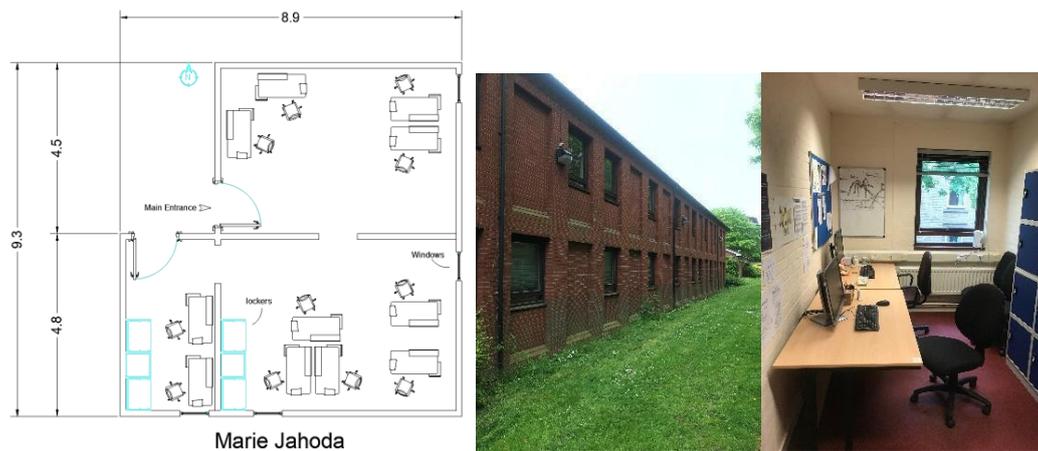
The Toolkit was created to give Biophilia-inspired ideas for designers and architects seeking solutions for various IEQ issues in different office environments. The elements are related to each other but serve different functions. To reach the best design results, all elements should

be used together. The Toolkit envisions a design methodology in which researching is the first step, followed by an immersive focus on the design itself. Therefore, the Activity Guide and the Flourish Cards are meant to be used first, followed by the Biophilic Cards.

4 THE TOOLKIT EVALUATION

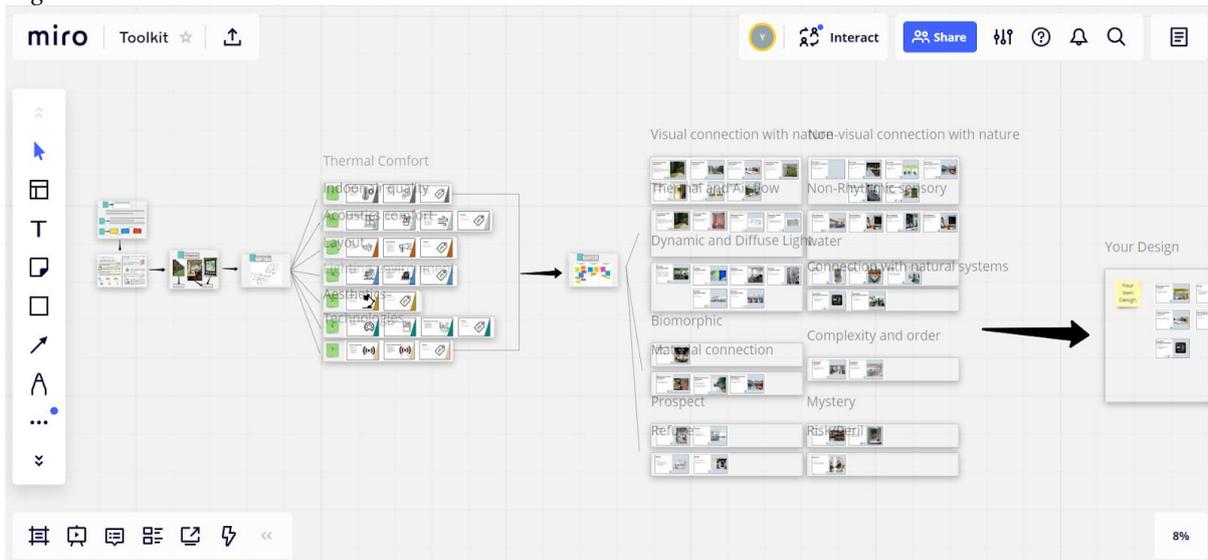
The toolkit evaluation undertook to discover whether the Toolkit was adequate in communicating the needed information; provided an efficient way to collect data; ensured that users carried out the appropriate exercises; assisted users in identifying problems and obtaining solutions; enabled the collected data to be easy to use and supported the researchers in their field of work and expanded their knowledge (Grinyer, 2016). Due to the COVID-19 pandemic and the new instructions on social distancing, it was not possible to evaluate the Toolkit in person, using the printed cards as originally intended. The Toolkit was therefore evaluated in an online focus group using Zoom and Miro (www.miro.com), which enabled sharing the cards with the participants and having them interact simultaneously. The evaluation involved six designers and architects in the first round and another 13 designers and architects for the second round. Both groups were asked to use the Toolkit to assess and improve a research room in the Marie Jahoda building, located at the Brunel University London campus in Uxbridge, UK (Figure 7). This building was chosen as it is an old building with different IEQ issues.

Figure 7. Marie Jahoda research room



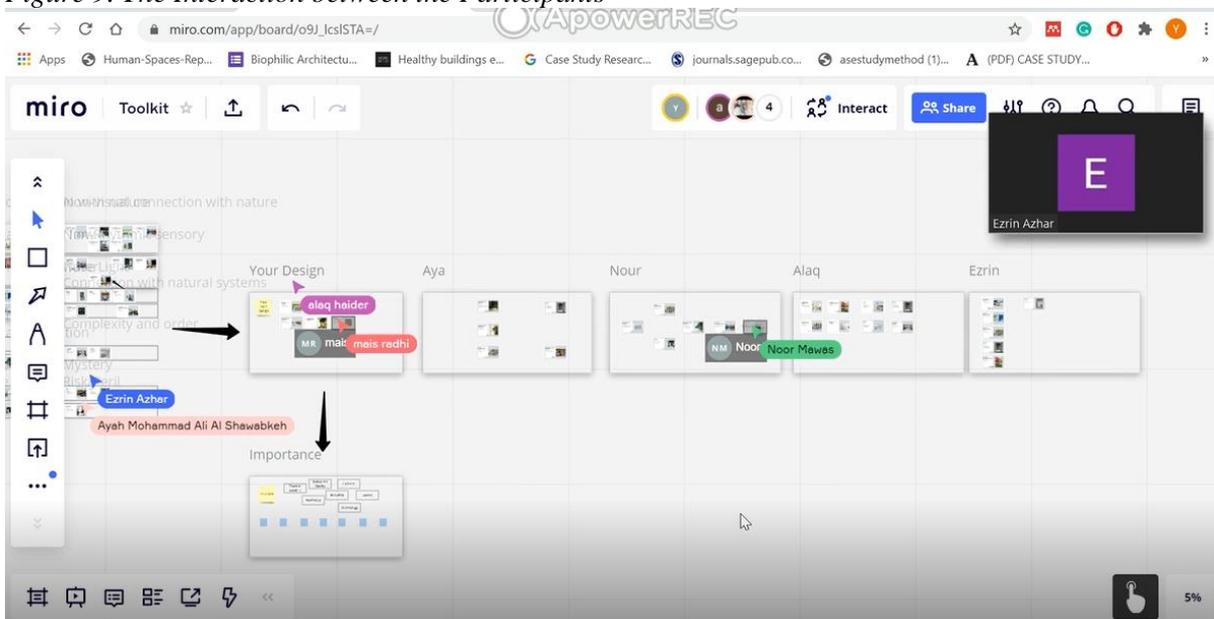
The researcher provided each one of the participants with a plan of the office, together with some pictures showing the main issues. The participants started to use the Toolkit, and the components of the Toolkit were available step by step on an online Miro board that was created specifically for the purpose of the evaluation (Figure 8).

Figure 8. The Evaluation Board



After reading the activity guide, the researcher presented the case study pictures showing the current state of the Marie Jahoda research room so that the participants could answer the questions on the Flourish Cards and discuss how each of the six categories affected the worker-occupants' health, well-being and productivity while they were spending time working in the research room. Next, the researcher asked the participants to use the Biophilic Cards to find suitable solutions for the research room problems based on the 14 patterns of Biophilic Design. The interaction between the participants can be seen in Figure 9.

Figure 9. The Interaction between the Participants



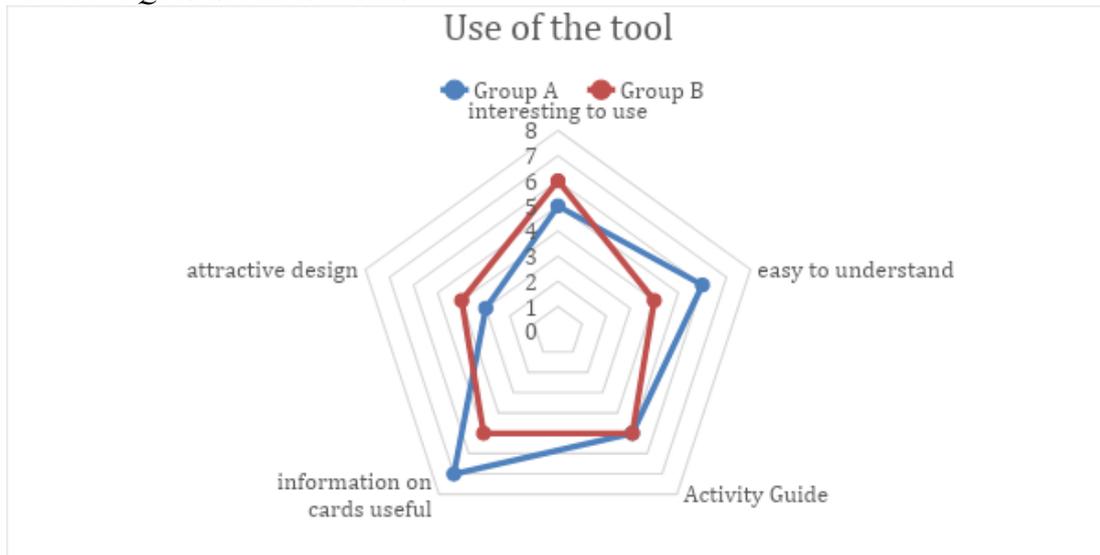
After the exercise, the additional user comments were collected in a survey questionnaire that consisted of nine questions: 01) Is the tool easy to use? 02) Is the Toolkit efficiently designed? 03) Does the tool include the information that you expect? 04) Does the tool enable you to indicate your ideas? and 05) Were the objectives of the co-design achieved using this tool?

The participants emphasised that the activity guide helped them understand how to use the toolkit cards step by step. They also gave some comments regarding the toolkit design, such as the suggestion to use the key colours to link the use stages together and to include an indication of the budget needed for each design concept. Moreover, two designers asked to add more information about Biophilic Design to the Toolkit in its digital version so that the user can learn more about the benefits of Biophilic Design and how it is different from the other design approaches. Finally, the Toolkit enabled the participants to show several possible improvements for a single space, indicating that it is flexible to use in different workplaces. As a result, most participants confirmed that the co-design objectives were achieved using this Toolkit. The online focus group took around 45 minutes, and everyone in the workshop observed all the toolkit elements. Additionally, the advantages and disadvantages of the Toolkit and its components were discussed under the headings of use, design and information delivery.

5 RESULTS AND DISCUSSION

Most users agreed that the Toolkit was very straightforward, simple and well laid out and well explained, and the colours were well coded. Moreover, the tool allowed the users to identify the quality issues in an indoor environment (here, an office) and link the problems with the occupants' health and well-being. It also defined all the categories and asked the users to put every item on a scale according to its importance; consequently, they were sure that it provided or called for detailed and well-explained information. The tool also allowed users to arrive at design recommendations using the Biophilic Design patterns for a comprehensive solution. Even though one participant found that the link between the IEQ factors and the design patterns was slightly unclear, the other users indicated that the Toolkit clearly demonstrates this relationship. With regards to the output of the tool, the researchers felt that it served its purpose and helped them expand their knowledge of the relationship between workplace design and Biophilic design. In addition, it gave them a good understanding of the need to improve the workplace since people spend most of their day in an office. Moreover, the participants suggest adding another part to the Toolkit to give an idea of the types of plants that are suitable for use in a workplace, define the botanical features and show how each could help balance the IEQ levels and give the workplace aesthetic value. As for the second round, the participants presented the ideas generated during the workshop to exemplify the type and complexity of ideas that can be achieved within each one of the sessions, and they followed all the steps in the activity guide. The ideas by designers expressed their ideas about the toolkit components and how it has been generated to help designers improve an office space completely to enhance the occupants' health and well-being. Roles of the tool Data from the questionnaires suggest that the cards were generally perceived as applicable, as shown in Figure 10.

Figure 10. The Questionnaires Results

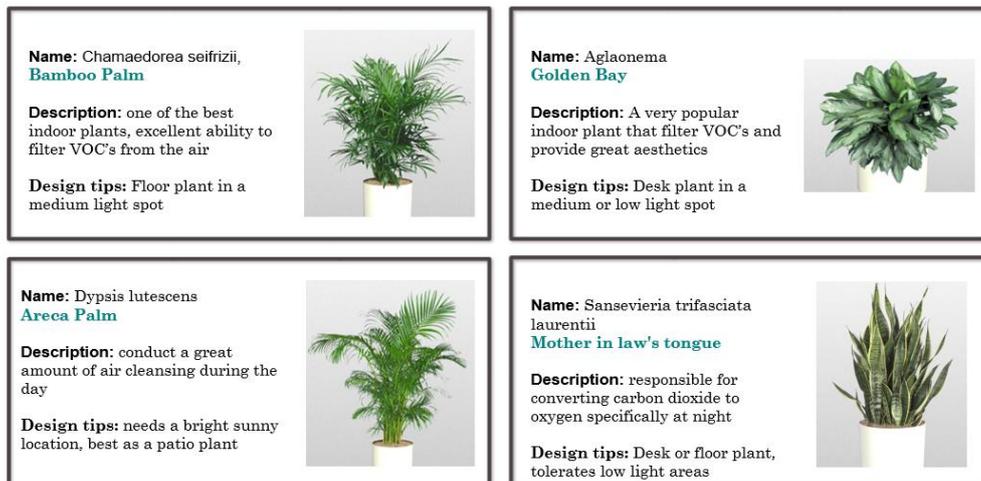


Almost three designers and four architects agreed that the card's design was appealing and the majority agreed that the cards were easy to understand and that the design process provided an activity guide to develop new ideas. Informing participants about the Biophilic toolkit components, observations and data from the questionnaires show that the tool was useful in helping users navigate through the workplace design. Furthermore, some participants suggested improvements to the plant card process.

5.1 Further development of the Biophilic Co-Design Toolkit

Following the result of the analysis and the users' suggestions, the researcher added a new part to the main design of the Toolkit: The Plants Cards. These cards suggest several plants that can be used inside the workplace and help balance the IEQ levels. Generally, plants enable humans to connect with nature, providing numerous social and economic benefits, including improved performance, satisfaction, and physical and mental health. Plants that help in offering fresh air and converting carbon dioxide to oxygen, specifically at night, help improve the IEQ in the workplace. Besides the previous plants, some examples of the Plants Cards that will be used in the Toolkit are shown in Figure 11 below. The cards help designers and architects to make different scenarios as to how to improve existing workplaces using Biophilic Design:

Figure 11. Biophilic Design Plant Cards



During the improvement stage, designers and architects may recommend a mix or choose mass planting to create that special effect depending on several factors as the open-plan office has many micro-environments; some areas get full sun, and some are in shade or rooms without natural light (low light plants), some are near air-conditioning and some near external doors, a balcony in the shade or full sun. Moreover, some offices will take large wide plants and some spaces tall narrow plants; some office staff have preferences about the type of plant, and others leave it up to the designer's expertise. The Physical version helps improve team interaction and collaboration. It is also different for its creative customisations and easy work decomposition. However, the online version is beneficial for Asynchronous collaboration like comments, attachments and notes, remote collaboration and being inclusive to remote team members, and home and travel access for co-located teams.

6 CONCLUSION

Besides showing the process of development of the Toolkit for co-designing workplaces using Biophilic Design, this study also tries to reach out to the interior design community. Its goal is to open up discussion about the best ways to design a successful office environment and to engage architectural companies and stakeholders, especially universities, in testing and expanding the Toolkit. This Toolkit offers a methodology based on constant research, which encourages being aware and up-to-date with all the latest architectural and design developments. Its structure is also able to evolve and expand. It aims to help to spread the design approach to the built environment as far as dealing with office buildings. This idea of openness is also related to the possibility of personalising the Toolkit's elements and receiving suggestions for new forms of integration. This way, the Toolkit can evolve, following future scenarios and covering updated issues and topics. The "Flourishing the Biophilic Workplaces Toolkit" aims to make its users, whether designers or architects, more aware of the office design possibilities of Biophilic Design. The next step envisioned in the development of the Toolkit is the further evaluation with the built environment and design experts to validate it physically while tangibility is valuable for some activities, like workshop use and team discussion, a digital version or a digital toolkit element may augment some specific functionalities.

REFERENCES

- Aboulnaga, M. M. (2006), "Towards green buildings: Glass as a building element - The use and misuse in the gulf region", *Renewable Energy*, 31(5), 631-653.
- Agarwal, A., Kaushik, A., Kumar, S., Mishra, R. K. (2020), "Comparative study on air quality status in Indian and Chinese cities before and during the COVID-19 lockdown period", *Air Quality, Atmosphere & Health*, 13(10), 1167-1178.
- Alrubaih, M.S., Zain, M.F.M., Alghoul, M.A., Ibrahim, N.L.N., Shameri, M.A., Elayeb, O. (2013), "Research and development on aspects of daylighting fundamentals", *Renewable and Sustainable Energy Reviews*, 21, 494-505.
- Bordass, B., Cohen, R., Standeven, M., Leaman, A. (2001), "Assessing building performance in use 3: energy performance of the Probe buildings", *Building Research & Information*, 29(2), 114-128.
- Browning, B., Cooper, S. C. (2011), *Human Spaces: The Global Impact of Biophilic Design in the Workplace*.
- Candido, C. et al. (2019), "Designing activity-based workspaces: satisfaction, productivity and physical activity", *Building Research and Information*, 47(3), 275-289.
- Clements-Croome, D. (2006), *Creating the productive workplace*, Taylor & Francis.

- Clements-Croome, D. (2020), *Designing Buildings for People: Sustainable liveable architecture*, The Crowood Press Ltd.
- De Bono, E. (1986), *Six Thinking Hats*, Viking.
- Deng, Y., Antle, A. N., Neustaedter, C. (2014), “Tango cards: A card-based design tool for informing the design of tangible learning games”, in *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, Association for Computing Machinery, New York, USA, 695–704.
- Di Blasio, S., Shtrepi, L., Puglisi, G.E., Astolfi, A. (2019), “A cross-sectional survey on the impact of irrelevant speech noise on annoyance, mental health and well-being, performance and occupants’ behaviour in shared and open-plan offices”, *International journal of environmental research and public health*, 16(2), 280.
- Fisk, W.J., Black, D., Brunner, G. (2012), “Changing ventilation rates in US offices: Implications for health, work performance, energy, and associated economics”, *Building and environment*, 47, 368-372.
- Green, T. B. (2015), *The Economics of Biophilia Why Designing with Nature in Mind Makes Financial Sense*, Terrapin Bright Green, London.
- Grinyer, L. (2016), *Designing a toolkit for policy makers - Policy Lab*.
- Han, M., May, R., Zhang, X., Wang, X., Pan, S., Da, Y., Jin, Y. (2020), “A novel reinforcement learning method for improving occupant comfort via window opening and closing”, *Sustainable Cities and Society*, 61, 102247.
- Haynes, B., Suckley, L., Nunnington, N. (2017), “Workplace productivity and office type: An evaluation of office occupier differences based on age and gender”, *Journal of Corporate Real Estate*, 19 (2), 111–138.
- Hornecker, E. (2010), “Creative idea exploration within the structure of a guiding framework: The card brainstorming game”, in TEI’10, *Proceedings of the 4th International Conference on Tangible, Embedded, and Embodied Interaction*, 101–108.
- Kellert, S. R., Calabrese, E. F. (2015), *The Practice of Biophilic Design*, Terrapin Bright LLC, London.
- Lan, L., Wargocki, P., Lian, Z. (2011), “Quantitative measurement of productivity loss due to thermal discomfort”, *Energy and Buildings*, 43(5), 1057-1062.
- Lockton, D. (2013), Design with Intent A design pattern toolkit for environmental & social behaviour change. *Brunel University School of Engineering and Design PhD Thesis*.
- MacKerron, G., Mourato, S. (2013), “Happiness is greater in natural environments”, *Global environmental change*, 23(5), 992-1000.
- McCunn, L.J., Kim, A., Feracor, J. (2018), “Reflections on a retrofit: Organisational commitment, perceived productivity and controllability in a building lighting project in the United States”, *Energy Research & Social Science*, 38, 154-164.
- Mujan, I., Anđelković, A.S., Munćan, V., Kljajić, M., Ružić, D. (2019), “Influence of indoor environmental quality on human health and productivity-A review”, *Journal of cleaner production*, 217, 646-657.
- Newsham, G. R., Mancini, S., Birt, B. J. (2009), “Do LEED-certified buildings save energy? Yes, but...”, *Energy and Buildings*, 41(8), 897–905.
- Roy, R., Warren, J.P. (2019), “Card-based design tools: A review and analysis of 155 card decks for designers and designing”, *Design Studies*, 63, 125-154.
- Tsushima, S., Tanabe, S.I., Utsumi, K. (2015), “Workers’ awareness and indoor environmental quality in electricity-saving offices”, *Building and Environment*, 88, 10-19.
- Vaajakallio, K., Mattelmäki, T. (2014), “Design games in codesign: as a tool, a mind-set and a structure”, *CoDesign*, 10(1), 63–77.

- Veitch, J. et al. (2008), “Lighting appraisal, well-being and performance in open-plan offices: A linked mechanisms approach”, *Lighting Research & Technology*, 40(2), 133–151.
- Wilson, E. (1984), *Biophilia: The human bond with other species*, Harvard University Press, London.
- Wölfel, C., Merritt, T. (2013), “Method Card Design Dimensions: A Survey of Card-Based Design Tools”, In: Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J., Winckler, M. (ED.) *Human-Computer Interaction*, Springer, Berlin, Heidelberg.
- Wong, L.T., Mui, K.W., Hui, P.S. (2006), “A statistical model for characterising common air pollutants in air-conditioned offices”, *Atmospheric Environment*, 40(23), 4246-4257.
- World Green Building Council (2014), *Health, Wellbeing Productivity in Offices*.

The effects of salutogenic workplace characteristics on productivity, stress, concentration, and mood in a virtual office environment

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ABSTRACT

This study aimed to get insights in salutogenic workplace characteristics that affect employees' workplace preference, while considering their mental health. Workplaces have been designed to improve employees' workplace experience and well-being. Until today, research mainly focused on the influence of indoor environmental quality (IEQ) on well-being, while 'tacit'/salutogenic aspects have been considered less frequently. Such characteristics (e.g. wall colours and views outside) were found to contribute to positive workplace experience and well-being too. A virtual open-plan office was designed, with variations in six attributes (screens between desks, occupancy rate, window-to-wall ratio, views outside, colour palette, and plants). In an online survey, employees were asked to choose between two of these office designs, based on where they would be able to work most productively or concentrated, feel least stressed, most relaxed, and happy. A fractional factorial design, consisting of 27 unique profiles, allowed the identification of main effects. By using a multinomial logit model, the part-worth utility values of these attributes were revealed, based on employees' trade-offs. Plants had the highest positive effect on employees' mental health. A window-to-wall ratio (WWR) of 60%, an occupancy rate of 25%, and a natural view outside also had a positive effect on employees' mental health. Screens between desks were only preferred for employees' concentration. Last, a red/warm colour palette had a positive effect on all mental health states, except for concentration and productivity. The novelty is the use of a virtually designed office workplace, combined with a stated-choice experiment. Instead of focussing on IEQ aspects, this method allows to focus on tacit workplace characteristics, which are difficult to estimate in living-lab experiments. Insights can be used by workplace managers to optimise workplace designs while possibly also increasing employees' well-being.

Keywords

Salutogenic workplace design, Virtual office, Stated choice experiment, Colours, Plants.

1 INTRODUCTION

In the past years, office-workplace design increasingly focussed on a positive workplace experience and the support of occupants' health and well-being (Candido et al., 2020). As such, the salutogenic design approach has gained interest, because it focuses on the determinants of overall health instead of disease prevention (Forooraghi et al., 2020). Heerwagen et al. (1995)

argued that a salutogenic environment should include several environmental features, such as natural views outside, daylight entrance, environmental attractiveness through plants and freshly painted walls, but also social features, including social interactions and feelings of belonging. However, as Forooraghi et al. (2021) mentioned, only a few studies have focussed on the salutogenic approach in the office-context. Previous studies focussed mainly on traditional indoor environmental quality (IEQ) aspects, such as noise, air quality or temperature, while more ‘tacit’ or salutogenic aspects, such as views outside, biophilic elements, or look and feel (e.g., colour use), have been studied less frequently (Bergefurt et al., 2022). The aim of this study is therefore to get insights into the influence of salutogenic workplace characteristics on employees’ mental health (i.e., productivity, concentration, mood, stress). A stated choice experiment with non-immersive virtual reality (VR) is used to simulate an open-plan office, in which different levels of salutogenic workplace characteristics are varied. This method overcomes the issues of living lab experiments, in which some factors cannot be controlled (Jo et al., 2019). To the best of the authors’ knowledge, only some studies have used a virtual environment in the office design context (Ahmaniemi et al., 2018; Yin et al., 2020), while no such virtual environment has so far been created for the open-plan office specifically. The use of a stated choice experiment has also not been used before in this context.

2 LITERATURE REVIEW

The systems-thinking theory shows that workplaces are complex systems, with features that are highly interrelated (Thakore et al., 2021). These environmental features might have an influence on employees’ mental health. First, natural views outside, especially on vegetation and water, and the introduction of plants in the office contribute to people’s recovery from stress (Nag, 2019; Veitch, 2011), as the Stress Recovery Theory by Ulrich et al. (1991) explains. These elements also stimulate mood, productivity, and well-being (Al Horr et al., 2016; Hähn et al., 2020). Besides a view, office windows provide daylight entrance. While too limited daylight reduces employees’ mood, too much daylight increases the risk of glare, thereby reducing concentration levels (Jamrozik et al., 2018). The window-to-wall ratio (WWR) can be used to determine optimal daylight access, which depends on the size and the number of windows. Hong et al. (2019) recommended a WWR of 15 to 60 percent. Furthermore, Heerwagen et al. (1995) indicated the importance of freshly painted walls in the office. The use of wall colours might influence the office experience (Nag, 2019; van der Voordt et al., 2017), because colours are associated with a specific mood (e.g., red signifies excitement, blue/green signifies relaxation, white signifies neutralisation). Although in most offices neutral colours have been applied (Ainsworth et al., 1993), colour-use might contribute to employees’ mood (Küller et al., 2006). Salutogenic design aspects are also related to social outcomes. For instance, social interactions are influenced by visual exposure or proximity of colleagues (Heerwagen et al., 1995). Screens between workstations reduce visual exposure, because they provide a physical and symbolic barrier to increase occupants’ productivity and reduce distractions. This is especially important for employees who perform highly concentrative jobs (Haynes et al., 2017; Veitch, 2018). The proximity to colleagues depends on the spatial (i.e., area available per occupant) and social density (i.e., number of occupants per office) of the office. A higher spatial density means that the available space per workstation is larger, leading to less distractions and a higher concentration rate (Veitch, 2018). In contrast, a high social density increases the frequency of social interactions but should be limited to prevent concentration-and productivity-issues (Hua et al., 2010; Veitch, 2018).

3 METHOD

3.1 Research method

A stated-choice approach was used, in which a respondent is repeatedly asked to choose one alternative from choice sets. This method allows the researcher to control the attributes and their levels, while varying other attributes (Hensher et al., 2015). In this study, the six discussed salutogenic workplace characteristics (i.e., the attributes that were varied) were selected, namely screens between workstations, occupancy rate, WWR, views outside, colour palette and plants. For each of these attributes, three corresponding levels were designed and varied in an orthogonal experimental design, leading to 27 alternative office designs (i.e., profiles). Two profiles were randomly combined as alternatives in different sets, and the sets were randomly assigned to the respondents. Each respondent was asked several times to choose between two office designs presented in a choice set, by selecting in which office (A or B) they would be able to work most productive or concentrated, feel least stressed, most relaxed, and happy (i.e., mental health states), respectively. They were also asked to indicate which office (A or B) they preferred the most in general. In case none of the two designs was preferred for a mental health state, the ‘no preference’ option could be chosen. Each respondent was shown four different choice sets, resulting in 24 (6 mental health states x 4 choice sets) choice observations per respondent. Using this design, the utilities that individuals assign to each level of each attribute can be derived, which, summed up, shows which alternative is most preferred. A multinomial logit model can be used to determine the probability that a particular alternative is chosen by an individual (Hensher et al., 2015). The model was estimated in the program R, using the ‘mlogit’ package (Croissant, n.d.). Dummy coding was used to code each attribute level that appeared in the scenario with one, and zero otherwise. The base level received a value of zero for each dummy coded variable.

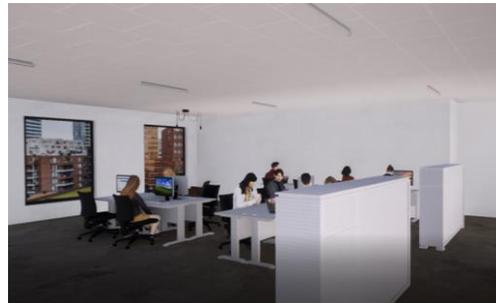
3.2 Research design

The office scenarios were virtually designed, by first making a basic open-plan office design in SketchUp Pro 2021 software. Tables and chairs were imported via the 3D Warehouse Repository. Twinmotion 2020.2 was used to add surface materials and animated people, and to make videos of 20 seconds in duration. As Figure 1a-d shows, a walk through the office was simulated, in which the respondent was guided to a free workspace. The videos were exported from Twinmotion as MP4 files and uploaded on YouTube.

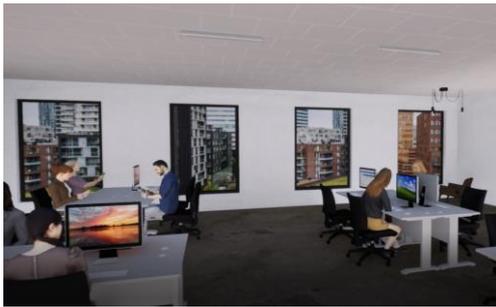
Figure 1. a. Screenshot of video at start of alternative 23; b. at 5 seconds; c. at 10 seconds; d. at 20 seconds.



a. Screenshot at start



b. Screenshot at 5 seconds



c. Screenshot at 10 seconds



d. Screenshot at 20 seconds

Next to the four choice tasks, several personal characteristics were asked, including gender, age, and personality. Personality was measured by the 10-items Big Five Inventory (BFI) (Rammstedt & John, 2007). Respondents were also asked to describe their current office workspace (before the COVID-19 pandemic), and to indicate their current concentration, productivity, stress, and mood (happy and relaxed) level, on a 10-point scale.

3.3 Data collection

The stated-choice experiment was implemented in the server-based software LimeSurvey. This software was used to make an online survey that was first distributed via email to several companies that financially support an overarching research project. These companies were asked to distribute the online survey to their employees, which resulted in a very small sample. Therefore, it was decided to share a link to the online survey via LinkedIn of the first two authors, resulting in a non-random sample. Data were collected between September 2021 and December 2021 and resulted in a total sample of 221 office workers.

4 RESULTS

4.1 Sample description

The sample consists of somewhat more females (53.4%) than males, with a mean age of 39.6 (SD=11.3). Most employees indicate an agreeable personality (M=3.85; SD=0.63), followed by neurotic (M=3.50; SD=0.86) and open traits (M=2.41; SD=0.73). Regarding respondents' current workplace (before the COVID-19 pandemic), most indicate to work from an open-plan office (80.5%), characterized by front screens (44.3%) or without screens (36.2%). The occupancy rate is average (around 70%), according to most respondents (44.8%). Most rated the daylight entrance at the office as high (61.5%) and indicated to have a city view (55.7%). In most offices, white/neutral colour palettes were used (53.4%), and horizontal plants were placed (67.0%). Employees were also asked to rate their mental health on a 10-point scale, ranging from 1 (Negative health) to 10 (Positive health). On average, respondents rate their hedonic tone the highest with a 7.21 (SD=1.65), followed by concentration (M=7.02, SD=1.64), productivity (M=6.95, SD=1.56), tense arousal (M=6.62, SD=1.97), and stress (M=4.28, SD=2.38). These findings indicate that employees rate their stress levels fairly high.

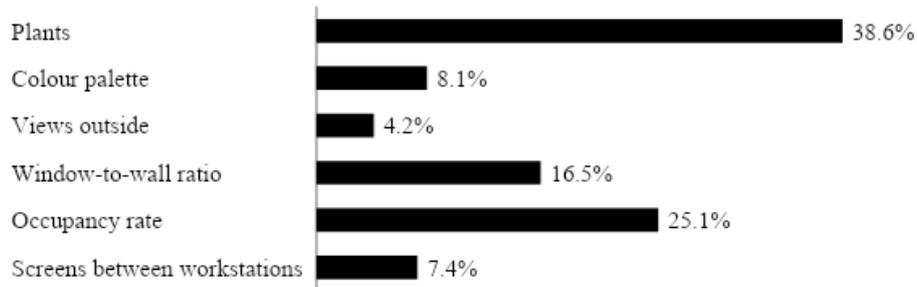
4.2 Multinomial logit model

Values of adjusted McFadden's Rho-Square (ρ^2) should be between 0.2 and 0.4 to represent a good model fit (Louviere, Hensher, Swait, 2000). Tables 1-6 show that the adjusted ρ^2 values are lower than 0.2, and therefore represent a poor fit. The log-likelihood of the estimated MNL models (LL(β)) should show a statistical improvement over the log-likelihood of the base models (LL(0)), which they do.

Productivity. Table 1 shows that screens between workstations, views outside and colour palette do not have a significant effect on perceived productivity. Relative to an occupancy rate of 70% (base), an occupancy rate of 25% has a positive effect, while 100% has a negative effect. This suggests that a more crowded office reduces employees' productivity. A WWR of

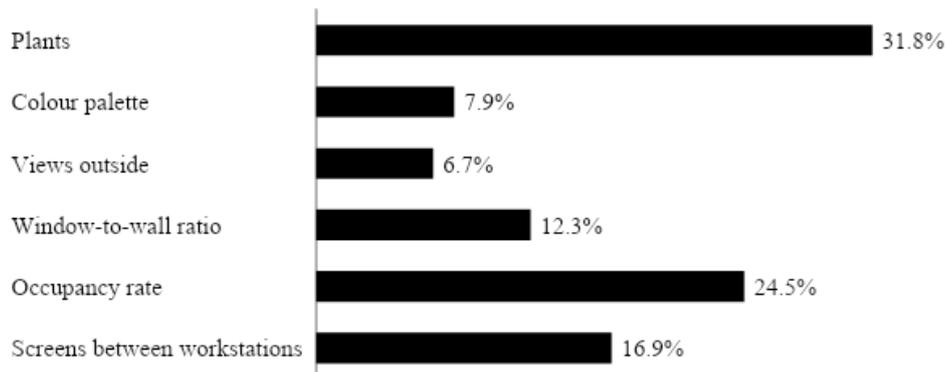
60% rather than 40% (base) positively affects perceived productivity. Last, horizontal plants have a positive effect relative to vertical plants (base). Figure 2 shows the relative importance of the different attributes, which has been calculated by taking the range between the lowest and highest utility for each attribute, divided by the overall sum of ranges across attributes. This shows that the attributes plants and occupancy rate have the highest relative importance on the overall office preference for productivity.

Figure 2. Relative importance of workspace attributes – Productivity



Concentration. The effect of colour palette on perceived concentration is insignificant, while the other attributes have a significant effect. Compared to no screens (base), front and side screens have a positive effect, while front screens only have a negative effect. An occupancy rate of 25% rather than 70% (base) also has a positive effect. Furthermore, a WWR of 60% rather than 40% (base) positively affects perceived concentration. Natural views compared to city views (base) also have a positive effect. Last, horizontal plants have a positive effect relative to vertical plants (base). Figure 3 shows that the attributes plants and occupancy rate have the highest relative importance on the overall office preference for concentration.

Figure 3. Relative importance of workspace attributes – Concentration



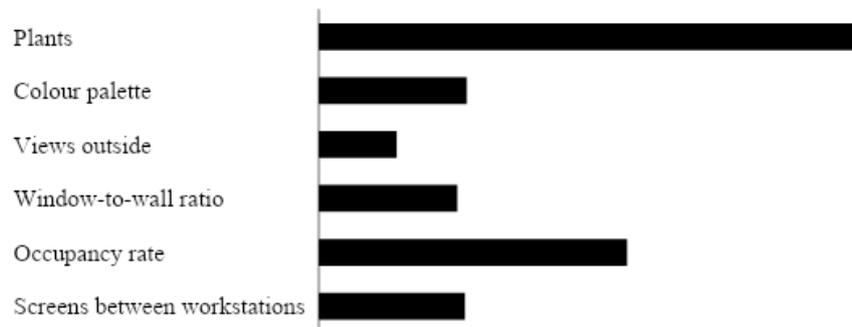
Stress. The WWR has no significant effect on perceived stress. Front and side screens or side screens only have a negative effect on perceived stress compared to no screens (base), which means that the use of such screens might cause the perception of stress. Furthermore, an occupancy rate of 25% rather than 70% (base), and industrial or natural views outside (relative to city views) positively affect perceived stress (i.e., reducing stress). The effects of a red/warm colour palette instead of neutral colours, or horizontal plants instead of vertical plants, are also both significant and positive. Figure 4 shows that, again, plants and occupancy rate have the highest relative importance on the office preference to work without stress.

Figure 4. Relative importance of workspace attributes – Stress



Feeling happy. All attributes have a significant effect on feeling happy. First, front screens or front and side screens have a negative effect compared to no screens (base). An occupancy rate of 25% contributes to feeling happy, while 100% has a negative effect compared to 70% (base). A WWR of 60% rather than 40% (base) has only a minor positive effect. Furthermore, a natural view outside (compared to city views) or a red/warm colour palette (compared to neutral colours) positively affect feeling happy. Last, no plants in the office have a negative effect, while horizontal plants have a positive effect relative to vertical plants (base). Figure 5 shows that plants and the occupancy rate have the highest relative importance on the overall office preference to feel happy.

Figure 5. Workspace preference – Feeling happy



Feeling relaxed. For feeling relaxed, it is again found that all attributes have a significant effect. First, both front screens or front and side screens have a significant negative effect compared to no screens (base). Occupancy rates of 25% or 100% rather than 70% (base) negatively affect feeling relaxed. In addition, a WWR of 60% (relative to 40%) or a natural view outside (compared to city views) contribute to feeling relaxed. Last, a red/warm colour palette rather than neutral colours (base) and horizontal plants (compared to vertical plants) have a positive effect on feeling relaxed. Figure 6 shows that employees' office preference to feel relaxed is, relative to other attributes, most impacted by plants.

Figure 6. Relative importance of workspace attributes – Feeling relaxed



General preference. All attributes are found to have a significant effect on employees’ general office preference. First, front screens or front and side screens have a negative effect on the general preference compared to no screens (base). An occupancy rate of 25% has a positive effect and 100% a negative effect (compared to 70% base level). In addition, a WWR of 60% rather than 40% (base) or having a natural view outside (compared to city views) both have a significant positive effect on the general office preference. Last, a red/warm colour palette (relative to neutral colours) or horizontal plants (compared to vertical plants) have a positive effect. Figure 7 shows that, again, plants and the occupancy rate have the highest relative importance on employees’ general office preference.

Figure 7. Relative importance of workspace attributes – General preference



4.3 Estimated utility values

Figure 8 shows the estimated utility values for each attribute per mental health characteristic relative to the baseline levels. Figure 8a shows that front screens compared to no screens have a significant negative effect on all mental health states except for productivity. Front and side screens only have a positive effect on employees’ concentration. An occupancy rate of 25% rather than 70% (base) has a positive effect on all mental health states, except for feeling relaxed. Furthermore, a WWR of 60% (compared to 40%) positively affects all mental health states except for stress. Natural views outside also have a positive effect on mental health, except for productivity (relative to city views). As Figure 8d shows, the effect of natural views outside on stress is the strongest. The red/warm colour palette (relative to neutral colours) have a positive effect on stress, feeling happy or relaxed, and general preference. Last, compared to vertical plants, horizontal plants have a positive effect on all health states.

Table 1. Estimation results multinomial logit model (I)

		Productivity	Concentration	Stress
Attribute	Level	Coefficient β (t-statistic)		

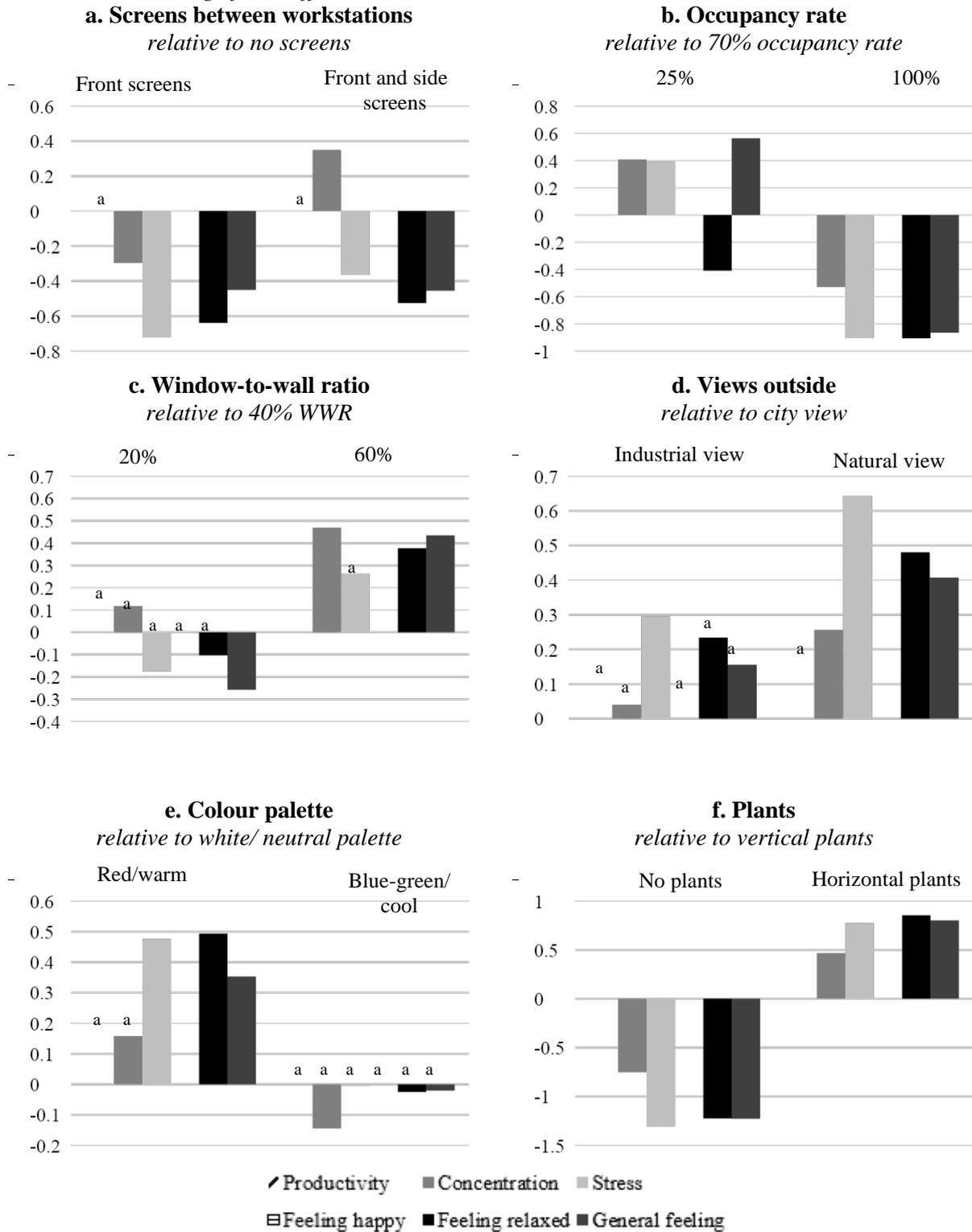
Constant		.723 (3.74) ** *	.764 (3.92) ** *	1.428 (7.12) ** *
Screens between workstations	Front screen	-.274 (-1.92)	-.297 (-2.07) *	-.722 (-4.81) **
	Front and side screen	-.0035 (-.020)	.349 (2.04) *	-.365 (-2.07) *
	No screens (base)	0	0	0
Occupancy rate	25%	.497 (3.64) ** *	.407 (3.01) **	.391 (2.72) **
	70% (base)	0	0	0
	100%	-.442 (-3.50) ** *	-.529 (-4.19) ** *	-.902 (-6.62) ** *
Window-to-wall ratio	20%	.164 (1.32)	.118 (.95)	-.176 (-1.40)
	40% (base)	0	0	0
	60%	.616 (4.51) ** *	.469 (3.44) ** *	.262 (1.89)
Views outside	City view (base)	0	0	0
	Industrial view	.098 (.71)	.040 (.28)	.296 (1.99) *
	Natural view	.158 (1.22)	.256 (1.98) *	.643 (4.58) ** *
Colour palette	Red/ warm	.151 (1.20)	.158 (1.26)	.476 (3.63) ** *
	Blue-green/ cool	-.153 (-1.30)	-.144 (-1.23)	-.0046 (-.038)
	White/ neutral (base)	0	0	0
Plants	No plants	-.784 (-5.58) ** *	-.750 (-5.36) ** *	-1.305 (-8.60) ** *
	Horizontal plants	.661 (4.87) ** *	.466 (3.40) ** *	.774 (5.52) ** *
	Vertical plants (base)	0	0	0
Goodness of fit statistics				
Log likelihood of estimated parameters (LL(β))		-810.71	-813.69	-752.24
Log likelihood of the null model (LL(0))		-881.51	-885.39	-861.74
Adjusted McFadden's Rho-square (ρ^2)		0.0733	0.0739	0.120
Akaike Information Criterion (AIC)		1647.42	1653.38	1530.48
AIC/N		1.93	1.93	1.79
*** p < 0.001; ** p < 0.01; * p < 0.05				

Table 1. Estimation results multinomial logit model (II)

		Feeling happy	Feeling relaxed	General preference
Attribute	Level	Coefficient β (t-statistic)		

Constant		1.533 (7.73) ***	1.373 (6.92) ***	1.995 (9.38) *
Screens between workstations	Front screen	-.556 (-3.80) ***	-.639 (-4.34) ***	-.450 (-3.08) *
	Front and side screen	-.493 (-2.84) **	-.526 (-2.99) **	-.455 (-2.56) *
	No screens (base)	0	0	0
Occupancy rate	25%	.415 (2.93) **	-.409 (2.86) **	.563 (3.88) *
	70% (base)	0	0	0
	100%	-.757 (-5.63) ***	-.906 (-6.67) ***	-.864 (-6.15) *
Window-to-wall ratio	20%	-.238 (-1.91)	-.103 (-.82)	-.258 (-2.07) *
	40% (base)	0	0	0
	60%	.289 (2.11) *	.377 (2.73) **	.435 (3.07) *
Views outside	City view (base)	0	0	0
	Industrial view	.0573 (.39)	.234 (1.60)	.156 (1.05)
	Natural view	.297 (2.15) *	.480 (3.45) ***	.407 (2.93) *
Colour palette	Red/ warm	.488 (3.78) ***	.493 (3.80) ***	.353 (2.73) *
	Blue-green/ cool	-.064 (-.53)	-.025 (-.21)	-.020 (-.17)
	White/ neutral (base)	0	0	0
Plants	No plants	-1.298 (-8.62) ***	-1.225 (-8.19) ***	-1.227 (-8.13) *
	Horizontal plants	.763 (5.56) ***	.854 (6.10) ***	.801 (5.64) *
	Vertical plants (base)	0	0	0
Goodness of fit statistics				
Log likelihood of estimated parameters (LL(β))		-762.79	-760.82	-696.05
Log likelihood of the null model (LL(0))		-863.32	-864.21	-795.23
McFadden's Rho-square (ρ^2)		0.110	0.113	0.118
Akaike Information Criterion (AIC)		1551.58	1547.64	1418.10
AIC/N		1.81	1.81	1.66
*** p < 0.001; ** p < 0.01; * p < 0.05				

Figure 8. Utility values (β) for each attribute per mental health state, relative to baseline level.
 Note. a. indicates insignificant effects



4 DISCUSSION, LIMITATIONS AND CONCLUSIONS

This study aimed to get insights in the effects of salutogenic workplace characteristics on employees' mental health. Results showed that horizontal plants had the highest positive effect on all mental health states. As Thomsen et al. (2011) indicated, the presence of plants is closely

linked to employees' well-being. Employees even indicated that a workplace without plants increases feelings of pressure and stress (Smith & Pitt, 2009). Furthermore, a red/warm colour palette positively affected employees' mental health, although the effects on concentration and productivity were insignificant. Colours are related to moods, with red signifying excitement (Nag, 2019; van der Voordt et al., 2017). It is therefore not surprising that the effects of red/warm colours on feeling relaxed and happy were significant. Another attribute with a positive effect on mental health (except for stress) is a WWR of 60%. Since employees spend most of their time indoors, exposure to daylight is important for their circadian rhythm, which influences their mental health (Veitch, 2018). Next to daylight, windows also provide views outside. Natural views had positive effects on all mental health states, except for productivity. Previous studies confirm that employees experience immediate cognitive- and long-term mental health improvements because of natural views outside (Nag, 2019; Veitch, 2018). More socially related attributes also had significant effects on mental health. Overall, screens between desks were not preferred, except for front and side screens to enhance concentration. Especially in open-plan offices, the use of screens between workstations provides a distraction-free workspace (Al Horr et al., 2016; Kaarlela-Tuomaala et al., 2009). The finding that employees preferred an occupancy rate of 25% for all mental health states (except for feeling relaxed) might also be related to the need to work without interruptions. As Fried et al. (2001) indicated, high office-occupancy results in uncontrollable distractions, which reduce people's ability to concentrate. Surprisingly, an occupancy rate of 25% or 100% had a negative effect on feeling relaxed. Employees thus seem to prefer a somewhat occupied office to feel relaxed. Although this research gained valuable insights, some limitations remain. First, the virtual office was designed to be as realistic as possible. However, only 18% of the respondents indicated the office-videos to be very realistic, and 70% somewhat realistic. Some respondents commented that the render quality was not optimal and that plants were rendered too large. Future research could focus on increasing the reality of the renders, but also on including different attributes or attribute-levels, such as environmental sounds, or varying heights of screens between desks. Furthermore, values of the adjusted McFadden's Rho-Square were rather low. This could indicate that there is much heterogeneity between individuals in preferences. Future research should therefore use a mixed-multinomial logit model to find unobserved heterogeneity between individuals. Nonetheless, this study can be considered as a first indication of how employees' mental health is affected by salutogenic workspace characteristics in an open-plan office. Especially during the return to the office after the COVID-19 pandemic, these insights can be used by employers to optimise the office-workspace according to employees' preferences.

REFERENCES

- Ahmaniemi, T., Lindholm, H., Muller, K., Taipalus, T. (2018), Virtual reality experience as a stress recovery solution in the workplace. *2017 IEEE Life Sciences Conference, LSC 2017, 2018-Janua*, 206–209. <https://doi.org/10.1109/LSC.2017.8268179>
- Ainsworth, R. A., Simpson, L., Cassell, D. (1993), Effects of Three Colours in an Office Interior. *Perceptual and Motor Skills*, 76(17), 235–241.
- Al Horr, Y., Arif, M., Kaushik, A., Mazroei, A., Katafygiotou, M., Elsarrag, E. (2016), Occupant productivity and office indoor environment quality: A review of the literature. *Building and Environment*, 105, 369–389. <http://dx.doi.org/10.1016/j.buildenv.2016.06.001>
- Bergefurt, L., Weijs-perrée, M., Appel-meulenbroek, R., Arentze, T. (2022), The physical office workplace as a resource for mental health – A systematic scoping review. *Building and Environment*, 207. <https://doi.org/10.1016/j.buildenv.2021.108505>

- Candido, C., Marzban, S., Haddad, S., Mackey, M., Loder, A. (2020), Designing healthy workspaces: results from Australian certified open-plan offices. *Facilities*. <https://doi.org/10.1108/F-02-2020-0018>
- Croissant, Y. (n.d.). *Estimation of multinomial logit models in R: The mlogit Packages*.
- Forooraghi, M., Cobaleda-cordero, A., Chafi, M. B. (2021), A healthy office and healthy employees: a longitudinal case study with a salutogenic perspective in the context of the physical office environment salutogenic perspective in the context of the physical office environment. *Building Research & Information*, 1–18. <https://doi.org/10.1080/09613218.2021.1983753>
- Forooraghi, M., Miedema, E., Ryd, N., Wallbaum, H. (2020), Scoping review of health in office design approaches. *Journal of Corporate Real Estate*, 22(2), 155–180. <https://doi.org/10.1108/JCRE-08-2019-0036>
- Fried, Y., Slowik, L. H., Ben-David, H. A., Tiegls, R. B. (2001), Exploring the relationship between workspace density and employee attitudinal reactions: An integrative model. *Journal of Occupational and Organisational Psychology*, 74(3), 359–372. <https://doi.org/10.1348/096317901167406>
- Hähn, N., Essah, E., Blanusa, T. (2020), Biophilic design and office planting: a case study of effects on perceived health, well-being and performance metrics in the workplace. *Intelligent Buildings International*, 1–20. <https://doi.org/10.1080/17508975.2020.1732859>
- Haynes, B., Suckley, L., Nunnington, N. (2017), Workplace productivity and office type: An evaluation of office occupier differences based on age and gender. *Journal of Corporate Real Estate*, 19(2), 111–138. <https://doi.org/10.1108/JCRE-11-2016-0037>
- Heerwagen, J. H., Heubach, J. G., Montgomery, J., Weimer, W. C. (1995). Environmental Design, Work, and Well Being. *AAOHN Journal*, 43(9), 458–468. <https://doi.org/10.1177/216507999504300904>
- Hensher, D. A., Rose, J. M., Greene, W. H. (2015), *Applied Choice Analysis*. Cambridge University Press.
- Hong, T., Lee, M., Yeom, S., Jeong, K. (2019), Occupant responses on satisfaction with window size in physical and virtual built environments. *Building and Environment*, 166. <https://doi.org/10.1016/j.buildenv.2019.106409>
- Hua, Y., Loftness, V., Kraut, R., Powell, K. M. (2010), Workplace Collaborative Space Layout Typology and Occupant Perception of Collaboration Environment. *Environment and Planning B: Planning and Design*, 37(3), 429–448. <https://doi.org/10.1068/b35011>
- Jamrozik, A., Ramos, C., Zhao, J., Bernau, J., Clements, N., Vetting Wolf, T., Bauer, B. (2018), A novel methodology to realistically monitor office occupant reactions and environmental conditions using a living lab. *Building and Environment*, 130, 190–199. <https://doi.org/10.1016/j.buildenv.2017.12.024>
- Jo, H. I., Kim, H. W., Jeon, J. Y. (2019), Investigation of work performance in an open-plan office with soundscape variation using virtual reality. *INTER-NOISE 2019 MADRID - 48th International Congress and Exhibition on Noise Control Engineering*, 1–7.
- Kaarlela-Tuomaala, A., Helenius, R., Keskinen, E., Hongisto, V. (2009), Effects of acoustic environment on work in private office rooms and open-plan offices - Longitudinal study during relocation. *Ergonomics*, 52(11), 1423–1444. <https://doi.org/10.1080/00140130903154579>
- Küller, R., Ballal, S., Laike, T., Mikellides, B., Tonello, G. (2006), The impact of light and colour on psychological mood: A cross-cultural study of indoor work environments. *Ergonomics*, 49(14), 1496–1507. <https://doi.org/10.1080/00140130600858142>

- Louviere, J.J., Hensher, D.A., Swait, J. D. (2000), Stated choice methods: analysis and applications. In *Cambridge university press*.
<https://doi.org/10.1017/CBO9781107415324.004>
- Nag, P. K. (2019), Spatial and Behavioural Attributes in Office Design. In *Office Buildings, Design Science and Innovation* (pp. 29–49). https://doi.org/10.1007/978-981-13-2577-9_2
- Rammstedt, B., John, O. P. (2007), Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German &. *Journal of Research in Personality*, 41, 203–212.
- Smith, A., Pitt, M. (2009), Sustainable workplaces: Improving staff health and well-being using plants. *Journal of Corporate Real Estate*, 11(1), 52–63.
<https://doi.org/10.1108/14630010910940552>
- Thakore, R., Kavantera, A., Whitehall, G. (2021), Systems-thinking theory. In *A Handbook of Management Theories and Models for Office Environments and Services* (pp. 25–35). Routledge. <https://doi.org/10.1201/9781003128786-3>
- Thomsen, J. D., Sønderstrup-Andersen, H. K. H., Müller, R. (2011), People-plant relationships in an office workplace: Perceived benefits for the workplace and employees. *HortScience*, 46(5), 744–752. <https://doi.org/10.21273/hortsci.46.5.744>
- Ulrich, R. S., Simons, R. F., Losito, B. D., Florito, E., Miles, M. A., Zelson, M. (1991), Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11, 201–230.
- van der Voordt, T., Bakker, I., de Boon, J. (2017), Colour preferences for four different types of spaces. *Facilities*, 35(3–4), 155–169. <https://doi.org/10.1108/F-06-2015-0043>
- Veitch, J. A. (2011), Workplace design contributions to mental health and well-being. *HealthCarePapers*, 11, 38–46. <https://doi.org/10.12927/hcpap.2011.22409>
- Veitch, J. A. (2018), How and why to assess workplace design: Facilities management supports human resources. *Organisational Dynamics*, 47(2), 78–87.
- Yin, J., Yuan, J., Arfaei, N., Catalano, P. J., Allen, J. G., Spengler, J. D. (2020), Effects of biophilic indoor environment on stress and anxiety recovery: A between-subjects experiment in virtual reality. *Environment International*, 136.
<https://doi.org/10.1016/j.envint.2019.105427>

SESSION 4A: COVID-19 AND THE FUTURE OF WORKSPACES

Thriving or surviving? How the physical work setting at home was experienced globally during COVID-19

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ABSTRACT

One of the most prominent and widely adopted COVID-19 countermeasures globally was the recommendation to work from home for all non-essential workers. Working from home (WFH) already entails many challenges, including difficulties in maintaining a healthy work-life balance. Moreover, the COVID-19 enforced remote working differed from planned remote work, as it was unplanned and involuntary, not based on individual work activities, and excluded the use of third places. This study aims to establish how, on a global scale, demographics, time with company, and the social and physical work setting at home affected employees' satisfaction with their physical work setting during the pandemic. The study employs a quantitative research approach utilising secondary data comprising 137,289 respondents from 77 countries globally. Employees' experienced suitability of their physical work setting at home are regressed on demographic factors (age, gender), time with company, presence of others at home, type of work space, satisfaction with desk and chair, access to IT devices and tools, and country, using a linear probability model. The study finds that the majority of the respondents globally, ca 61%, felt that their physical work setting at home was suitable. Women had a higher probability of being satisfied than men, and older employees a higher probability of satisfaction than younger employees. Recent recruits also had a higher probability of satisfaction. The presence of family members reduced the probability of satisfaction, presence of friends and flatmates even more so. Not having a dedicated work room also reduced the probability of satisfaction, while satisfaction with a desk, chair and access to IT devices and tools had a large positive effect. This study is among the first to analyse employee experiences during COVID-19 on a truly global scale. As hybrid work continues to gain a foothold, our findings are useful workplace managers in the post-pandemic era.

Keywords

COVID-19, Employee experience, Hybrid work, Working from home (WFH), Work setting.

1 INTRODUCTION

There has been a dramatic shift in the way we work and use different spaces for working since the outbreak of the COVID-19 pandemic. By the spring of 2020, COVID-19 had turned into a global pandemic sparking several measures from governments, ranging from wide-spread restrictions to softer guidelines. One of the most prominent and widely adopted measures globally was the recommendation to work from home for all non-essential workers. This forced

an unexpected massive shift to home working worldwide. According to the estimates of Eurofound (2020) approximately 40% of the workers in the EU started to work full time remotely when only 15% of them had any previous experience of it. Even for those with previous experience, the COVID-19 enforced, full-time remote working differs from planned remote work in many ways.

First, WFH during the pandemic is not voluntary, or dependent on the employees' work tasks or preferences. Voluntary WFH is typically used for activities that require concentration, or activities that do not require social interaction (Kojo and Nenonen, 2015). Offices offer space for collaboration and socialisation, with activities such as knowledge sharing, co-creation, brainstorming and face-to-face communication. These activities have likely been negatively impacted during the home-working period. Second, working out of the office may normally take place in privileged spaces with invited access such as airport lounges, or public spaces with open access such as cafés or hotel lobbies (Haynes et al., 2017). Working in third places is typically used by mobile workers that travel (Kojo and Nenonen, 2015). However, in this case, the work was to be conducted specifically at home, and most of the third places were unavailable during the COVID-19 pandemic. Consequently, employees were placed in an unequal position depending on factors such as work setting at home, or family status. As an example, working parents with younger children are expected to have a disadvantage compared to households without children. Further, while men are more likely to be affected by the direct health impacts of COVID-19, women are known to be more affected by the indirect impacts, for example from closing down of schools (Alon et al., 2020). Finally, the shift was abrupt and unplanned from both the employees' and employers' side and thus required adaptability and high tolerance for ambiguity. Previous research has shown that younger generations are more agile when it comes to changes in their work environment (Rothe et al., 2012). Moreover, age is known to be a risk factor in COVID-19, which could imply more distress and greater level of self-isolation in older employees. Rudolph and Zacher (2020) even report the emergence of ageism due to the pandemic. It is therefore expected that younger age is a moderating factor in the abrupt shift to WFH. Relatedly, Appel-Meulenbroek et al. (2022) recently found that very few employees want to continue WFH post-pandemic, although most prefer a hybrid solution, and that women, part-time employees, employees with administrative duties, or a long commute were more prone to continue working from home (Appel-Meulenbroek et al., 2022). A central issue contributing to the positive or negative experience of WFH is the characteristic and suitability of the work setting at home. The workplace environment offered by the employer can be carefully planned to support the work tasks. Among factors to consider are indoor comfort, lighting, daylight and views, décor, biophilia, cleanliness, physical security, noise, control, furniture, and space layout (e.g. Haynes, 2008; Ng, 2010; Oseland & Burton, 2012; Usher, 2018). Meanwhile the work setting at home, including its spatial and sensory characteristics, varies between employees, and potential shortcomings can be left unknown to the employer. For example, WFH can expose employees to ergonomic risks due to poor physical work setting design (Larrea-Araujo et al. 2021). An unsuitable desk and incorrect chair height can increase the risk for computer work related musculoskeletal disorders (e.g. Harrington & Walker 2004). A Dutch study by Arkesteijn et al. (2021) shows that the characteristics of the work space at home have influenced the perceived productivity during the COVID-19 pandemic in that people felt more productive when working in a dedicated room than when working in a bedroom or in a shared room (Arkesteijn et al., 2021). Possibility of privacy, and a dedicated room at home have further been found to be connected to better mental health and well-being (Awada, 2021; Bergefurt et al., 2022). Yet, a Spanish study found that a quarter of respondents did not feel their homes were adequate for WFH, although 38.5% reported a dedicated space for work and 48.8% were happy with the size of the work room,

and 33.8% were satisfied with their office furniture at home (Cuerdo-Vilches et al. 2021) One previously reported challenge with WFH is the difficulty to maintain a healthy work-life balance (Grant et al., 2013). A dedicated room that the employee can leave at the end of the work day will likely ease this challenge.

As the above mentioned studies show, the direct and indirect impacts of WFH during the pandemic on work setting, productivity and mental and physical health, and the relations between them, has received plenty of research interest, with many interesting contributions. However, there are few global studies. Our study therefore aims to establish how, on a global scale, demographics, time with company, social setting and characteristics of the physical work setting affected employees' satisfaction with their physical setting when working from home during the pandemic. The study employs a quantitative research approach utilising secondary data collected by a private company via a home working survey, comprising 137,289 respondents from 77 countries globally. In order to take both demographics and other factors that might affect satisfaction into account simultaneously, we conduct a multiple regression where employees perceived 'suitability of physical work setting' at home are regressed on demographic factors (age, gender), time with company, presence of others at home, type of work space, satisfaction with desk and chair, access to IT devices and tools and country using a linear probability model. Although the focus of study is on the implications of the COVID-19 enforced WFH period, working in second and third places is expected to continue to grow in the near future, accelerated by megatrends such as digitalization, environmental crises, and individualism. The findings can therefore be utilised in the post-pandemic era as well.

2 RESEARCH DESIGN

The research follows a deductive research logic in that it builds on existing theory on workplaces, including prior knowledge on working outside the office. The study employs a quantitative research approach and utilises secondary data collected by a private company. The dataset we have access to is derived from a home working survey conducted during the period 1st April 2020 – 31st March 2021. The surveys comprised 181,406 respondents from 74 organisations across 90 countries. About 15 percent of the respondents were employed in the public sector. Of the 181,406 respondents, the dataset we have access to covers the 151,756 respondents who provided ratings based on their home working experience (e.g. '*When I work from home, I...*'). The other 29,650 respondents did not work from home at the time of the survey and responded to a slightly different version of the questions (e.g. '*If I were to work from home, I...*'). Apart from information on the home working experience, the data contains information on gender, age group, time with company and location country. From the dataset of 151,756 respondents we exclude respondents for whom there is no information on the country (11,397 respondents) and respondents from 13 countries with less than 31 respondents. We also exclude respondents for whom information is missing on our outcome variable 'suitability of physical setting' or on some of the explanatory variables. After these exclusions we are left with 137,289 observations from 77 countries.

Employees' perception of the suitability of their physical setting is regressed on *demographic factors (age, gender), time with company, presence of others at home, type of work setting, access to IT devices and tools, satisfaction with chair, satisfaction with desk or table, and country*, using a linear probability model. More precisely, our outcome variable is modelled as a dummy variable that takes the value 1 if the respondent agreed or strongly agreed with the statement "*The physical settings I use when working from home are suitable for the work that I do*" and 0 otherwise. The explanatory variables are mostly straightforward dummy variables corresponding to the group division in the original dataset, see Table 1. However, the explanatory variable access to IT devices and tools has been constructed as a dummy variable

that takes the value 1 if the respondent agreed or strongly agreed with the statement “*I have access to all of the IT devices and tools I need to work from home*” and 0 otherwise, and the explanatory variable satisfaction with chair (desk or table) has been constructed as a dummy variable that takes the value 1 if the respondent was satisfied or highly satisfied with their chair (desk or table) at home and 0 otherwise. Further, the degree of satisfaction with a chair (desk or table) is only available for those respondents who first indicated that a chair (desk or table) was an important feature when working from home. We have therefore run one regression excluding the explanatory variables satisfaction with chair and satisfaction with desk or table and one regression including these explanatory variables but where we only consider respondents that indicated both chair and desk or table as important features (about 88% of the respondents).

3 FINDINGS

This section first presents summary statistics and then the results of the regression analyses. As can be seen from the summary statistics in Table 1, ca 61% of the respondents globally agreed or strongly agreed with the statement “*The physical settings I use when working from home are suitable for the work that I do*”. Surprisingly, it was the most common for the employee to have a dedicated work room or office, ca 42% of the respondents. As many as ca 66% had access to the needed IT devices and tools. Among respondents that indicated both chair and desk or table as important features, approximately 58% were satisfied with their chair and ca 64% were satisfied with their desk or table (which corresponds to ca 51% and 57% of all observations).

Table 1. Summary statistics

The physical settings I use when working from home are suitable for the work that I do	Frequency	Percentage of observations
Disagree strongly	3012	2.19
Disagree	5937	4.32
Disagree slightly	10772	7.85
Neutral	11384	8.29
Agree slightly	22150	16.13
Agree	42179	30.72
Agree strongly	41855	30.49
gender		
Female	59220	43.14
Male	75052	54.67
Non-binary	130	0.09
Prefer not to say	2887	2.10
age group		
-24	4485	3.27
25-34	37324	27.19
35-44	44582	32.47
45-54	34217	24.92
55-64	15652	11.40
65 or over	923	0.67
Prefer not to say	106	0.08
time with company		
0 - 6 months	7694	5.60
6 - 18 months	17023	12.40
18 months - 3 years	20575	14.99
3 - 8 years	35551	25.90
8 - 12 years	16746	12.20
Over 12 years	39700	28.92

When you are working from home who is usually present?		
One or more children or dependents	51120	37.24
A partner or other family member(s)	84470	61.53
Friend(s) or flatmate(s)	4806	3.50
Other person(s)	3494	2.54
No one	33346	24.29
Working from home, what type of work setting do you use most often?		
A dedicated work area (but not a separate room)	41333	30.11
A dedicated work room or office	56997	41.52
A non-work specific home location (such as a dining table)	36692	26.73
Other	2267	1.65
I have access to all of the IT devices and tools I need to work from home		
Disagree strongly	1955	1.42
Disagree	5621	4.09
Disagree slightly	11223	8.17
Neutral	7525	5.48
Agree slightly	20004	14.57
Agree	46426	33.82
Agree strongly	44535	32.44
Number of countries	77	
Total number of observations	137289	100
Chair		
Not available	4011	2.92
Highly dissatisfied	9241	6.73
Dissatisfied	19651	14.31
Neutral	17985	13.10
Satisfied	35480	25.84
Highly satisfied	34238	24.94
Desk or table		
Not available	4177	3.04
Highly dissatisfied	5729	4.17
Dissatisfied	15200	11.07
Neutral	17878	13.02
Satisfied	40970	29.84
Highly satisfied	36652	26.70
Total number of observations:	120606	87,85

Table 2 presents the results of the regression of ‘*suitability of physical work setting at home*’ on demographic factors (age, gender), time with company, presence of others at home, type of work space, access to IT devices and tools and country, and additionally for estimation 2, satisfaction with chair and satisfaction with desk or table.

Table 2. Regressions

physical setting suitable	est1		est2	
	b	robust se	b	robust se

Gender (ref: Male)				
Female	0.034***	0.002	0.025***	0.002
Non-binary	0.019	0.034	-0.009	0.034
Prefer not to say	0.002	0.008	0.012	0.008
Agegroup (ref:35-44)				
-24	-0.012	0.007	-0.020**	0.007
25-34	-0.009**	0.003	-0.006	0.003
45-54	0.013***	0.003	0.009**	0.003
55-64	0.020***	0.004	0.009*	0.004
65 or over	0.054***	0.013	0.028*	0.012
Prefer not to say	0.084*	0.035	0.083*	0.036
Time with company (ref: over 12 years)				
0 - 6 months	0.009	0.005	0.015**	0.005
6 - 18 months	0.019***	0.004	0.023***	0.004
18 months - 3 years	0.009*	0.004	0.011**	0.004
3 - 8 years	0.001	0.003	0.005	0.003
8 - 12 years	-0.001	0.004	0.001	0.004
Usually present (ref: No one)				
One or more children or dependents	-0.053***	0.003	-0.037***	0.002
A partner or other family member(s)	-0.037***	0.002	-0.022***	0.002
Friend(s) or flatmate(s)	-0.124***	0.007	-0.075***	0.007
Other person(s)	-0.080***	0.007	-0.049***	0.007
Type of workset (ref: A dedicated work room or office)				
A dedicated work area (but not a separate room)	-0.119***	0.003	-0.083***	0.003
A non-work specific home location (such as a dining table)	-0.314***	0.003	-0.183***	0.003
Other	-0.279***	0.01	-0.169***	0.01
Access to all it devices and tools	0.411***	0.003	0.307***	0.003
Chair satisfied or more			0.147***	0.003
Desk or table satisfied or more			0.276***	0.004
Country dummies (ref: United Kingdom)	Yes		Yes	
Constant	0.512***	0.005	0.231***	0.005
Observations	137289		120606	
Adjusted R-squared	0.301		0.417	

The demographic factors provided both expected and unexpected results. Controlling for the other variables, women had a higher probability of being satisfied with the physical setting when working from home than men (in the order of 2.5-3.4 percentage points depending on the estimation specification). Meanwhile, the presence of children or other family members reduced the probability of satisfaction, and the presence of friends and flatmates even more so. The probability of satisfaction increased with age, while recent recruits had a higher probability of satisfaction than those who had been with the company for a longer time. Interestingly, though, looking at the simple shares of respondents, a larger share among those who had been with the company for more than 12 years were satisfied with their physical home work setting, than among those who had been with the company for a shorter time. This indicates that there is an age effect (i.e., the probability of being satisfied increased with age).

Considering the characteristics of the physical settings at home, working from a dedicated work space as compared to working in a separate room reduced the probability of being satisfied

with the physical work setting at home, and working without a dedicated work space reduced the probability of satisfaction even more. Further, satisfaction with desk, chair and access to IT devices and tools had a large positive effect on the probability of satisfaction with the physical work setting at home overall. For example, having access to needed IT-devices and tools increased the probability of satisfaction with the physical work setting at home with approximately 30,7-41,1 percentage points depending on the estimation specification. This corresponds to almost a doubling of the baseline probability in the first estimation and more than a doubling in the second estimation.

4 DISCUSSION AND CONCLUSION

This study aims to establish how, on a global scale, demographics, time with company, social setting and characteristics of the physical work setting affected employees' satisfaction with their physical setting when working from home during the COVID-19 pandemic. Overall, we find that the majority of employees globally experienced their physical and social setting at home as suitable for their work. Our results further show that women had a higher probability of being satisfied with their physical setting than men. This aligns with Appel-Meulenbroek et al. (2022) who found that women are more likely to continue working from home post-pandemic, possibly due to their administrative tasks, or part-time positions that are suitable for WFH. In accordance with Alon et al. (2020), who considered women to be more indirectly affected by the pandemic because of increased responsibilities such as home schooling, our results show that having children present at home reduced the probability of satisfaction with the physical work setting at home. Whether the effect is larger for women, however, remains to be studied. We also find that having flat mates or friends present reduced the probability of satisfaction. This is somewhat contradictory to Weijs-Perrée et al (2021) who found that those living alone felt the least productive working from home. Having a possibility to interact socially at the home, might decrease the negative impacts of WFH such as social isolation, however, this is not reflected in our results.

Our results also show that older employees had a higher probability of satisfaction than younger employees, which could be considered to contradict earlier findings by e.g. Rothe et al. (2012) that younger employees are more adaptable. One explanation could be that since age is a risk factor for COVID-19, in the specific situation of the pandemic, older employees might have felt that their home work setting was protecting them. Controlling for age (and the other variables), we find that recent recruits (up to 3 years with the company) had a higher probability of satisfaction than those having been with the company for a longer time. One explanation for this could be that recent recruits do more routine and individual tasks whereas those who have been with the company for longer times tend to have more managerial responsibilities that might be difficult to carry out from home. We further find that, not having a dedicated, separate office reduced the probability of being satisfied with the physical work setting at home, supporting e.g. Awada et al. (2021), Arkensteijn et al. (2021) and Bergefurt et al (2022) previous findings about the positive effects of a dedicated room at home. Finally, our results show that having access to needed IT devices and tools and being satisfied with chair and desk or table had a large effect on the probability of employees' being overall satisfied with the physical settings when working from home.

When interpreting our results, some limitations should be noted. Even though the country of the respondents is controlled for in the regressions, data about e.g. city, industry sector, work tasks, and housing conditions of the respondents were not available. For example some sectors were already more digitalized before the pandemic and therefore more prepared for WFH in terms of tools and technology available to their employees. Moreover, the general expectations of employees concerning the work settings might vary as the working culture might differ

between e.g. organisational positions, companies, and sectors. These factors could have an impact on WFH experiences and would be important to study in their own right. Further, to the extent that they are also correlated with the variables included in our regressions, our estimates might be biased.

Nonetheless, this study is among the first to analyse employees' satisfaction with their physical settings on a truly global scale during the temporary, quickly enforced home working period. The strength of this study lies in the extensive data set of 137,289 observations from 77 countries. In most aspects, this study confirms the findings of the previous studies with smaller data sets and local or regional perspectives. Despite the extreme and unique conditions for remote working during COVID-19 (e.g. homeschooling, lack of childcare, social restrictions, and inadequate preparedness) overall globally, employees seem to be relatively satisfied with WFH. Yet, our findings shed light on the differences between different demographics and social and physical settings when working at home. Based on our findings, a separate work space, IT devices and furniture have an important role in satisfaction with home work setting. This gives room for speculating whether it would be feasible for employers to finance employees' home office equipment or even compensate for the space costs of home offices.

Our findings highlight the need to understand that remote workers' circumstances differ, not only with regard to the physical setting, but also socio-demographic factors, and social setting at home. This challenges the equal opportunities of employees, and places new types of pressure on employers who have traditionally focused on the workplace management of their own premises. In the future, more individually tailored hybrid work arrangements will be needed. Work cultures will continue to diversify and already include working from the office, WFH, working from third places, and hybrid solutions, forming a tangled web of reasons and consequences. This calls for, not only the reconsideration of workplace management strategies of organisations, but also research about the possible future consequences of different options to e.g., space needs at the office and at home.

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REFERENCES

- Arkesteijn, M., Jansen, S., Kieft, B., Appel-Meulenbroek, R., Hoekstra, B., Jongens-van der Schaaf, P. (2021), "The influence of the physical home work environment on perceived productivity during the COVID-19 pandemic." *The proceedings of the 20th EuroFM Research Symposium 2021*, European Facility Management Network, 16-17 June 2021, online conference.
- Alon, T., Doepke, M., Olmstead-Rumsey, J., Tertilt M. (2020), "The Impact of COVID-19 on Gender Equality", *NBER Working Paper No. 26947* JEL No. D10, E24, J16, J22.
- Appel-Meulenbroek, R., Kemperman, A., Van de Water, A., Weijs-Perrée, M., Verhaegh, J. (2022), "How to attract employees back to the office? A stated choice study on hybrid working preferences", *Journal of Environmental Psychology*, Volume 81, 101784.
- Awada, M., Lucas, G., Becerik-gerber, B., Roll, S. (2021), "Working from home during the COVID-19 pandemic: Impact on office worker productivity and work experience", *Work*, 69, pp. 1171-1189, [10.3233/WOR-210301](https://doi.org/10.3233/WOR-210301)
- Bergefurt, L., Weijs-Perrée, M., Appel-Meulenbroek, R., Arentze, T., de Kort, Y. (2022), "Satisfaction with activity-support and physical home-workspace characteristics in relation to mental health during the COVID-19 pandemic", *Journal of Environmental Psychology*, Volume 81.

- Cuerdo-Vilches T., Navas-Martín M.Á., Oteiza I. (2021), Working from Home: Is Our Housing Ready? *International Journal of Environmental Research and Public Health*, 18(14):7329, available at: <https://doi.org/10.3390/ijerph18147329>
- Giovanis, E. (2018), “The relationship between flexible employment arrangements and workplace performance in Great Britain”, *International Journal of Manpower*, 39, 1, 51–70, available at: <https://doi.org/10.1108/IJM-04-2016-0083>
- Grant, C.A., Wallace, L.M., Spurgeon, P.C. (2013), “An exploration of the psychological factors affecting remote e-worker's job effectiveness, well-being and work-life balance”, *Employee Relations*, Vol. 35 No. 5, pp. 527-546.
- Eurofound (2020), “Living, working and COVID-19 data”. Available at: <http://eurofound.link/covid19data> (accessed 31 March 2022)
- Harrington, S. S., Walker, B. L. (2004), “The effects of ergonomics training on the knowledge, attitudes, and practices of teleworkers” *Journal of Safety Research*, 35 (2004), 13 – 22
- Haynes, B., Nunnington, N., Eccles, T. (2017), *Corporate Real Estate Asset Management*, Routledge.
- Kojo, I., Nenonen, S. (2015), “Places for multi-locational work–opportunities for facilities management”, *Facilities*.
- Larrea-Araujo, C., Ayala-Granja, J., Vinueza-Cabezas, A., Acosta-Vargas, P. (2021), “Ergonomic Risk Factors of Teleworking in Ecuador during the COVID-19 Pandemic: A Cross-Sectional Study” *International Journal of Environmental Research and Public Health*, 18, 10: 5063. 2-14. <https://doi.org/10.3390/ijerph18105063>
- Oseland N., Burton, A. (2012), “Quantifying the impact of environmental conditions on worker performance for inputting to a business case to justify enhanced workplace design features”, *Journal of Building Survey, Appraisal & Valuation*, 1, 2, 151–164
- Rothe, P., Lindholm, A., Hyvönen, A., Nenonen, S. (2012), “Work environment preferences - does age make a difference?”, *Facilities*, 30, 1/2, 78-95.
- Rudolph, C.W., Zacher, H. (2020), “The COVID-19 generation: A cautionary note”, *Work, Aging & Retirement* doi.org/10.1093/workar/waaa009
- Weijs-Perrée, M., Appel-Meulenbroek, R., Looijen, J., Hoekstra, B.S., Jongens-van der Schaaf, P. (2021), “Analysing perceived communication and productivity of different office workers while working fully from home due to COVID-19 restrictions”, *The proceedings of the 20th EuroFM Research Symposium 2021*, European Facility Management Network, 16-17 June 2021, online conference.

Professional isolation in the home workplace during the COVID-19 pandemic

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ABSTRACT

COVID-19 forced most office workers to work from home. Alongside known positive aspects of home-based telework, it is also associated with reduced organisational support and feelings of isolation. Isolation is often cited as the primary reason for not wanting to work from home (WFH) full-time, but there is limited knowledge on the relationships between personal- and environmental factors of WFH and feelings of isolation. It is therefore interesting to study isolation during obliged WFH and see how relationships with colleagues might have changed. Two surveys were distributed amongst office workers of 12 different (mostly public) Dutch office organisations in 3 cohorts across the Covid-pandemic in 2020 (April-December; n=25,058 and 18,859, response rates 33% and 23%). Bivariate analyses of survey 1 show significant relationships between personal and environmental characteristics and the professional isolation scale. Descriptive analyses of the survey 2 data are used to interpret how relationships have changed. Findings show that many respondents missed informal contact with their colleagues at the office, but on average professional isolation increased only slightly from 3.12 for cohort 1 to 3.16 (on a 5-point scale) for the later cohorts. Managers, females, and employees with similar workloads since working from home suffered less from isolation than non-management and/or male employees, and those with increased or decreased workloads. Also, respondents of higher age, those with a furnished and/or private home workspace, those living with others and those with higher perceived organisational support showed less feelings of isolation, while those with higher educational levels and/or children living at home perceived more professional isolation. Both the content (less personal) and the frequency of contact with

colleagues changed since working from home. Also, managers felt more involved with their colleagues, and found it more rewarding to see their colleagues during video meetings compared to regular employees.

Keywords

Home workplaces, Professional isolation, COVID-19 pandemic, Teleworking, Worker relationships.

Enacting interpersonal connectivity remotely during COVID-19: an approach of Danish middle managers

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ABSTRACT

Digital technologies and their connective properties have enabled distance work, which provides autonomy and flexibility for individuals to work and collaborate at a distance. As digital technologies enable us to work at a distance, they also separate and disconnect individuals, affecting task coordination and knowledge sharing, and potentially causing loneliness and isolation. As the outbreak of COVID-19 enforced work at a distance, line and middle managers were faced with a new task to ensure and maintain closeness and connection to the distant team members to minimise the negative consequences and retain employee well-being and performance from afar. In fact, research suggests developing and maintaining interpersonal connectivity i.e. one-on-one connection with team members. While research also states that interpersonal connectivity between individuals predominantly forms through face-to-face interaction, the technical capabilities of digital technologies permit establishing a sense of community and close relation development within the community, if users utilise this technology masterfully. However, developing and maintaining interpersonal connectivity between distant workers is challenging and requires deliberate managerial effort. Therefore, this article aims to explore how line and middle managers enact interpersonal connectivity work with their teams at a distance as a means of closing a connectivity gap. To do so, we draw on qualitative interviews within a longitudinal case of a large Danish pharmaceutical company to demonstrate how thirteen middle managers maintain interpersonal connectivity with their teams from a distance during the COVID-19 pandemic, from May 2020 to May 2021. We conclude by considering strategies middle managers utilise to ensure closeness and connection to their teams while balancing employee well-being and performance. Through this study, we observe that middle managers enact interpersonal connectivity by adjusting their behaviour to establish a virtual presence that brings them closer to employees. Moreover, the middle managers use techniques exuding both care and control over their employees through organised virtual interaction points and activities. The study contributes to the body of knowledge on interpersonal connectivity work enacted by line and middle managers over time in distance work. Furthermore, this study informs management practice on relevant skill development for

distance work by demonstrating a case that outlines the elements needed when employing interpersonal connectivity work.

Keywords

Interpersonal connectivity, Middle managers, Connectivity gap, Distance management, COVID-19.

1 INTRODUCTION

Interpersonal relationships play a central part in shaping the social experience within organisations and creating a meaningful work-life (Eby & Allen, 2012) as individuals accomplish work through social processes and connections (Stephens et al. 2011 in Cameron & Spreitzer, 2012). Within work relationships individuals share experiences, discuss and engage in challenges collaboratively, thus leading to a sense of belonging to each other and the workplace (Hafermalz & Riemer, 2021) and the experience of work satisfaction and well-being of employees in organisations (Nurmi & Hinds, 2020). The outbreak of COVID-19 and the respective lockdowns that triggered the transition towards remote work and distance management brought concerns relating to people's productivity, well-being (Rubin et al., 2020), and workers' attachment (Hafermalz & Riemer, 2021) and connectivity to the organisation (Kolb et al., 2020). The transition highlighted the importance of having social relationships at work even more than before. During the COVID-19 confinement, people expressed that lack of social contact was among the most pressing issues when working from home due to feeling isolation and loneliness caused by the lack of presence (Rubin et al., 2020). Moreover, solely using digital technology to mitigate and bridge connections between team members was still new to many. Line and middle managers were concerned about the effects of COVID-19 lockdowns affecting company culture and team cohesion and it was up to them to experiment and implement activities that would bring employees together (McKinsey & Company, 2022). However, the upkeep of meaningful interpersonal relationships is more challenging over distance (Nurmi & Hinds, 2020). Distance between people and organisations may lead to experiencing a social connectivity gap e.g. disconnection from others, and a weakening sense of community (Vuori et al., 2019). Hence, adjusting to the new work mode i.e. working from distance needs effective management of the distance (Gilson et al., 2015; Raghuram et al., 2001) to reduce the connectivity gap i.e. potential disturbances influencing tasks and relationships (Breidbach et al., 2013). Recognizing and filling these connective gaps and reflecting on connective needs and practices has become a task of managers operating from a distance (Kolb, 2008). This can be done by engaging in interpersonal connectivity work as a means to maintain a close one-on-one connection with each employee (Hafermalz & Riemer, 2020). Interpersonal connectivity enhances the sense of closeness and cohesiveness and employees are more likely to experience belonging to the organisation and adapt to the norms and fulfil the goals of the organisation (Fonner & Roloff, 2012; Nurmi & Hinds, 2020). Thus, interpersonal connectivity work functions as a pathway towards ensuring both employee well-being and performance at work while strengthening the employees' attachment to the team and the workplace. Previous studies found that by focusing on meeting employees' basic needs e.g. connection and belongingness to the team, managers can motivate and support their performance when working at a distance (Ipsen et al., 2021). Yet, while organisations worldwide embrace distance work, ways to ensure interpersonal connectivity are still an under-explored area, needing more insights from research and practice (Hafermalz & Riemer, 2020). Consequently, we respond to the call by Hafermalz and Riemer (2020) on exploring ways line and middle managers perceive they have been working towards enacting and maintaining interpersonal connectivity with their teams' at a distance in a large pharmaceutical company

located in Denmark, from May 2020 to May 2021. Therefore, this article aims to answer the following research question: *How and (driven by what) do line and middle managers enact and maintain interpersonal connectivity with their teams as a way to close the connectivity gap?*

The findings contribute to connectivity research, especially the social dimension in a distance work setting. Additionally, the article informs the management practice on relevant skill development for distance management by demonstrating a case that outlines the elements needed when employing interpersonal connectivity work. We organised this article in the following way; the introduction outlines the research area and the research question. The theoretic background defines the key concepts. Further, we illustrate the methods applied in this study. The analysis demonstrates the findings of this study, and finally, we conclude the article by responding to the research question.

2 THEORY

2.1 Connectivity gaps and requisite connectivity

The notion of connectivity tends to be discussed as the connection to digital technology (Yli-Kauhaluoma & Pantzar, 2018), however, connectivity may also refer to physical (e.g. space, time, and location) as well as social processes and mechanisms (e.g. relations connecting individuals, closeness, group cohesion) (Kolb, 2008; Kolb et al., 2012; Nie, 2001). Lack of connectivity in terms of availability, disconnection, and interruption within any of these dimensions manifests in a connectivity gap. The connectivity gaps may be experienced within any of these dimensions, even in an onsite setting. Connectivity gaps bring new concerns to organisations, for example, a social connectivity gap (e.g. too excessive or too scarce collaboration) may negatively affect decision-making, collaboration, limit knowledge sharing, overall deplete and reduce well-being (Eby & Allen, 2012), impede relationships between employees (Nurmi & Hinds, 2020), and constrain employee attachment to the organisation (Fonner & Roloff, 2012; Raghuram et al., 2001). Even though physical distance tends to be viewed as a constraint on collaboration and communication with others as it limits the visibility of behaviours, thus causing uncertainty about others and their activities and affecting the level of trust (Birnholtz et al., 2012). However, also a collocated team may struggle with developing closeness, hence it is not the location but the connectivity gap influenced by the distance that requires attention (Kolb, 2008). For example, the quality of social ties within a team may either promote or eliminate connective gaps (Breidbach et al., 2013). On the other hand, while connective gaps may challenge teams, they can also be closed by enhancing the perceived closeness to others despite the distance (Kolb, 2013; Wilson et al., 2008). While maintaining proper social and technical connectivity is desirable, at the same time, individuals need to draw a distance and alternate between collaborating and performing generative tasks. While distance limits face-to-face contact, it still offers interaction opportunities (Birnholtz et al., 2012), and too excessive collaboration tends to turn into constant connectivity affecting performance negatively, wasting time, and triggering a stress response due to overstimulation and perception of invading personal space (Kolb, 2008). The appropriate connectivity is achieved through interpersonal connectivity work, which aims for realising the feeling of closeness through effective communication, adequate to the needs of the task at hand despite the physical location (Hafermalz & Reimer, 2020).

2.2 Working towards interpersonal connectivity

The foundation of interpersonal connectivity lies in being present with another in an embodied way (Hafermalz & Riemer, 2020) and thus relating to the physical and mental experience of the other (McCarthy & Glozer, 2022). In addition, interpersonal connectivity forms through the combination of being present with others i.e. empathic dimension and with an understanding of when to take control over a situation and when to let go i.e. agentic dimension.

This requires a process of ‘tuning in’ with the other and the situation at hand (Hafermalz & Riemer, 2020; Whyte et al., 2022). An indication of established interpersonal connectivity is a sense of closeness despite the distance. The empathic dimension refers to being present with someone and can manifest in both an online setting through video conferencing and phone, as well as physically onsite. Being present with someone means becoming situated with another individual and visualising ‘getting into their shoes’ while simultaneously connecting to their experience through their own past experiences. Becoming present with someone corresponds to immersing in the situation, feeling, thinking, and acting based on the information through the body (McCarthy & Glozer, 2022). This involves listening deeply, engaging senses, participating consciously, and holding openness beyond one’s preconceptions (Senge et al., 2005), thus engaging in challenging and highly demanding work (Hafermalz & Riemer, 2020). The agentic dimension i.e. being there for another corresponds to the action of taking control and letting go when necessary (Hafermalz & Riemer, 2020). Being present with and being there for are connected processes in the sense that the ability to grasp a situation appropriately is informed by relating to own past experiences that provide cues on the appropriate response i.e. it informs when to push or pull in either direction to take control of the situation. Having extensive experience in a certain area provides an understanding of approaching different challenges. For example, an experienced (and aware) manager instinctively detects when someone is experiencing stress. This happens through the manager consulting their own experience and forming a response to the tension informed by zooming in and out on the situation at hand. By engaging in these actions, the manager evaluates where to offer flexibility by allowing selection of tasks or minimising workload, and where to take the lead, set deadlines, and drive the direction (Hafermalz & Riemer, 2020).

3 APPROACH

We conducted an in-depth, exploratory case study in a large Danish pharmaceutical company during COVID-19 and the consequent lockdowns and re-openings of the workplaces. Our respondents expressed that the case company has always (even before COVID-19) been very mindful to ensure the well-being and providing good working conditions for their employees. Our respondents revealed that they place high importance on driving the work further and at the same time, managing their employees in a caring and considerate way. This management approach has been encouraged by the top management and has essentially been ingrained into the company culture. We took this into account when selecting the case for our exploration. Furthermore, we followed criterion sampling (Patton, 1990) pre-defining elements of interest before fixating on the case. Our selection criteria focused on the size of the company e.g. large with a workforce comprising of 250+ employees, location e.g. in Denmark, domain e.g. knowledge-intensive with a high emphasis and focus on employee well-being and working conditions, as well as accessibility to the case that would provide us minimum 6+ months of access. Within our case, we explored the experiences of thirteen line and middle managers transitioning into distance management from May 2020 until May 2021. Seven of our respondents were first-line managers whereas the remaining six were second-line managers, the respondents had between two to twelve employees reporting to them. Semi-structured interviews were our primary source of data where we obtained retrospective and real-time reflections by respondents describing their lived experiences. To conduct our interviews, we followed an interview guide. Our interview guide focused on three areas: (1) a discussion surrounding digital technology use and frequency of meetings; (2) managers’ reflections on distance work, management, well-being, performance, and team cohesion; (3) theme reflections through which we explored a different topic in each interview round inspired by our curiosity and gained insights from previous rounds. The theme inquiry covered topics such as

trust, managerial expectations towards employees in distance work, and perception of shifts in the managerial role. Our data collection stretched over ten rounds of interviews conducted every 4 to 6 weeks. Each interview round comprised 8 to 10 individual interviews, resulting in a total of 101 interviews. A typical interview lasted between 20 and 40 minutes. Over the ten interview rounds, we adhered to the same thirteen respondents. Participation in the interviews was voluntary. We conducted the interviews in Microsoft Teams and afterward transcribed verbatim using the Otter.ai transcription service and double-checked for accuracy of transcripts.

3.1 Data analysis

For data analysis, we used the software Atlas.ti. We applied a systematic approach to analysing the data to develop new concepts (Gioia et al., 2013). Beginning with a first-order analysis that centred on respondent terms emerging from the data, we identified 40 initial codes. Further, we performed a second-order analysis where we narrowed down the initial codes, by seeking similarities and differences between them and labelling them in a way to retain the respondent terms. In the second-order analysis, we created links between our respondents and our insights, still honouring the respondents' voices while merging them with our insights. This resulted in distilling the initial codes into 9 second-order themes. Subsequently, by approaching the themes through theoretic concepts, we organised the second-order themes into 3 aggregate dimensions, thus establishing a data structure that visualises the transitioning from raw data to a sound visual representation, which we illustrate in the following section (in Table 1).

4 FINDINGS

Table 1 demonstrates our data structure and pictures the first-order codes, second-order themes, and aggregate dimensions. Further below, we elaborate on the findings.

Table 1 - Representation of the data structure

First-order codes	Second-order themes	Aggregate dimensions
<ul style="list-style-type: none"> - Following and noticing the well-being - Respecting the needs and preferences of employees - Showing acknowledgment - Encouraging work-life balance - Giving space for employees - Enhancing togetherness 	Caring behaviours	Being present with
<ul style="list-style-type: none"> - Getting to know each other better - Having fun together - Celebrating successes 	Being together as a team	
<ul style="list-style-type: none"> - Having antennas out i.e. having an intense awareness of cues - Zooming in on said and the subtext of the communication - Engaging 'gut feeling' - Adopting others perspectives 	Sensing	
<ul style="list-style-type: none"> - Working to become more visible, available and accessible - Trying to be more present through listening, asking, showing interest 	Managing presence	Being there for

<ul style="list-style-type: none"> - Spreading positive energy - Working to be clear in communication and expectations 			
<ul style="list-style-type: none"> - Engaging a watchful eye - Securing well-being - Enabling access to practical tools and social infrastructure - Taking action to make things happen - Following up on assessments - Having corrective dialogues 	Taking responsibility		
<ul style="list-style-type: none"> - Making things work as a team - Keeping teams' energy levels up - Bringing the team together - Replicating office - Ensuring equality at meetings 	Bringing the team together		
<ul style="list-style-type: none"> - Taking in others' feedback - Monitoring work engagement - Drawing on mandates and systems 	Gathering external input		
<ul style="list-style-type: none"> - Experiencing a loss of control - Sensing a lack of efficiency - Growing concern and frustration - Feeling fed up and demotivated - Feeling guilty 	Negative emotional states		Drivers and enablers
<ul style="list-style-type: none"> - Feeling impressed - Sense of calm - Enjoying flexibility - Positively surprised 	Uplifting feelings and moods		

4.1 The drivers for interpersonal connectivity

Our analysis demonstrates that the deliberate engagement in interpersonal connectivity work is driven by negative emotional states and uplifting feelings and moods experienced by managers as well as influenced by the process of sensing i.e. gathering of the available cues. These elements combined influenced the approach taken by the line and middle managers e.g. pursuing action or not responding to the situation. For example, experiencing negative emotional states contributed to managers questioning whether employees work while at home. This doubt manifested in an increase in check-ins with employees as well as introducing various controlling measures e.g. checking on people early in the morning, and replicating the office environment by engaging in 'roundtable discussions' at meetings where each team member updated others on their tasks. Furthermore, the managers followed whether everyone had shared their tasks and goals at each meeting and gave new targets, with a follow-up meeting shortly after.

When the managers experienced growing frustration, they acknowledged the need for finding a way to cope with the situation. This included pushing the feelings away, taking one day at a time, setting up meetings and informal activities, reaching out to their teams as a way to pull themselves out of the negative experience, and finding ways to energise themselves. The negative emotional states such as feeling tired and 'fed up' with the situation, pushed the managers into organising online gatherings, walks and talks with their reports, or simply reevaluating the way their day is structured. Additionally, the managers empathically acknowledged that employees are likely sharing the experience.

The uplifting feelings and moods influenced the managers to exude appreciation through team interaction points, which resulted in further enhancing togetherness and belonging among the team members. Furthermore, the experienced sense of calmness allowed the managers to appreciate and enjoy the newly-found flexibility and organise life and work between work and home.

4.2 Enacting interpersonal connectivity

‘Being present with’, the empathic dimension of interpersonal connectivity work, manifested through the managers’ attempting to close the connectivity gap by connecting with the team members through the processes of sensing, caring, and enhancing togetherness as a team.

We found that the process of sensing becomes a conscious process in a distance work setting and the challenge of engaging in this process becomes recognized, whereas, in an onsite setting, it is experienced as a natural part of a workday. Sensing from distance requires deliberate effort through concentrating on nonverbal cues (e.g. facial expressions, voice tone, surroundings, and posture), observing behaviours and stress cues, noticing language and subtext, and internalising the observations while engaging intuition during interactions. Furthermore, the managers engaged more with their teams’, which allowed the managers to relate stronger to the experiences of the team. Lastly, we found that managers ‘tune in’ with their employees through engaging in caring behaviours, allowing the managers to feel and show compassion towards them as it requires being present with the other person, as well as connecting employee’ experiences to their reflections, hence the managers connected with employees by drawing to their own experience and responding to employees compassionately.

In addition to the ‘being present with’, the managers engaged in ‘being there for’, the agentic dimension, where they took control through more subtle methods e.g. managing their presence by adjusting behaviours to appear in a certain way, for example, striving to become more available and present, and transmitting positive emotion to influence others. Additionally, the managers engaged in stronger controlling behaviours as well e.g. sharpening their watchful eye where they noted down and mapped out the information on employees, taking action in bringing the team together, requesting employees to come to the offices whenever possible, reaching out individually and following up, ensuring equality in meetings, and generally striving to replicate the office environment through facilitating roundtable discussions at meetings and organising coffee meetings as a way to mimic the small talk and knowledge sharing organically occurring at the coffee machine onsite.

Moreover, we found that the managers were gathering external input on how their employees were performing e.g. from colleagues, and buddy systems, as well as through monitoring work engagement and following productivity assessments. In addition, the managers followed employee presence and availability online, requesting to have the camera on in online meetings and keeping their calendars up to date, as well as considering employees’ response time in emails and chats.

Our analysis confirms the way the line and middle managers enacted interpersonal connectivity work was through the processes of being present with and being there for the employees where the two dimensions influence each other i.e. the action is informed by the embodiment of the experience (being present with the team) influenced the managers taking control measures (being there for). For example, as the managers sensed disconnection between the team members growing (through being with the team), they increased the frequency and variety of teamwork activities involving various games and gimmicks, physical exercises, meditations as well as experimenting with gratitude journaling, creativity training, and different work setups such as four-day workweeks (thus taking control of the situation). At the same time, we found that the activities the managers pursued were affected by their negative emotional states as well

as uplifting feelings and moods e.g. negative emotional states drove them to take action as a way to cope with the situation.

5 DISCUSSION AND CONCLUSION

The purpose of this case study was to explore further how line and middle managers enacted interpersonal connectivity, through ‘being present with’ their reports in an empathic sense and ‘being there for’ them in an agentic sense, thus enhancing the interpersonal connectivity, simultaneously closing the connectivity gap.

The managers engaged in different actions to become present with their reports, for example, the processes of sensing, caring, and being together as a team. These actions meant that the managers connected with their reports in an embodied, empathetic way, striving to understand employees’ experiences by drawing on their own past. This informed them on further actions, partaking in controlling actions such as taking responsibility and managing presence, which required the managers to adjust their responses and ways they presented themselves online. The way the managers adjusted their presence whenever interacting with their reports was through active listening, demonstrating interest in their employees, and asking questions about both work and their private life. The managers tended to save this information so they could refer to it later. Furthermore, the managers found it important to ‘spread positive energy’ during interactions as a way to emotionally influence others towards positive outcomes.

While the increased attention on employees through sensing their states and bringing the teams together enhanced the teams’ interpersonal connectivity, this shift may trigger another connectivity gap i.e. causing excessive communication (Kolb, 2008). Even though the physical distance may have been viewed as a constraint on collaboration and communication with others, excessive communication through digital technology tends to contribute to stress and overwhelm (Fonner & Roloff, 2012) as well as it extends and intensifies work. The shift towards people management in distance work in this case meant that the line and middle managers still kept their previous tasks, thus leading them to experience work extensification (Hassard & Morris, 2021).

Furthermore, since distance work to this extent (where teams work from home for an extended time) was new to the managers involved in our study, trying to achieve appropriate connectivity meant that the managers primarily tried to establish closeness with their reports and take action in a controlling way, rather than providing freedom and establishing separation with employees. These elements (e.g. freedom and separation) are involved in enacting interpersonal connectivity artfully as outlined by Hafermalz and Riemer, (2020). However, we argue that the managers focused on establishing closeness and taking action in a controlling way solely because of their limited experience in distance management as well as due to the pressure placed on them by the top management to ‘care’ for their employees i.e. it was up to the line and middle managers to experiment and implement activities that would bring employees together during the COVID-19 pandemic.

Furthermore, while the managers were focusing on sensing the states of their reports by focusing on their body language and non-verbal cues, they may have generated biased assessments of others’ emotional states. While the line and middle managers focused on appearing more present and available, none of them were experts in sensing, and were largely built on their assumptions. The illusion of transparency and biased assumptions have been addressed by Gilovich et al., (1998) and may contribute to misinterpretations in distance work. In addition, as we have identified in this article, interpersonal connectivity work is driven by negative emotional states and uplifting feelings and moods, however, these are affective and shifting states influenced by the moment and are prone to change depending on the external situation and internal experience.

With this article, we contribute to elaborating on the concept of interpersonal connectivity work by further unpacking the concept as well as extending it by pinpointing the drivers of interpersonal connectivity work. We found that the interpersonal connectivity work is driven by the negative emotional states and uplifting feelings and moods, and these elements further affect actions the managers engage in as a way to cultivate interpersonal connectivity with their employees. Furthermore, the negative emotional states and uplifting feelings influence the managers' capacity to empathically sense.

REFERENCES

- Birnholtz, J., Dixon, G., Hancock, J. (2012), Distance, ambiguity and appropriation: Structures affording impression management in a collocated organisation. *Computers in Human Behaviour*, 28(3), 1028–1035. <https://doi.org/10.1016/j.chb.2012.01.005>
- Breidbach, C. F., Kolb, D. G., Srinivasan, A. (2013), Connectivity in Service Systems: Does Technology-Enablement Impact the Ability of a Service System to Co-Creat Value? *Journal of Service Research*, 16(3), 428–441. <https://doi.org/10.1177/1094670512470869>
- Cameron, K. S., Spreitzer, G. M. (2012), *The Oxford handbook of positive organisational scholarship*. Oxford University Press.
- Eby, L. T. de T., Allen, T. D. (2012), *Personal Relationships: The Effect on Employee Attitudes, Behaviour, and Well-being*. Routledge.
- Fonner, K. L., Roloff, M. E. (2012), Testing the Connectivity Paradox: Linking Teleworkers' Communication Media Use to Social Presence, Stress from Interruptions, and Organisational Identification. *Communication Monographs*, 79(2), 205–231. <https://doi.org/10.1080/03637751.2012.673000>
- Gilovich, T., Medvec, V. H., Savitsky, K. (1998), The illusion of transparency: Biased assessments of others' ability to read one's emotional states. *Journal of Personality and Social Psychology*, 332346.
- Gilson, L. L., Maynard, M. T., Jones Young, N. C., Vartiainen, M., Hakonen, M. (2015), Virtual Teams Research: 10 Years, 10 Themes, and 10 Opportunities. *Journal of Management*, 41(5), 1313–1337. <https://doi.org/10.1177/0149206314559946>
- Gioia, D. A., Corley, K. G., Hamilton, A. L. (2013), Seeking Qualitative Rigour in Inductive Research: Notes on the Gioia Methodology. *Organisational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
- Hafermalz, E., Riemer, K. (2020), Interpersonal Connectivity Work: Being there with and for geographically distant others. *Organisation Studies*, 41(12), 1627–1648. <https://doi.org/10.1177/0170840620973664>
- Hafermalz, E., Riemer, K. (2021), Productive and connected while working from home: What client-facing remote workers can learn from telenurses about 'belonging through technology'. *European Journal of Information Systems*, 30(1), 89–99. <https://doi.org/10.1080/0960085X.2020.1841572>
- Hassard, J., Morris, J. (2021), The extensification of managerial work in the digital age: Middle managers, spatio-temporal boundaries and control. *Human Relations*, 00187267211003123. <https://doi.org/10.1177/00187267211003123>
- Ipsen, C., van Veldhoven, M., Kirchner, K., Hansen, J. P. (2021), Six Key Advantages and Disadvantages of Working from Home in Europe during COVID-19. *International Journal of Environmental Research and Public Health*, 18(4), 1826. <https://doi.org/10.3390/ijerph18041826>
- Kolb, D. (2013), Virtually There: The Paradox of Proximity (pp. 171–192). https://doi.org/10.1057/9781137280640_8

- Kolb, D. G. (2008), Exploring the Metaphor of Connectivity: Attributes, Dimensions and Duality. *Organisation Studies*, 29(1), 127–144. <https://doi.org/10.1177/0170840607084574>
- Kolb, D. G., Caza, A., Collins, P. D. (2012), States of Connectivity: New Questions and New Directions. *Organisation Studies*, 33(2), 267–273. <https://doi.org/10.1177/0170840611431653>
- McCarthy, L., Glozer, S. (2022), Heart, Mind and Body: #NoMorePage3 and the Replenishment of Emotional Energy. *Organisation Studies*, 43(3), 369–394. <https://doi.org/10.1177/0170840621994501>
- Nie, N. H. (2001), Sociability, Interpersonal Relations, and the Internet: Reconciling Conflicting Findings. *American Behavioural Scientist*, 45(3), 420–435. <https://doi.org/10.1177/00027640121957277>
- Nurmi, N., Hinds, P. J. (2020), Work Design for Global Professionals: Connectivity demands, connectivity behaviours, and their effects on psychological and behavioural outcomes. *Organisation Studies*, 41(12), 1697–1724. <https://doi.org/10.1177/0170840620937885>
- Patton, M. Q. (1990), *Qualitative evaluation and research methods*, 2nd ed. Sage Publications, Inc.
- Raghuram, S., Garud, R., Wiesenfeld, B., Gupta, V. (2001), Factors contributing to virtual work adjustment. *Journal of Management*, 27(3), 383–405. [https://doi.org/10.1016/S0149-2063\(01\)00097-6](https://doi.org/10.1016/S0149-2063(01)00097-6)
- Rubin, O., Nikolaeva, A., Nello-Deakin, S., Brömmelstroet, M. (2020), What can we learn from the COVID-19 pandemic about how people experience working from home and commuting? <https://doi.org/10.13140/RG.2.2.34785.74080>
- Senge, P. M., Scharmer, C. O., Jaworski, J., Flowers, B. S. (2005), *Presence: An Exploration of Profound Change in People, Organisations, and Society*. Crown.
- Smet, A., Dowling, B., Mugayar-Baldocchi, M., Spratt, J., (2022), “It’s not about the office, it’s about belonging”, available at <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/the-organization-blog/its-not-about-the-office-its-about-belonging?cid=other-eml-alt-mip-mck&hdpid=3f6ee2eb-db59-4338-935c-ba019c15e615&hctky=11692940&hlkid=cf2cb817ffe049a2a21832b9a677dca7> (accessed 10th of February, 2022)
- Vuori, V., Helander, N., Okkonen, J. (2019), Digitalization in knowledge work: The dream of enhanced performance. *Cognition, Technology & Work*, 21(2), 237–252. <https://doi.org/10.1007/s10111-018-0501-3>
- Whyte, J., Comi, A., Mosca, L. (2022), Making futures that matter: Future making, online working and organising remotely. *Organisation Theory*, 3(1), 26317877211069136. <https://doi.org/10.1177/26317877211069138>
- Wilson, J. M., Boyer O’Leary, M., Metiu, A., Jett, Q. R. (2008), Perceived Proximity in Virtual Work: Explaining the Paradox of Far-but-Close. *Organisation Studies*, 29(7), 979–1002. <https://doi.org/10.1177/0170840607083105>
- Yli-Kauhaluoma, S., Pantzar, M. (2018), Seeking connectivity to everyday health and wellness experiences: Specificities and consequences of connective gaps in self-tracking data. *DIGITAL HEALTH*, 4, 2055207618779714 <https://journals.sagepub.com/doi/10.1177/2055207618779714>

Does working from home during the COVID-19 pandemic increase academic productivity? The role of gender, space, and family workload

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ABSTRACT

Work-from-home (WFH) during COVID-19 pandemic has had a differential impact on women and men. Recent literature has shown that work and family boundaries became indistinct, and the gendered distribution of responsibilities within the household became more apparent or even worsened. The normal benefits of WFH may not apply in emergency situations. However, the reasons for such disparities may have different causes which date back long before the COVID-19 pandemic. Namely, both family-related and space-related issues which were pre-existing may have been magnified by the emergency restrictions. This research explores the relationship between WFH and academic productivity taking advantage of the COVID-19 natural experiment. We distributed a large-scale survey to the whole population of Italian tenured academics with the aim of understanding whether WFH had positive or negative effects on females' and males' academic productivity and if childcare, household duties and allocation of home spaces influenced women and men differently. Results on the analysis of the 7,865 answers, showed that WFH implied productivity gains more for men than for women. On the contrary, without certain boundary conditions, WFH had a negative effect on women's productivity and even worse on men. This research discusses the results according to gender role theory and boundary theory, providing several practical and theoretical contributions to support gender equality within and outside the academic setting.

Keywords

Work-from-home, Academic productivity, Academia, University, COVID-19.

1 INTRODUCTION AND BACKGROUND

Work-from-home (WFH) during COVID-19 pandemic has had a differential impact on women and men. Recent literature has shown that work and family boundaries became indistinct, and the gendered distribution of responsibilities within the household became more apparent (Cui et al., 2020) or even worsened (Minello, 2020). The reasons for such disparities may have

different causes. Namely, both family-related (Yildirim & Eslen-Ziya, 2020) and space-related (Yerkes et al., 2021) issues may be magnified by the emergency restrictions.

There has been some debate about whether working-from-home challenges or reinforces gendered work and family roles (Sullivan and Lewis, 2001). Literature has for long recognized flexible work arrangement as a means to reach gender equality because it permits work continuity, allows women to work in their personal most productive hours by reaching a better work-life balance and increases work productivity by reducing sickness and absenteeism (Tremblay & Thomsin, 2012). Some authors confirm that the chance to avail of WFH is a crucial factor in job selection for women – e.g., remain in academia; work in flexible creative industries. However, the dark side of WFH is also well reported. Several studies recognized that WFH is often considered a *feminine* task to the point that co-workers may question the leadership status of women working from home, considering them as less productive and less focused on their job tasks (Munsch et al., 2014). In addition, WFH is associated with greater levels of both work pressure and work-life conflict (Russell et al., 2009) because work interferes with home lives and at the same time reduce potentially career and networking opportunities (Yerkes et al., 2021; Burchell et al., 2020; Yildirim and Eslen-Ziya, 2020). Furthermore, unavailability of appropriate spaces for WFH and the need to negotiate space with the partner or with children, may also influence the WFH experience. Frequently, rather than work in well-appointed home offices, *improvised* remote workers had to work in bedrooms or kitchens while partners, children, and siblings distract them (Ralph et al., 2020; Tremblay & Thomsin, 2012). Of note, allocation of home spaces when working from home may *space gender* (Tyler and Cohen, 2010, p. 193) because it likely depends on expectations based on socially identifiable gender (i.e., men as breadwinners, women as homemakers) as according to social role theory (Eagly & Wood, 1991). When working from home, women and men use space as a cue for role transition, by managing spatial boundaries in order to integrate or blur their personal identities as workers or as family members (Ashforth et al., 2000:472). However, especially in emergency context, blurred roles transitions may lead to amplified work-family conflicts. In an attempt to understand the extent to which WFH during the pandemic has affected women and men, we designed a survey that asked a series of questions related to the work experiences after the first strict lockdown phase. The survey referred to a period that we called Covid-working where workers were mostly allowed to work at the office but still discouraged from full time presence. The survey targeted Italian tenured academics, as a privileged category of knowledge workers who maintained relatively stable their workload (compared to other types of knowledge workers who may have lost their job or reduced working hours) and who were yet used to WFH because of their high level of location autonomy. In particular, we examine the extent to which space-related and family-related constraints influenced different work productivity of female and male academics. We answer the following question: To what extent did WFH during COVID-19 impact female and male academic productivity? Did childcare and household duties and allocation of home spaces influence female and male productivity differently?

2 METHOD

The data used in this paper stem from an extensive survey administered to the whole population of Italian tenured academics. This target population was sampled thanks to the Italian education Ministry's lists (MIUR)³³ that are publicly available online. These lists include all the Italian scholars tenured in public Italian universities but exclude PhD students, post-doc researchers and research grant holders. The target population consists of 52,630 academics, based all over

³³ Retrieved from: <https://cercauniversita.cineca.it/php5/docenti/cerca.php>.

Italy, and comprise all the scientific sectors (Settori scientifico-disciplinari - SSD) of Italian Academia³⁴. After a pilot-test and pre-test, we distributed the survey to the target population via email. Participation was voluntary and confidential, and remained open from July 24th to September 24th, 2020. Overall, 11,634 answers were collected (response rate 22,11%). According to the objectives of this study and to avoid missing variables, we selected 7,865 usable and consistent answers (response rate 14,94%). The sample consists of 3,853 women (48.99%) and 4,012 men (51.01%). Respondents are on average 51 years old. They are geographically distributed all over Italy (North, 48.29%; Centre, 25.86%; South, 25.85%). The survey collected information which allow us to compute variables related to (i) the percentage of time of the work week devoted to WFH before and during Covid-working; (ii) the access to difference spaces for work at home (distinguishing among personal study room, bedroom, kitchen, living room and other rooms/open spaces), (iii) the number of children and the availability of a household help; (iv) the perceived productivity computed as the respondents' perceived difference between their during-Covid and their pre-Covid individual productivity; (v) the number of scientific papers submitted during the Covid-working period and (vi) the endowment in institutional roles within the faculty. Thanks to MIUR lists also other background information was available, namely, gender, age, discipline, seniority, and geographical location. As our research excluded on purpose teaching commitments in evaluating work, every question of the survey explicitly referred only to research activity. The questionnaire used directly measurable variables such as age, country, number of children and availability of household help, assuming that these have inherent validity. For the other variables we used validated scales as much as possible to improve construct validity. To avoid the risk of common method bias due to single-source data, after data collection, we performed the Harman's one-factor test, indicating that common method variance is minor in our dataset. The dependent variable of the model is Δ *perceived productivity*. Because of the ordinal nature of this variable (collected through a Likert type scale from -2=worse than before COVID-19 to +2=better than before COVID-19), we used the ordered probit regression model to first evaluate the effects of our explanatory variables on perceived productivity. We are aware that research on WFH has been criticised for relying on self-reported perceived productivity (Bailey and Kurland, 2002) and we plan to adopt more robust secondary data; however, we decided to use this variable for a preliminary analysis. Among the explanatory variables, *WFH* indicates the percentage of time of the work week devoted to WFH. On average, academics worked from home for 72.82% of their work week (S.D.=29.34). *HHI_space* is a proxy of the allocation of different types of rooms (i.e., personal study room, bedroom, living room, kitchen and other) at home. This variable resulted from the computation of the Herfindahl-Hirschman index (HHI) which allowed us to give a synthetic index of concentration of research activities in one single room at home. On the contrary, *HHI_space* has values lower than 1 if the academics have to move between different rooms to find their quiet space for working. Moreover, to evaluate the household load, we generated three dummies: *High_household_load* means having school or pre-school children, taking care of non-self-sufficient persons, and not having any household help. *Low_household_load* indicates that the respondent does not have children and has a household help, while *Medium_household_load* indicates the remaining cases. Finally, the

³⁴ Italian SSD included are the following: 01 – Scienze matematiche e informatiche; 02 – Scienze fisiche; 03 – Scienze chimiche; 04 – Scienze della Terra; 05 – Scienze biologiche; 06 – Scienze mediche; 07 – Scienze agrarie e veterinarie; 08 – Ingegneria civile e Architettura; 09 – Ingegneria industriale e dell'informazione; 10 – Scienze dell'antichità, filologico-letterarie e storico-artistiche; 11 – Scienze storiche, filosofiche, pedagogiche e psicologiche; 12 – Scienze giuridiche; 13 – Scienze economiche e statistiche; 14 – Scienze politiche e sociali

model contains several controls variables, namely: age, seniority, discipline, geographical locations. Table 1 reports descriptive statistics of the relevant variables.

Table 1. Descriptive Statistics

Variable	Variable type	Obs	Mean	Std. Dev.	Min	Max
<i>Full_professor</i>	Dummy	7,865	0.190	0.392	0	1
<i>Associate_professor</i>	Dummy	7,865	0.450	0.498	0	1
<i>Researcher</i>	Dummy	7,865	0.179	0.383	0	1
<i>R.T.D.A.</i>	Dummy	7,865	0.090	0.286	0	1
<i>R.T.D.B.</i>	Dummy	7,865	0.091	0.288	0	1
<i>Age</i>	Continuous	7,865	51.268	9.334	26	75
<i>Istitutional_role</i>	Dummy	7,865	0.428	0.495	0	1
<i>North_Italy</i>	Dummy	7,865	0.483	0.500	0	1
<i>Center_Italy</i>	Dummy	7,865	0.259	0.438	0	1
<i>South_Italy</i>	Dummy	7,865	0.258	0.438	0	1
<i>Colocation</i>	Dummy	7,865	0.423	0.494	0	1
<i>Collaborative_research</i>	Continuous	7,865	0.310	0.215	0	1
<i>WFH_before</i>	Continuous	7,865	0.302	0.225	0	1
<i>Δ_productivity</i>	Continuous	7,865	-0.081	1.016	-2	2
<i>WFH</i>	Continuous	7,865	0.728	0.293	0	1
<i>Gender (1=male)</i>	Dummy	7,865	0.510	0.500	0	1
<i>Study_room</i>	Interval	7,865	1.916	1.755	0	4
<i>Living_room</i>	Interval	7,865	1.569	1.424	0	4
<i>Kitchen_room</i>	Interval	7,865	0.733	1.106	0	4
<i>Bed_room</i>	Interval	7,865	0.497	0.749	0	4
<i>Other_room</i>	Interval	7,865	0.253	0.377	0	4
<i>HHI_space</i>	Continuous	7,865	0.622	0.269	0	1
<i>High_household</i>	Dummy	7,865	0.307	0.461	0	1
<i>Medium_Houseold</i>	Dummy	7,865	0.492	0.500	0	1
<i>Low_Household</i>	Dummy	7,865	0.200	0.400	0	1

3 ANALYSIS AND RESULTS

As a first access to our dataset, we examined if relevant differences emerged between genders, and we then verified the existence and sign of correlations between the variables. According to t-test, the *Δ _productivity* variable is higher for men than for women ($t=-1.6864$; $pvalue=0.0459$). According to Mann-Whitney U test for not normally distributed variables, the *HHI_space* resulted significantly different between women and men ($z=-10.933$; $pvalue=0.0000$), confirming that women had to move more frequently between home rooms for working than men which instead have more frequently access to a fixed and dedicated space for work. These results are confirmed by Mann-Whitney U test on the five house space variables (*study_room*, *living_room*, *kitchen*, *bed_room* and *other_room*). The test confirms that women access more frequently to kitchens, living rooms, bedrooms and other liminal spaces for work ($pvalue=0.0000$) while men have more access to private study spaces at home ($z=-5.694$, $pvalue=0.0000$). Moreover, the dummy variables indicating household load are

significantly different between genders. Namely, higher household duties weigh more on men than on women ($t=-2.6679$; p value= 0.0038).

According to our theoretical model, after checking correlations among the variables, we build the ordered probit model where $\Delta_productivity$ is the dependent variable, while WFH , $Gender$, HHI and $Household_load$ are the explanatory variables. Table 2 presents the results of the analysis, with standard errors clustered by university. Model 1 only contains the control variables. Model 2 introduces our key explanatory variables. Model 3 adds their interaction term. Findings are rather confirmatory of the literature. In Model 2 we find a positive and significant effect of WFH on productivity ($\beta = 0.133$; $p = 0.013$). Moreover, having a high household load negatively influence academics' productivity ($\beta = -0.109$; $p = 0.000$), while the possibility to work in a fixed environment at home (i.e., only from the study room or from the bedroom without the need of moving around the house) increases perceived productivity ($\beta = 0.128$; $p = 0.011$). In Model 3 we found a significant effect of the two interaction terms which consider WFH variable, meaning that when working from home with a high family load academics have a negative effect on productivity ($\beta = -0.228$; $p = 0.000$) whereas having a "saved" space (i.e., private and fixed space from where to work) has a positive effect on productivity ($\beta = 0.421$; $p = 0.000$).

Table 2. Model results (full sample)

	Model 1	Model 2	Model 3
<i>Scientific sector dummies</i>	yes	yes	yes
<i>Full_professor</i>	0.031 (0.06)	0.030 (0.06)	0.028 (0.06)
<i>Associate_professor</i>	0.006 (0.05)	0.008 (0.05)	0.009 (0.05)
<i>Researcher</i>	0.057 (0.06)	0.057 (0.06)	0.058 (0.06)
<i>R.T.D.B.</i>	0.134* (0.05)	0.130* (0.05)	0.126* (0.06)
<i>R.T.D.A.</i>	baseline	baseline	baseline
<i>Age</i>	-0.027 (0.02)	-0.023 (0.02)	-0.023 (0.02)
<i>Age_squared</i>	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
<i>North_Italy</i>	-0.060 (0.04)	-0.065 (0.04)	-0.063 (0.04)
<i>Centre_Italy</i>	-0.085* (0.04)	-0.089* (0.04)	-0.089* (0.04)
<i>South_Italy</i>	baseline	baseline	baseline
<i>Colocation</i>	-0.034 (0.02)	-0.034 (0.02)	-0.035 (0.02)
<i>Institutional_roles</i>	-0.008 (0.03)	-0.006 (0.03)	-0.006 (0.03)
	0.198**		
<i>Collaborative_work</i>	* (0.07)	0.218*** (0.07)	0.222*** (0.07)
<i>Digitaltools_before</i>	0.024* (0.01)	0.025* (0.01)	0.025* (0.01)

	0.052**		
<i>Digitaltools_covid</i>	*	0.046***	0.046***
	(0.01)	(0.01)	(0.01)
	0.609**		
<i>WFH_before covid</i>	*	0.560***	0.555***
	(0.07)	(0.07)	(0.07)
	0.077**		
<i>Gender (male=1)</i>	*	0.079***	0.079***
	(0.02)	(0.02)	(0.02)
<i>WFH</i>		0.133*	-0.081
		(0.05)	(0.08)
<i>HHI_space</i>		0.128*	-0.227*
		(0.05)	(0.11)
<i>High_household</i>		-0.109***	-0.168*
		(0.03)	(0.07)
<i>High_household x WFH</i>			-0.228***
			(0.07)
<i>HHI_space x WFH</i>			0.421***
			(0.12)
<i>HHI_space x High_household</i>			0.175
			(0.10)
	-		
<i>_cons</i>	1.573**		
	*	-1.386***	-1.569***
N. of observations	7,865	7,865	7,865
Pseudo R2	0.0141	0.0155	0.0162
	-		
Log pseudolikelihood	11003.8	-	-
	7	10988.419	10980.375

Parentheses: standard errors clustered by University.
 Note that * p<0.1, ** p<0.05, *** p<0.01

Since we are aware that in multinomial models a positive coefficient of an explanatory variable does not necessarily correspond to an increase in the probability of the outcome category, we calculate the marginal effects of our variables of interest on the probability of perceiving a higher productivity based on the econometric specification of Model 2 and Model 3. The results reported in table 3 confirm the first results. We further calculated the marginal effects of *WFH* on productivity based on the estimates of Model 3, while differentiating between four cases: Model 3-I reports the results of the *best-case scenario* when academics have the availability of an adequate space for work ($HHI=1$) while they do not have children and they are supported by an household help ($High_household=0$); Model 3-II and Model 3-III report the results of the two intermediate cases when there is space and not household load (3-II) or there is not an adequate space neither an high household load (3-III); finally Model 3-IV report the results of the *worst-case scenario* when academics care of high household loads but they have houses which do not allow them a quiet and safe space. According to the results, we found that the positive and significant relationship between *WFH* and productivity exists only in particular boundary conditions. Namely, in the best-case scenario (Model 3-I) the availability of private space improves academic productivity by 6.7 percentage points ($p\text{ value}=0.000$) while in the case of high family and house load, the availability of private space at home positively moderates the relationship between *WFH* and productivity by implying a lighter positive effect

of 3.4 percentage points (p value 0.031), as shown in Model 3-II. Indeed, even if lower, the benefits of WFH for academics remain relevant. This positive relation is lost when there is not availability of adequate space at home (Model 3-III and 3-IV). In sum, home space moderates the negative influence of family load (children and home care) on academic productivity. In the absence of adequate space at home, working from home has no positive influence.

Table 3. Marginal effects model 2 and model 3 (full sample)

	Model 2	Model 3	Model 3	Model 3	Model 3
Marginal effect of WFH on:		(I)	(II)	(III)	(IV)
$\Delta_{productivity}=-2$	-0.018 (0.007) [0.014]	-0.041 (0.011) [0.000]	-0.022 (0.010) [0.035]	-0.006 (0.008) [0.416]	0.019 (0.013) [0.146]
$\Delta_{productivity}=-1$	-0.030 (0.012) [0.013]	-0.079 (0.019) [0.000]	-0.040 (0.018) [0.030]	-0.011 (0.014) [0.419]	0.026 (0.017) [0.129]
$\Delta_{productivity}=0$	0.005 (0.002) [0.020]	0.006 (0.004) [0.142]	0.005 (0.004) [0.145]	0.002 (0.002) [0.423]	-0.010 (0.007) [0.157]
$\Delta_{productivity}=1$	0.026 (0.011) [0.013]	0.067 (0.017) [0.000]	0.034 (0.016) [0.031]	0.010 (0.012) [0.417]	-0.023 (0.015) [0.134]
$\Delta_{productivity}=2$	0.017 (0.007) [0.013]	0.047 (0.012) [0.000]	0.022 (0.010) [0.032]	0.006 (0.008) [0.420]	-0.012 (0.008) [0.125]
Variable specified:	<i>best case</i>			<i>worst case</i>	
HHI	HHI=1		HHI=1	HHI=0.31	HHI=0.31
High_Household	High_household=0		High_household=1	High_household=0	High_household=1

Brackets: p-values; parentheses: standard errors clustered by university. Model3-I reports the marginal effects in the best-case scenario when $HHI = 1$ and $High_Household = 0$. Model 3-II reports the corresponding marginal effects when $HHI = 1$ and $High_Household = 1$. Model 3-III reports the corresponding marginal effects when $HHI = 0.31$ (tenth percentile) and $High_Household = 0$. Finally, Model 3-IV reports the marginal effects in the worst-case scenario when $HHI=0.31$ (tenth percentile) and $High_Household=1$.

We then verified whether the results obtained for the full sample differ between female and male academics, since we are aware that households may have a burden mainly on women (especially in COVID-19 times) and space at home is frequently allocated according to gendered norms. We thus ran the same probit models (from model 4 to model 9) on the two sub-samples of male ($n=4,012$) and female academics ($n=3,853$).

The results are reported in Table 4. Rather surprisingly, in Model 5 and 8 we found that that working from home has positive and significant effect only on males' academic productivity ($\beta = 0.140$; $p = 0.036$), as well as variable HHI has ($\beta = 0.140$; $p = 0.044$). On the contrary, having an high household load has a negative effect on both female ($\beta = -0.067$; $p = 0.048$) and male productivity ($\beta = -0.153$; $p = 0.001$). When adding interaction terms in Model 6 and 9, we found significant effects only on the males' sub-sample. Namely, working from home with a high family load have a negative effect on male productivity ($\beta = -0.308$; $p = 0.015$) whereas having a "saved" space has a positive effect on male productivity ($\beta = 0.542$; $p = 0.000$). Those effects are not evident in the females' sub-sample. To further explore these results, we dig in

the interpretations of marginal effects (Table 5 and 6). We found that the positive effect of *WFH* on productivity is more than double than the positive effect that *WFH* have on women (8.5 percentage points vs 4.4 percentage points) even in the best-case scenario, i.e., when academics have a suitable space and non-particular household duties (Model 6-I and Model 9-I). Interestingly, the positive effects of working from home disappear in the other cases considered to the point that in the worst case (when there is no availability of a suited spaces and high household duties to care of), the negative effects for men are more pronounced than for women (-2.2 percentage points vs 0.1 percentage points). In sum, we confirmed again that the impact of working from home is very sensitive to space; indeed, lack of space nullifies productivity gains. This is particularly evident in the case of men: family load has a negative impact which is amplified by the lack of space. For women, family load has a negative impact but less than for men (not significant in our estimates).

Table 4. Model results (sub-sample by gender)

	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Sub-sample Male			Sub-sample Female		
<i>Scientific sector dummies</i>	yes	yes	yes	yes	yes	yes
<i>Full_professor</i>	0.098 (0.08)	0.095 (0.08)	0.091 (0.08)	-0.042 (0.08)	-0.042 (0.08)	-0.042 (0.08)
<i>Associate_professor</i>	0.058 (0.08)	0.061 (0.08)	0.062 (0.08)	-0.044 (0.07)	-0.042 (0.07)	-0.041 (0.07)
<i>Researcher</i>	0.077 (0.09)	0.075 (0.09)	0.073 (0.09)	0.032 (0.07)	0.033 (0.07)	0.034 (0.07)
<i>R.T.D.A.</i>	0.100 (0.09)	0.090 (0.08)	0.082 (0.08)	0.177* (0.08)	0.175* (0.08)	0.175* (0.08)
<i>R.T.D.B.</i>	baseline	baseline	baseline	baseline	baseline	baseline
<i>Age</i>	-0.046* (0.02)	-0.036 (0.02)	-0.035 (0.02)	-0.002 (0.02)	-0.002 (0.02)	-0.002 (0.02)
<i>Age_squared</i>	0.000* (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
<i>North_Italy</i>	-0.085* (0.04)	-0.092* (0.04)	-0.087* (0.04)	-0.038 (0.06)	-0.042 (0.06)	-0.041 (0.06)
<i>Centre_Italy</i>	-0.061 (0.04)	-0.066 (0.04)	-0.065 (0.04)	-0.110 (0.06)	-0.112* (0.06)	-0.113* (0.06)
<i>South_Italy</i>	baseline	baseline	baseline	baseline	baseline	baseline
<i>Colocation</i>	-0.022 (0.04)	-0.022 (0.04)	-0.023 (0.04)	-0.044 (0.03)	-0.045 (0.03)	-0.046 (0.03)
<i>Institutional_roles</i>	-0.032 (0.04)	-0.031 (0.04)	-0.030 (0.04)	0.017 (0.03)	0.020 (0.03)	0.019 (0.03)
<i>Collaborative_work</i>	0.193* (0.10)	0.216* (0.09)	0.224* (0.09)	0.215* (0.10)	0.232* (0.10)	0.234* (0.10)
<i>Digitaltools_before</i>	0.026 (0.02)	0.028 (0.02)	0.029 (0.02)	0.025 (0.02)	0.027 (0.02)	0.026 (0.02)
<i>Digitaltools_covid</i>	0.044*** (0.01)	0.037** (0.01)	0.038*** (0.01)	0.063*** (0.02)	0.057*** (0.02)	0.058*** (0.02)
<i>WFH_before covid</i>	0.732*** (0.10)	0.666*** (0.10)	0.659*** (0.10)	0.499*** (0.10)	0.465*** (0.10)	0.464*** (0.10)

<i>WFH</i>	0.140*	-0.114		0.119	-0.009
	(0.07)	(0.12)		(0.07)	(0.16)
<i>HHI_space</i>	0.140*	-0.302*		0.118	-0.113
	(0.07)	(0.14)		(0.07)	(0.18)
<i>High_household</i>	-0.153***	-0.062		-0.067*	-0.135
	(0.05)	(0.11)		(0.03)	(0.13)
<i>High_household x WFH</i>		-0.308*			-0.056
		(0.13)			(0.10)
<i>HHI_space x WFH</i>		0.542***			0.238
		(0.17)			(0.22)
<i>HHI_space x High_household</i>		0.206			0.186
		(0.13)			(0.16)
<i>_cons</i>	-2.254***	-1.972***	-2.170***	-0.748	-0.652
N. of observations	4,012	4,012	4,012	3,853	3,853
Pseudo R2	0.0164	0.0187	0.0203	0.0152	0.0160
Log pseudolikelihood	-5538.0255	-5525.0336	-5516.2654	-5440.1156	-5435.9876
				-5434.4365	

Parentheses: standard errors clustered by University.

Note that * p<0.1, ** p<0.05, *** p<0.01

Table 5. Marginal effects model 5 and 6 (sub-sample men)

	Model 5	Model 6	Model 6	Model 6	Model 6
Marginal effect of WFH on:		(I)	(II)	(III)	(IV)
$\Delta_{productivity=-2}$	-0.017	-0.047	-0.015	-0.006	0.041
	(0.008)	(0.014)	(0.015)	(0.010)	(0.020)
	[0.040]	[0.001]	[0.322]	[0.526]	[0.040]
$\Delta_{productivity=-1}$	-0.032	-0.099	-0.028	-0.013	0.055
	(0.015)	(0.026)	(0.028)	(0.020)	(0.025)
	[0.035]	[0.000]	[0.321]	[0.529]	[0.025]
$\Delta_{productivity=-0}$	0.004	0.002	0.004	0.001	-0.025
	(0.002)	(0.005)	(0.004)	(0.002)	(0.013)
	[0.050]	[0.732]	[0.350]	[0.518]	[0.054]
$\Delta_{productivity=1}$	0.028	0.085	0.024	0.011	-0.049
	(0.013)	(0.023)	(0.025)	(0.017)	(0.022)
	[0.035]	[0.000]	[0.322]	[0.528]	[0.028]
$\Delta_{productivity=2}$	0.017	0.059	0.015	0.007	-0.022
	(0.008)	(0.017)	(0.015)	(0.011)	(0.010)
	[0.040]	[0.001]	[0.333]	[0.534]	[0.027]
Variable specified:	<i>best case</i>			<i>worst case</i>	
HHI	HHI=1	HHI=1	HHI=0.31	HHI=0.31	HHI=0.31
High_Household	High_household=0	High_household=1	High_household=0	High_household=1	High_household=1

Brackets: p-values; parentheses: standard errors clustered by university. Model 6-I reports the marginal effects in the best-case scenario when *HHI* = 1 and *High_Household* =0. Model 6-II reports the corresponding marginal effects when *HHI* = 1 and *High_Household* =1. Model 6-III reports the corresponding marginal effects when *HHI* = 0.31 (tenth percentile) and *High_Household* =0. Finally, Model 6-IV reports the marginal effects in the worst-case scenario when *HHI*=0.31 (tenth percentile) and *High_Household*=1.

Table 6. Marginal effects model 5 and 6 (sub-sample women)

	Model 8	Model 9	Model 9	Model 9	Model 9
Marginal effect of WFH on:		(I)	(II)	(III)	(IV)
$\Delta_{productivity}=-2$	-0.019 (0.010) [0.060]	-0.036 (0.016) [0.019]	-0.024 (0.015) [0.111]	-0.010 (0.015) [0.505]	0.003 (0.024) [0.899]
$\Delta_{productivity}=-1$	-0.030 (0.016) [0.056]	-0.064 (0.024) [0.008]	-0.043 (0.026) [0.100]	-0.016 (0.024) [0.509]	0.004 (0.033) [0.898]
$\Delta_{productivity}=-0$	0.006 (0.059) [0.076]	0.009 (0.005) [0.104]	0.005 (0.004) [0.283]	0.003 (0.004) [0.503]	-0.002 (0.012) [0.899]
$\Delta_{productivity}=1$	0.026 (0.014) [0.060]	0.054 (0.021) [0.012]	0.037 (0.023) [0.107]	0.013 (0.021) [0.508]	-0.004 (0.029) [0.899]
$\Delta_{productivity}=2$	0.017 (0.009) [0.057]	0.037 (0.014) [0.010]	0.026 (0.016) [0.109]	0.008 (0.013) [0.511]	-0.002 (0.016) [0.899]
Variable specified:		<i>best case</i>		<i>worst case</i>	
HHI		HHI=1	HHI=1	HHI=0.31	HHI=0.31
High_Household		High_household=0	High_household=1	High_household=0	High_household=1

Brackets: p-values; parentheses: standard errors clustered by university. Model 9-I reports the marginal effects in the best-case scenario when $HHI = 1$ and $High_Household = 0$. Model 9-II reports the corresponding marginal effects when $HHI = 1$ and $High_Household = 1$. Model 9-III reports the corresponding marginal effects when $HHI = 0.31$ (tenth percentile) and $High_Household = 0$. Finally, Model 9-IV reports the marginal effects in the worst-case scenario when $HHI = 0.31$ (tenth percentile) and $High_Household = 1$.

4 CONCLUSIONS AND FUTURE DEVELOPMENT OF THE RESEARCH

This preliminary contribution provides first empirical evidence on the effect of COVID-19 pandemic on academics' productivity. The study confirmed an increase in perceived productivity of WFH during COVID-19 pandemic. Moreover, the study finds positive relations between the change in productivity and home space availability. In addition, we found a strong negative relation between productivity and high household duties. Finally, the extent of change of academic productivity of women and men changes, especially in particularly familiar conditions, confirming the gendered effect of WFH during COVID-19 and at large, the persistence of the gender gap in academia. Namely, we found that for women productivity gains happen only whether their household load is low and shared and they have houses where they can benefit from fixed space for work.

We are planning future development of the study in order to validate the perceived productivity measure by collecting objective measures of academic productivity. Second, we will dig more into the implications of this study on the future of academic work. Concerning theory, this study aims at contributing not only to literature related to work-from-home and its effects on work performances. An original contribution of this work is that it considers physical home spaces as one boundary condition adding to recent debate on resilience of home spaces and hybrid spaces (e.g., Wapshott and Mallett, 2011; Cuerdo-Vilches et al., 2021) and discussing the results through the lenses of boundary theory (Ashforth et al., 2000) and gender roles theory (Eagly & Wood, 1991). Finally, this research aims at advancing knowledge on gender equality in academic workplaces, providing more evidence on the differential impact that COVID-19 pandemic had on female and male academics.

REFERENCES

- Ashforth, B., Kreiner, G., Fugate, M. (2000), 'All in a Day's Work: Boundaries and Micro Role Transitions'. *Academy of Management Review*, 25, 472–491.
- Bailey, D. E., Kurland, N. B. (2002), A review of telework research: Findings, new directions, and lessons for the study of modern work. *Journal of Organisational Behaviour: The International Journal of Industrial, Occupational and Organisational Psychology and Behaviour*, 23(4), 383-400.
- Baruch, Y. (2000), Teleworking: benefits and pitfalls as perceived by professionals and managers. *New technology, work and employment*, 15(1), 34(49).
- Burchell, B., Reuschke, D., Zhang, M. (2020), Spatial and temporal segmenting of urban workplaces: The gendering of multi-locational working. *Urban Studies*, Article 004209802090324. <https://journals.sagepub.com/doi/10.1177/0042098020903248>
- Cui, R. & Ding, H., Zhu, F. (2020), Gender Inequality in Research Productivity During the COVID-19 Pandemic. *Manufacturing & Service Operations Management*, Forthcoming, Available at: <http://dx.doi.org/10.2139/ssrn.3623492>
- Donnelly, N., Proctor-Thomson, S. B. (2015), Disrupted work: home-based teleworking (HbTW) in the aftermath of a natural disaster. *New Technology, Work & Employment*, 30(1), 47–61. <https://doi.org/10.1111/ntwe.12040>
- Eagly, A. H., Wood, W. (1991), Explaining sex differences in social behavior: A meta-analytic perspective. *Personality and Social Psychology Bulletin*, 17, 306-315.
- Minello, A. (2020), The pandemic and the female academic. *Nature*. Retrieved from <https://www.nature.com/articles/d41586-020-01135-9>
- Munsch, C. L., Ridgeway, C. L., Williams, J. C. (2014), Pluralistic Ignorance and the Flexibility Bias: Understanding and Mitigating Flextime and Flexplace Bias at Work. *Work and Occupations*, 41(1), 40–62. doi:10.1177/0730888413515894
- Ralph, P., Baltes, S., Adisaputri, G. et al. (2020), Pandemic programming. *Empir Software Eng* 25, 4927–4961. <https://doi.org/10.1007/s10664-020-09875-y>
- Russell, H., O'Connell, P. J., McGinnity, F. (2009), The impact of flexible working arrangements on work-life conflict and work pressure in Ireland. *Gender, Work & Organisation* 16(1), 73-97.
- Sullivan, C., Lewis, S. (2001), Home-based Telework, Gender, and the Synchronisation of Work and Family: Perspectives of Teleworkers and their Co-residents. *Gender, Work and Organisation* 8(2), 123–145. <https://doi.org/10.1111/1468-0432.00125>
- Tremblay, D. G., Thomsin, L. (2012), Telework and mobile working: analysis of its benefits and drawbacks, *Int. Journal of Work Innovation*, 1(1), 100–113.
- Yerkes M.A., Andre´ S.C.H., Besamusca J.W., Kruyen P.M., Remery C.L.H.S., van der Zwan R., et al. (2020). 'Intelligent' lockdown, intelligent effects? Results from a survey on gender (in)equality in paid work, the division of childcare and household work, and quality of life among parents in the Netherlands during the COVID-19 lockdown. *PLoS ONE* 15(11).
- Yildirim T. M., Eslen-Ziya H., The differential impact of COVID-19 on the work conditions of women and men academics during the lockdown. *Gender, Work & Organisation*, 28(S1), 243-249.

SESSION 4B: COWORKING SPACES, HEALTH AND WELLBEING

Coworking spaces and their effects on workers and working environments in Canada

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ABSTRACT

Following the context of the pandemic of COVID-19, it seems that coworking spaces are reappearing and may form an important part of the future of work, as telework has become more important over the last years, and self-employed are still looking for professional work spaces. Starting about six years ago, we have started our analysis of coworking and this specific context of third spaces for work. Our interest rests in the characteristics of coworkers, the social and physical dimensions of the spaces, as well as the forms of work and collaboration observed in these spaces. As they appear to be included in the future hybrid model of work, it is pertinent to look at data on what actually happens in these spaces in order to try to define the future of work in this context. Our paper shows the possibilities and advantages that coworking spaces can offer for sharing and developing new forms of work and collaboration, which may contribute also to competitiveness and sustainability of self-employed, entrepreneurs, firms and cities. As previous research has indicated that cooperation and innovation are often the objective of coworkers, we also want to address this issue with this data. In this paper, we will centre on our most recent research (with the Periwork project), but the paper is also informed by the previous Teluq research (Tremblay and Vaineau, 2020), as very similar trends were found, and the 2021 research thus confirms many previous observations. Amongst other elements, the data show interesting elements as to mobility from city to rural areas or smaller cities, which may offer opportunities for developing new coworking spaces, as we have observed in the last months.

Keywords

Coworking, Coworkers, Coworking spaces, Canada, Telework, Mobility, Work, Employment.

1 INTRODUCTION AND LITERATURE REVIEW

Following the context of the pandemic of COVID-19, it seems that coworking spaces are reappearing and may form an important part of the future of work, as telework has become more important over the last years, and self-employed are still looking for professional work spaces. Starting about six years ago, we have started our analysis of coworking and this specific context of third spaces for work. Our interest rests in the characteristics of coworkers, the social and physical dimensions of the spaces, as well as the forms of work and collaboration observed in these spaces. As they appear to be included in the future hybrid model of work, it is pertinent to look at data on what actually happens in these spaces in order to try to define the future of work in this context. According to most accounts, coworking emerged in the 90s and it is in San Francisco that the first formal coworking space appeared in 2005 (Lallement, 2015). Over the years, coworking spaces have multiplied and have reached 13,800 spaces in 2017 (Deskmag, 2017). The recent years have brought on closures and ups and downs in these spaces. There were closures over the pandemic and then new openings or reopenings, but they appear to be reemerging in 2022. Coworking spaces are now developing everywhere, including in Asia, and even Africa. Regus (IWG) has thus created 16 coworking spaces in Morocco, doubling its number in 3 years. In Africa and Asia, it is often expatriates who work in these

places, when their employer only has some 10-20 workers in the city or country, and all the more so when they are often working outside of their office. Business travellers can work in different coworking spaces when they are travelling abroad, provided they have a Regus membership card, which gives access to some 3300 sites all over the world (Gorwitz, 2019). This is one aspect of the picture, and the other refers to the local workers, who find here a place to work for a cheaper rental cost, and often without traffic congestion, with more proximity to home (Le Nadant et al, 2018). This is what is found more frequently in industrialised nations, including Canada, France and Germany, which we look at here. Our interest thus lies in the actual practice of work in these spaces, in work organisation, advantages and disadvantages that coworkers find in these spaces, but it also brings forth new questions and new ideas for city planning as city centres have been hollowed out with the rapid and very high diffusion of telework over the last two years. Our research group was also interested in the development of coworking spaces in peripheral and rural areas, as this has been observed in various countries over the recent years (Akhavan et al. 2022). Indeed, there appear to be developments of coworking in rural and peripheral areas, particularly since the development of working from home with the pandemic. Also, as many teleworkers have moved to the suburbs or even rural environments in the pandemic context, small cities and villages have attracted these teleworkers but are distant from metropolitan areas; they see coworking spaces as a form of professional service (working space, technology, meeting rooms, ...) which could be offered to these teleworkers and attract more population in these peripheral areas. Also, it appears that some real estate firms are looking towards coworking spaces as a form of revitalisation for city centres. Following the two years of telework, many salaried workers want to be given more autonomy in their work or want to free themselves from hierarchical environments and they are looking towards coworking spaces as a place to possibly work a few days a week, in the context of a hybrid model of work. Thus, it appears that the expectations of employers, as well as employees have changed and this leads us to rethink the organisation of work and the spaces for working. As before the pandemic, workers (self-employed as teleworkers) appear to be interested in coming to coworking spaces in order to enjoy the presence of other workers (Spinuzzi, 2019, 2012; Krauss and Tremblay, 2019). We thus conducted research to obtain a better picture of these coworking spaces in Canada in order to plan for future work and urban developments. The purpose of this paper is to show the possibilities and advantages that coworking spaces can offer for sharing and developing new forms of work and collaboration, which may contribute also to competitiveness and sustainability of self-employed, entrepreneurs, firms and cities. As previous research has indicated that cooperation and innovation are often the objective of coworkers, we also want to address this issue with this data. In this paper, we will centre on our most recent research (with Periwork), but the paper is also informed by the previous Teluq research (Tremblay and Vaineau, 2020), as very similar trends were found, and the 2021 research thus confirms many previous observations. Here and there, we may add some elements from one or the other, indicating similar or contrasting trends and observations (Tremblay and Vaineau, 2020, Scaillez, Tremblay, 2019a, b and c).

2 METHODOLOGY

As mentioned, we conducted two main research projects. The first was a project conducted within Teluq university and the second project called Peri#Work was conducted with French colleagues (with French and German coworkers). In both cases, we conducted research on coworking spaces, their physical environment and their impact on workers, human resources management, work organisation, physical and social work context, as well as collaboration between workers, networking and other elements which were put forward as benefits of coworking (such as creativity, innovation, etc.). In the first Teluq research, some 40 interviews

and observations were conducted from 2017 to 2019. In the second, an online survey was conducted within the project (with about 40 answers each from Canadian and German coworking spaces, over 300 for France) and some 20 interviews were also conducted in Québec spaces. In the second (Periwork) research, the questionnaire was sent out to all the coworking spaces that could be identified through our research and online research; for Canada, there was a possibility of about 500 spaces theoretically, but as many of them were shut during the early times of the pandemic in 2020, a good number did not receive the email on time, which explains the limited number of respondents, and the fact that they need to be considered with the qualitative aspects, i.e. previous interviews we did and are now doing again in 2022. The French sample was more numerous and therefore presents more respondents, especially as there were apparently less closures. As there is no representative list of coworking spaces in Canada and as we had a mainly qualitative approach in the interviews (Tremblay & Vaineau, 2020), there is no perfect representation of coworkers, which is of course a limitation of the research. However, there is a sufficient amount of interviews over the years (over 60, from 2016 to 2022), so that the quantitative data come as a complement, and together, this data appears sufficiently reliable, although of course, more research is indicated. We will thus present here some results from this last research, as concerns coworking practices, motivations for this type of work, physical and social elements of work contexts, impacts, etc., as well as the hypotheses concerning cooperation, networking and development of innovations. These results can contribute to the reflection on the future of work, and particularly of coworking. We are centering here on the Canadian coworkers, but will here and there highlight differences with the French and German data (from Periwork project).

3 RESULTS

3.1 Who are the coworkers?

First, we are interested in the coworkers themselves and their characteristics. In both our projects, we observed that there were as many men and women in coworking spaces, even if some are specialised in certain sectors or professions and may have a predominance of one or another. In the most recent research, respondents are 61% women and 39% men, and in our previous research in Québec, the percentages were closer to 50-50. (Tremblay and Vaineau, 2020). In France, the percentage is also about 50-50, so this seems to be the general trend (Colas-Périwork, 2021). As concerns the age of coworkers, the great majority in Canada (55% ; vs 44% in France) were aged 30-39 years, followed by 40-49 (34%, vs 31% in France), other age groups being less present; the situation is similar to that of France, although the 50+ are more present in France (14%) than in Canada (7%). Given the image of coworking, it is surprising to see there are so few very young workers (under 30), but the following information may explain this. Indeed, many coworkers have a college or university degree, a situation similar to France (62% of Bac +5) and many of them are white-collar workers. Data for Canada indicate that the majority of coworkers are individual entrepreneurs (42% vs 50% in France), or salaried CEO or other top executive, usually in very small firms (26% in Canada vs 10% in France). The next highest percentage is that of a salaried teleworker, for which there are 16% in Canada and 31% in France, where this is much more common. We can imagine these groups will have different objectives and interests in attending a coworking space.

3.2 Advantages and disadvantages of coworking

Previous research shows that telework from home presents disadvantages such as feeling of isolation, lack of exchanges with colleagues, but offers the advantage of gaining time since transportation time is reduced. (Tremblay, 2020). The survey investigated some of these aspects as concerns coworking. It appears that about half (48,8% for Canada and 47,6% for France) find that there is a gain in time by reducing transportation. The feeling of isolation is

important in Canada (61% vs 47% for France) and it is clear that a coworking space can offer an advantage here, especially in times of pandemic. Over 85% of coworkers found there were disadvantages in the confinement and closure of many businesses.

3.3 Change of habits and adaptation of homes

The effect of the COVID-19 was important in many countries, but it appears that it was more important in Canada than in France or Germany as concerns changes of habits in relation to mobility and housing. In Canada, the housing market exploded during the pandemic as many tried to move out of the city, and towards rural areas or smaller cities in various non metropolitan areas. The first figure below indicates there were more changes in Canada, and this is probably due to the fact that telework was already more developed in Canada before the crisis and thus was more readily and strongly adopted. In May 2020, 40% of Canadians were in telework and while this went down to 32% in the fall of 2021 (Statistics Canada data), the Omicron virus brought back compulsory telework in many companies, sectors and provinces in early 2022. (This refers to Table 1, but tables are not included for online conference proceedings as will be published elsewhere, but available upon request). The situation is very different in various countries. In France 31% indicate no change, while this is only the case for 7% in Germany and 17% in Canada. However, there is change for only about 30% (value over 5) in all countries. Another interesting question to determine to what extent coworking spaces can be interesting for salaried workers and others has to do with the characteristics of the home. This can lead to more or less interest in telework, but also in coworking. The data shows to what extent the home was adapted to working from home *before* the pandemic, and also shows to what extent it was adapted *after* the pandemic. (1 = not at all; 7 = perfectly). The situation did not change much before and after the pandemic, but the data indicate that Germans are more divided on this question than Canadians or French coworkers. Nevertheless, we will see further on that there was some mobility induced by the pandemic.

3.4 Mobility induced by the pandemic

The question of mobility and change of home is an important one in the wake of the pandemic and it could have an important impact on coworking spaces. Indeed, in France as in Canada, The majority of respondents in Canada (60%) as well as in Germany (67%) and in France (50%) did not move from the city to a rural area, but a higher percentage in Canada actually moved (17%) from the city to a rural area, as people were looking for more space and place to breathe during the pandemic, especially when there was a confinement to the home and even curfew. Canada also presents the highest percentage (7,3%) of people who moved from a rural area to the city. People were asked if they were interested in changing their place of work, which is also interesting for coworking spaces, and the results are the following: 22% for Canada, 27% for Germany and 16% for France. Let us not forget that the survey was addressed to people in coworking spaces in the spring of 2020, so these indications are only for this subgroup of the population.

3.5 Presence in coworking spaces before the pandemic

The pandemic could of course have an impact on coworking spaces. Let us not forget that the survey was addressed to people in coworking spaces in the spring of 2020. Questions related to their presence in the coworking spaces before the pandemic were asked, along with a few other elements related to this. The data indicate that over 50% of Canadian coworkers were present 5 days a week, more than in the other two countries; some 80% were present at least 2-3 days a week. As concerns the amount of time spent in the coworking space, it appears that the majority tend to spend the full day at the coworking space (67% for Canada, 71 % for France), some coworkers from Germany (21%) and Canada (17%) also going for a half day. It is also interesting to know what type of office the co-workers prefer. Our data indicate there is a higher percentage who prefer a closed office in Canada (30% vs 25% in France and only

14% in Germany. Germans clearly prefer open space (86%), while Canadians 69% prefer an open space. Our previous research indicated that open spaces tend to be preferred in metropolitan areas, while in rural or peripheral areas, coworkers tend to prefer closed offices. Questions were asked as to seniority in the coworking space, and some 40% of respondents in all countries appear to have been present in the premises for over 2 years. In Canada, many had only been there between 6 months to one year, and 22% between one and 2 years. There seems to be more seniority in Canada, but this may be surprising as the phenomenon is rather recent and not yet well known. There appear to be few recent arrivals in Canada, but this may be due to the timing of the survey, which was 4 months after the beginning of the pandemic, when many spaces had been closed and workers may not have been inclined to go to a new working environment.

3.6 Motivation for coworking

We now turn to the question of the motivation or reasons why individuals are interested in going to these coworking spaces. Previous publications indicated that networking, connecting with others, knowledge exchanges (Tremblay & Scaillez, 2021; Scaillez and Tremblay, 2019) were motivations for coworking. The data confirm that networking is particularly important in Canada, as the data show, but less important in France. In Canada, no one indicated this was not at all important, so this objective of networking clearly appears more important in Canada. In Canada as in other countries, the work ambiance is also very important : this is the case for 88% of coworkers in Canada, 84% in France, 81% in Germany. In our previous research, coworkers had also indicated that the ambiance and decoration was important, but this was more the case in metropolitan areas, than in non metropolitan areas or rural regions, where there is often only one space in a city or village (Tremblay & Vaineau, 2020). In such a case, there is no competition on this design dimension. Another motivation mentioned in the literature is the desire to share knowledge. While this does not come out in all surveys and countries (Krauss & Tremblay, 2019), it appears very important for about half of the coworkers, a little more so in Canada than in the other countries, as 90% consider it important or very important (80% or so in France and Germany). The objective of reducing one's transportation does not appear important in any of the countries, barely 10% considering it important (8% very important in Canada, 14% average importance).

3.7 Disadvantages of coworking

Most coworkers don't see so many disadvantages in coworking, and of course this is partly because most if not all coworkers chose this form of work voluntarily. However if there is one disadvantage which stands out, it is the noise. As many coworking spaces are open spaces, the noise can be a disadvantage. Still, 47% of Canadian coworkers find it is a mild disadvantage, while 37% consider it average, and 17% only find it a major disadvantage. Distance or time for transportation to the space could be a disadvantage or obstacle to go to a coworking space. However, this does not seem to be the case for the majority. About half of the coworkers of all countries take between 5 and 15 minutes to go to the coworking space. This also confirms our previous research, where we had found that there is a proximity issue and coworkers chose spaces rather close to home. (Tremblay & Vaineau, 2020). The following figure indicates modes of transportation. Canadians appear to use the car more than others, and this might be explained by the fact that public transportation is very limited outside of metropolitan areas. In metropolitan areas, coworkers can use a bicycle, public transportation or simply walking if the coworking space is close enough, but our previous research indicated that outside of large centres such as Montreal, coworkers tend to use their car (Tremblay & Vaineau, 2020).

3.8 Interaction between coworkers

As mentioned in previous publications (Krauss & Tremblay, 2019), coworkers are often seeking networking opportunities and possibilities to develop creative ideas and innovation.

The survey indicates that Canadian coworkers consider their coworkers as colleagues more than in other countries (32% vs 24% in France and 18% in Germany). The feeling of belonging to a community is important in order to develop exchanges and collaboration with coworkers. It is interesting to see that all Canadian respondents consider that their coworkers are part of a community, 61% totally agreeing with this feeling of community (48% and 47% for Germany and France). In order to build a community, social moments can be important so we asked questions on these social moments. We found that the French are the ones who most often take coffee or have lunch with their colleagues, which can be a source of proximity and knowledge exchanges. In Canada exchanges tend to happen more during seminars and training sessions than coffee breaks or lunch, although previous qualitative work had shown that coffee breaks and lunches were times to share information (Tremblay & Vaineau, 2020). In any case, it remains to be determined to what extent these social moments can contribute to knowledge exchanges, creativity and innovation. In any case, previous research has shown that coworkers find it important to have some coffee machines and eventually a kitchen corner in the coworking space so that some chance encounters can happen in these spaces (Tremblay & Vaineau, 2020). Some data indicate that coworkers have access to other coworkers' networks, and this seems to be more the case in Canada than in the other countries: 82% in Canada, 79% in Germany and 66% in France. As concerns collaboration with others, again more Canadians indicate this is the case (58%), while it is only found for 47% of French respondents and 32% of German respondents. And finally, for the possibility of obtaining contracts through these networks, Canadian respondents are 64% indicating that this was the case, while it was the case for 58% of Germans and 41% of French respondents. These are quite high percentages in any case. The motivations for these corporations vary. In Canada, it is mainly to develop one's competencies (30%), to be part of a team and integrate oneself into the coworking space (20%), to develop one's professional activity (15%), to develop a professional network (10%). As for the obstacles to collaboration, they are mainly the lack of synergy and lack of time, aspects which we look into in the qualitative part of the research and which have been mentioned in some of our interviews.

4 CONCLUSION

To conclude, all these elements from the research indicate that we can expect positive impacts for coworking spaces after the pandemic. There appears to be much interest in Canadian coworkers for developing networks and collaborations. The data also show interesting elements as to mobility from city to rural areas or smaller cities, which may offer interesting opportunities for developing new coworking spaces, as we have observed in the last months. As the pandemic fades somewhat, but is still not over, it seems that telework and hybrid models of work will continue over the coming years. In this context, not only are self-employed and small entrepreneurs interested in having their business in a coworking space, but some teleworkers are also interested in working there, to have a more professional environment, so coworking spaces appear to be multiplying in the suburbs of Montreal and in various small cities throughout the province and the country. As mentioned above, in the methodology, there are limits to the research, mainly as concerns representativity of respondents. First, as mentioned, there is no perfectly representative list of coworking spaces in Canada, or elsewhere for that matter, especially as there have been many closures over the pandemic, but also new openings in 2022. However, as we have done previous research with interviews (Tremblay & Vaineau, 2020), we got a good sense of the realities over the years and the quantitative data was to complete this. Unfortunately, with the pandemic, the timing was not good. This means the main limit to the research is that there is no perfect representation of coworkers, which is of course an important limitation of the research. However, there is a sufficient amount of

interviews over the years (over 60, from 2016 to 2022), so that the quantitative data come as a complement, and together, this data appears sufficiently reliable, as data and contents appear quite consistent as concerns the issues addressed here (advantages, disadvantages, motivation for coworking and mobility issues), although of course, more research is indicated. Concerning the future research agenda, we are presently picking up on the research, doing more interviews, and also some ergonomic observations which concern the way coworkers use the space, exchanges between them (nature, frequency and mode – direct or email or other), as well as the motivation, the well-being of coworkers and the design and comfort dimensions of the coworking space. We thus plan to complete the study of these spaces and new forms of working in the coming two years, to compensate for the difficulties in accessing coworkers and coworking spaces over the last two years of the pandemic. We also plan to continue international comparisons of coworking as this is clearly a method to better understand the specificities of various contexts, but also identify the similarities. Our international cooperation project is ongoing and future work could lead to new observations and comparisons.

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REFERENCES

- Akhavan, M., Mariotti, I. & Rossi, F. (2022), The rise of coworking spaces in peripheral and rural areas in Italy. *Territorio - Sezione Open Access*, (97-Supplemento). <https://doi.org/10.3280/tr2021-097-Supplementooa12925>
- Capdevila, I. (2013), Knowledge dynamics in localised communities: Coworking spaces as microclusters. Available at SSRN 2414121. Consulté à l'adresse http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2414121
- Capdevila, I. (2014a), Coworking spaces and the localised dynamics of innovation in Barcelona. *Proceedings of ISPIM Conferences*, (26), 1-25.
- Capdevila, I. (2014b), *Coworking spaces and the localised dynamics of innovation. The case of Barcelona*. Working Paper.
- Colas, N. (2021), *Analyse comparative des résultats Allemagne-Canada-France ; Preliminary Data from the Periwork Project*. Université de Rennes 2.
- Deskmag (2017), Final results of the global coworking survey in charts.
- Fabbri, J. (2015), *Les espaces de coworking pour entrepreneurs. Nouveaux espaces de travail et dynamiques inter organisationnelles collaboratives*. Thèse en Ecole polytechnique, Palaiseau, 454.
- Fabbri J. (2016), Les espaces de coworking : ni tiers-lieux, ni incubateurs, ni fab-Lab, *Entreprendre et Innover*, 31 (4), 8-16.
- Fabbri J., Charue-Duboc F. (2016), Les espaces de coworking : nouveaux intermédiaires d'innovation ouverte ?, *Revue française de gestion*, 254, 163-180.
- Garrett L., Spreitzer G., Bacevice P. (2017), *Co-constructing a sense of community at work: the emergence of community in coworking spaces*, *Organisation Studies*, 38 (6), 821-842.
- Gorwitz, N. (2019), Coworking et réseautage font bon ménage. Les espaces de travail partagés pourraient représenter jusqu'à 30% du portefeuille immobilier des entreprises d'ici à 2030. *Jeune Afrique*. No 3039, 70.

- Krauss, G., Tremblay, D. G. (eds, 2019), *Tiers-lieux - travailler et entreprendre sur les territoires: Espaces de coworking, fablabs, hacklabs*. Rennes-Québec: Presses universitaires de Rennes, Presses universitaires du Québec.
- Lallement, M. (2015), *L'âge du Faire, Hacking, travail, anarchie*, éditions du Seuil, Paris.
- Le Nadant, A-L., Marinos, C. et Krauss, G. (2018), Les espaces de coworking. Le rôle des proximités dans les dynamiques collaboratives, *Revue des sciences de gestion*, n° 272, 121-137.
- Liefoghe, C. (2016), Tiers-lieux, coworking spaces et fab labs: nouveaux lieux, nouveaux liens et construction de communautés de connaissance créatives, in C Liefoghe, *Lille, métropole créative? Nouveaux liens, nouveaux lieux, nouveaux territoires*, Lille, Presses universitaires du Septentrion, 183-221.
- Oldenburg, R. (1989), *The great good place: Cafes, coffee shops, community centres, beauty parlours, general stores, bars, hangouts and how they get you through the day*, NY, Paragon House.
- Oldenburg, R. (1999), *The great good place: Cafes, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community*, NY, Marlowe.
- Oldenburg, R. (2000), *Celebrating the Third Place: Inspiring Stories about the Great Good Places at the Heart of Our Communities*, New York, Marlowe.
- Scaillerez, A., Tremblay, D-G. (2016a), Coworking: une nouvelle tendance qui favorise la flexibilité du travail, Volet économie, *Revue État du Québec*, 215-218.
- Scaillerez, A., Tremblay, D-G. (2016b), Les espaces de co-working, les avantages du partage, *Revue Gestion de HEC Montréal*, numéro d'été 2016, 41, (2), 90-92.
- Scaillerez, A., Tremblay, D-G. (2016c), Le télétravail, comme nouveau mode de régulation de la flexibilisation et de l'organisation du travail : analyse et impact du cadre légal européen et nord-américain, *ROR (Revue des Organisations Responsables)*, mai-juin 2016, 21-31.
- Scaillerez, A., Tremblay, D-G. (2017), Coworking, fablabs et living labs, État des connaissances sur les tiers-lieux, *Territoire en mouvement Revue de géographie et aménagement* [En ligne], 34, URL : <http://tem.revues.org/4200> (page consultée le 2 avril 2020)
- Scaillerez, A., Tremblay, D-G. (2019), Travailler et collaborer autrement : les espaces de coworking, une approche apparentée aux communautés de pratique. Dans G. Krauss et D.-G. Tremblay (2019) *Tiers-lieux – travailler et entreprendre sur les territoires : Espaces de co-working, fab labs, hack labs*. Rennes et Québec : Presses universitaires de Rennes, Presses universitaires du Québec.
- Smits, M. (2015), *Les tiers-lieux sont-ils reproductibles à grande échelle ? Étude de la viabilité de l'intégration de ces espaces dans un processus d'aménagement formalisé*, Projet de fin d'étude, ENPC, 61.
- Spinuzzi, C. (2012), "Working Alone Together: Coworking as Emergent Collaborative Activity", *Journal of Business and Technical Communication*, 26, 4: 399-441. Doi:10.1177/1050651912444070.
- Spinuzzi, C., Bodrožić, Z., Scaratti, G., Ivaldi, S. (2019), 'Coworking Is About Community': But What Is 'Community' in Coworking?, *Journal of Business and Technical Communication*, 33, 2: 112-140. Doi: 10.1177/1050651918816357

- Tremblay, D-G. (2020), Le télétravail et le coworking: Enjeux socio-territoriaux dans la foulée du Covid 19. *Organisation et Territoire*. Vol. 29, no 2, Juin 2020, 159-162 <http://revues.uqac.ca/index.php/revueot/article/view/1167/997>
- Tremblay, D-G., Scaillerez, A. (2020), Coworking spaces : New Places for Business Initiatives? *Innovation-Journal of Innovation Economics and Management*. 2020/1, 31, 39-67 https://www.cairn.info/article.php?ID_ARTICLE=JIE_PR1_0063
- Tremblay, D.-G., E. Vaineau (2020), Le coworking en région au Québec : une innovation territoriale, entrepreneuriale, contribuant au développement local ? *Organisation et Territoire*. Vol. 29, no 2, Juin 2020, 55-67 <http://revues.uqac.ca/index.php/revueot/article/view/1150/985>

Work-life Balance through coworking: an insight from the Czech Republic

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ABSTRACT

We contribute to the discussion regarding work-life balance (WLB) in collaborative spaces. Our research question is twofold: which services are offered in coworking spaces intending to support WLB? How do managers from the Czech Republic consider and approach these elements? We aim to understand which kinds of tools are recognised as supportive to WLB daily experience at the workplace. WLB is defined as an individual's feeling that work and non-work activities are in harmony with their life priorities. Collaborative spaces provide services to align work and non-work activities (Shaik & Fusulier, 2015; Cochis et al., 2021). For instance, working hours, location and environmental conditions support well-being (Abendroth & den Dulk, 2011). Currently, it is understood that community managers in coworking spaces shape social and spatial proximities, which are the foundation to nurturing trust and values. They also support users in balancing work-life ratios, avoiding possible work-family conflict (Orel, 2022). We develop a qualitative study based on semi-structured interviews with managers from three coworking spaces in the Czech Republic. Primary data are supplemented with secondary data reflecting events and activities held pre and during the COVID-19 pandemic. The data are organised by association maps, sustained by the following themes: work, coworking and WLB elements. We invited managers to reflect upon their coworking spaces on three levels. First, they explain what work means to them. Second, we define WLB and ask them to analyse to which extent it makes sense in their realities. Third, based on the services offered to coworkers, they evaluate how these elements are translated into their business choices. They also reflect on the relational hybridity of organisational practices through WLB activities in the context of COVID-19. WLB is a regular topic in the literature about traditional work settings. However, research regarding the effects of collaborative spaces on it remains understudied. Our study presents two complementary insights. First, we introduce challenges faced by managers to shape the workplace and support WLB. Second, we point out the intrinsic limitations of the term.

Keywords

Communities, Coworking space, Well-being, Work-life balance, Life balance.

1 INTRODUCTION

Workers often state they are looking for balance in life, which, in response, is one of the main topics on organisations' perk agenda. The COVID-19 pandemic and its consequences on the digitalisation of the workplace through enforced remote working increased the discussions concerning WLB (Bukowska et al., 2021). Balance is usually addressed by setting clear boundaries between work life and personal life. The literature shows a limited scope in framing each concept, though. Life is typically framed upon family chores, while work is often

considered from its traditional model: a full-time job for only one employer (Kelliher et al., 2019). Balance relies on the idea of an equilibrium between those two dimensions. Most research about WLB is based on the interface between family and work (Sirgy & Lee, 2018). Agreeing with Kelliher et al. (2019), we also advocate for developing a ‘holistic’ and ‘nuanced’ understanding of contemporary life, considering the shifts in time/space experience and how people articulate different needs on their schedule. Therefore, we approach WLB in the context of collaborative spaces. On the one hand, the collaborative economy has provoked numerous changes in the ways of working (Mitev et al., 2019), even before the pandemic. On the other hand, coworking remains a growing phenomenon, meeting the needs of workers through the offered services (Weijs-Perrée et al., 2020). It is also one of the primary workplace alternatives in the forecasted post-pandemic world (Howell, 2021). We propose to answer the following research question: which services are offered in coworking spaces to support work-life balance? How do managers from the Czech Republic consider and approach these elements? We intend to understand which kinds of tools are recognised as supportive of WLB daily experience at the workplace. Additionally, we focus on the ongoing changing of CSs with their formal and informal interactions (Kindgma, 2017). The paper includes partial results of an ongoing investigation. Our study presents two complementary insights. First, we introduce challenges faced by managers to shape the workplace and support WLB in coworking spaces. Second, we point out limitations on the current mainstream perspective of WLB. The paper is organised as follows. The first section presents a brief theoretical discussion, and the section afterwards explains the methodological approach, followed by the presentation of data from fieldwork. We conclude the paper with a discussion and final comments regarding limitations and future studies.

2 WORK-LIFE BALANCE AND COWORKING

WLB is a long-term studied notion, especially in traditional work settings. An integrated conceptualisation (Sirgy & Lee, 2018) is often claimed. Yet, it is crafted on solid boundaries between private life and work demands (Bukowska et al., 2021). On the other hand, “the term ‘work-life balance’ refers to the relationship between work and non-work aspects of individuals’ lives, where achieving a satisfactory work-life balance is normally understood as restricting one side (usually work), to have more time for the other [life]”. (Kelliher et al., 2019, p. 3). Thus, it is related to a limitation on the number of hours spent on paid work, so one can use the remaining hours to perform other activities (Raja & Stein, 2014). The metaphor of work-life balance is a misnomer (Guest, 2002). Yet, it is a growing trend in media and research, notably related to the COVID-19 pandemic. Commonly, it entails binary categories: work and non-work (Kelliher et al., 2019; Raja & Stein, 2014; Sirgy & Lee, 2018); work life and personal life (Abendroth & den Dulk, 2011); work and leisure (Haworth & Veal, 2004; Smith et al., 2021), or work and family (Hu & Subramony, 2022; Krymis, 2011). We find the binary classifications problematic for three reasons. First, and obvious, it is reductive thinking about a subject related to humans based on only two dimensions. Second, it fundamentally leads us to ask: what is work? What is life? What is the balance? (Guest, 2002). The answer to each of them determines the stakes of the intended relationship. Third, it maintains boxed perspectives to understand one’s engagement with different life activities. Nevertheless, these binary categories are also invested in explaining why coworkers look for WLB in collaborative spaces. “Coworking spaces characterise itself as an optimal environment for balancing the work–life aspects of independent workers by enabling the stability and growth”. (Orel, 2019). Non-work aspects are defined as the role of flexibility, community, or a sense of belonging in the workplace, emerging from the edges of working elements (Ivaldi et al., 2018; Orel, 2019). In that sense, the duo work and non-work is translated into the services offered in coworking

spaces. Even though they might not be the predominant reason for users to be part of these collaborative spaces, services are based on working behaviour - 'working-alone-together', as conceptualised by Spinuzzi (2012). Coworking spaces provide services to align work and non-work activities regarding compatibility and support for the adaptation of work-related activities to life priorities (Shaik & Fusulier, 2015; Cochis et al., 2021). Community managers play a unique role in coworking spaces (Haubrich, 2021). They promote, keep, and/or change elements in the workplace, shaping social and spatial proximities, which are essential to nurturing mutual trust and values. They also support users in balancing work-life ratios, avoiding possible work-family conflict (Orel, 2022). Managers prepare the workplace by considering coworkers' demands. They translate the recognised needs into the location of the place (Felstead & Henseke, 2017), amenities (Morisson, 2019), and services offered to members (Shaik & Fusulier, 2015). They also foster cooperation within other organisations, bridging personal and professional interests (Cochis et al., 2021).

3 METHODOLOGY

Although our theoretical framework points out a dissonance between the existing concepts and the urgency for a holistic endeavour to WLB, we assume an iteration between theoretical propositions and practical perspectives is necessary. This text presents partial results from an ongoing investigation regarding WLB in coworking spaces. The data only include managers' views, a starting point for further research towards different arguments on WLB (Kelliher et al., 2019). Still, the complex matrix that constitutes coworking managers' jobs opens the gate for contemplation. They create strategies to communicate the community identity and translate them into rooms, services, and other materialities. Additionally, they constantly dialogue with coworkers, which fuels their perceptions and affects the translation process. Our qualitative research brings insights considering these aspects. From the existing theoretical tension to the translated aspects in the workplace, we can discuss possibilities to further research. The study is based on three semi-structured interviews with managers from three collaborative spaces in the Czech Republic. Interviews are supplemented with primary data concerning the change of community events from physical to virtual during the COVID-19 pandemic. The spaces were selected by accessibility. They are independent CWS (Bouncken et al., 2018) and incorporate mainstream or neo-corporate features (Gandini & Cossu, 2021). Due to the pandemic restrictions, interviews occurred digitally (by Zoom, for example) from January to July 2021. We organise the data based on the association map strategy considering the following categories: work, coworking, and work-life balance tools. We addressed three out of nineteen questions from the overall interview and selected them considering our focus on this paper. First, we inquire about work-life balance from an open view, inviting the managers to talk voluntarily to define the WLB. Later, we provide a conceptual framework and ask them to reflect upon the relationship between coworking and WLB. Finally, we asked the interviewees to evaluate some of the services provided in their CWS, namely: working hours, equipment and rooms, location, services, and cooperation. As introduced by the literature, these elements are helpful to workers to have the flexibility of time and space and, therefore, achieve WLB.

4 DATA AND DISCUSSION

The section presents the data collected and promotes a preliminary discussion regarding the notions of work, coworking and work-life balance. We divided it into three parts. First, we introduce the spaces; second, the data collected through the interviews. Finally, we proceed with the discussion.

4.1 Introducing the spaces

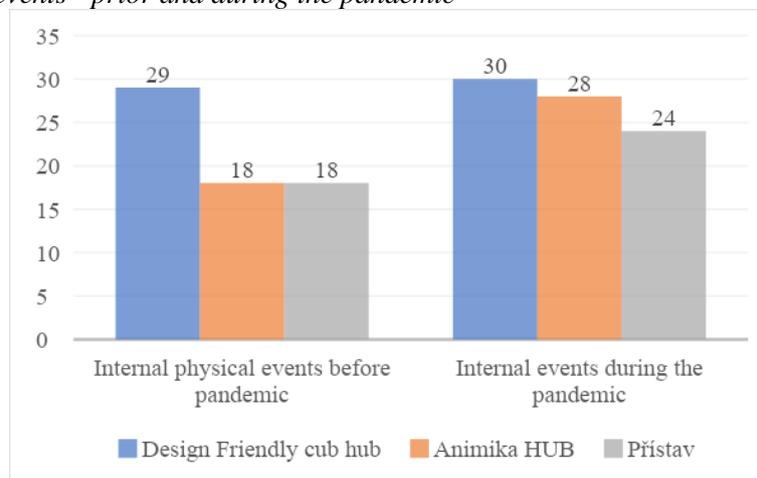
The CWS we studied are located in Prague, which is currently targeting niche markets for family-oriented spaces (Mayerhoffer, 2020). The rationale behind selecting Prague is the rise of community-oriented spaces with social entrepreneurship led by local communities as a contrast to coworking spaces organised by global providers (Bednár et al., 2021). Prague is growing as a business hub with an increased need for offices. However, the demand is concentrated in the city's historic core with an outlook to revitalise commercial buildings through collaborative spaces. Prague substantially attracts global providers of coworking spaces (WeWork, Impact Hub, HubHub). This trend signifies the dynamics of property-led development in the centre and inner city to develop open markets (Bednár et al., 2021). Electing independent coworking spaces to build the study-body relies on their role in community development and the renewal of local creative ecosystems. (Bednár and Danko, 2020). The three spaces differentiate in specialisation and approach. Pristav is a mix of coworking and maker space (crafts and creative studio). Animika combines a cinema and cultural exposition as a CWS. Design Friendly is a design-led space with architecture and fashion studios. A brief characterisation of each space is provided on Table 1:

Table 1. Spaces characterisation

Space	Description
<i>Pristav</i>	Coworking space devoted to start-ups. They also highlight the youth as a central point in their coworking space
<i>Animika</i>	It is a space devoted to events of any kind: meetings, workshops, lectures, exhibitions.
<i>Design Friendly</i>	It is a working space for workers in the field of interior design and creative industries.

Considering the disruption originated with the COVID-19 pandemic, managers were challenged to rearrange the ways they engage coworkers. Specifically in the Czech Republic, two major lockdowns were implemented, having a massive impact in coworking operations (Akhavan et al., 2022). Events are usually a valuable strategy adopted by coworking managers to attract new members, foster networking, and nurture the community. In the context of restricted interactions and physical encounters, managers had to host most of the events online or with a limited number of participants. Chart 1 shows how the three spaces have dealt with these impositions, culminating with a slight increase in the number of internal events during the pandemic.

Figure 1. Spaces events - prior and during the pandemic



From this snapshot regarding the three spaces, we can advance to the direct findings from the interviews, advancing the understanding of how managers see the offered services support WLB.

4.2 Approaching the spaces

As previously mentioned, we organised the data considering three main categories independently. We aim to recover managers' assumptions about the meanings stressed in collaborative spaces by the category work. Assessing the meaning attributed to work supports us in considering the translation of the CWS concept into each space. The translation refers to a connection between global standard features attributed to coworking and local cultural specificities. We assume this glocal dialogue as the source of differentiation among the spaces, supporting managers to straighten their business. Plus, coworkers can choose a workplace reflecting their values and worldviews. Finally, by analysing the provided services, we can relate the notion of WLB to this kind of workplace.

Category Work. The first category we approach concerns the managers' definition of work. We've chosen to start with this notion due to the definition of non-work activities on the edge of what is work. Therefore, we assume that it's important to recognise how managers define work whilst they try to meet coworkers' expectations. The following question guides us through this topic:

Q: Which elements do managers address when they talk about work?

In Pristav, the manager highlights the link between business and fun, making money while being part of a community. The idea of community relies on the bond among those members who share a worldview. Work is about the compatibility of beliefs and not about separating dimensions of life, e.g., this is personal, this is work. *"It actually educates them, opens their horizons, helps them get oriented in the given field more to have some experience, let's say, like quotes creating new quotes"* (Pristav manager).

Design Friendly managers claim that the boundaries between work and non-work are blurred and often overlapping. Through the workplace, they accomplish the mission of supporting a professional category and express such purpose by defining work from a set of values. For instance, they approach the "lifestyle" to describe the 'glue' holding coworkers together. *"Your work becomes your lifestyle as well, and work and non-work activities are compatible, and you don't dwell on it too much"* (Design Friendly manager).

One may say both spaces fuel an idealistic view of work. Others, though, would say they are following a neoliberal trend. Alternatively, we can point out an effort to express the activity of work (Schwartz, 2020), meaning they seek to foster meanings to work beyond the business or the paid job. We notice they aim for the inventive and creative dimension of working that involves knowledge, values, and a whole immaterial dimension.

In a different direction, Animika managers' definition of work relies on an economic view. They are interested in promoting solutions, so coworkers can complete their tasks. Therefore, they identify their clients' expectations to offer services that meet their claims in an almost linear consumption process. In their perspective, working in coworking is tied up to a traditional business relationship.

Category Coworking. The second studied category is tied to the previous one and refers to the concept of coworking and how the managers translate it to their space. The question supporting us in the analysis is as follows:

Q: How do managers perceive the coworking phenomenon?

While characterising their space, Pristav managers mentioned aspects related to the access 24/7 and how young people look for an energetic atmosphere, connecting this energy to the people sharing the space. *"The atmosphere that is related to some energy of a person there"*. They

also define coworking from other shared informal practices: “*we just all get together for a long weekend ... or smaller presentations during breakfast together, lunches together, where people are presenting what they're doing, or it's just a purely informal chat*” (Pristav managers).

Design Friendly managers choose to describe coworking based on the shared attributes of the coworkers. “*We are a specialised coworking space designed for interior designers. So, specifically for interior designers, or other members of the creative class. And I think ninety-nine percent are women. So our designers who work for us are primarily women*” (Design Friendly manager).

In its turn, Animika is defined by the managers as a “*not classic coworking space*” because they don't have any theme or public-oriented approach. The point of having the space is to deliver what the client needs. They highlight the focus on accommodating specific activities to companies that rent the space. “*These are companies that want to relax. There's not a lot of opportunity for personal access with that whole group*” (Animika managers).

Category Work-life balance. The third category relies on the concept of work-life balance, considering managers' evaluation of the services they provide. The question guiding our data analysis is:

Q: How important are the services provided by the coworking spaces regarding the balance in life?

Managers were relatively straightforward in their evaluation of the provided services. Regarding the space amenities, Pristav and Design Friendly managers have a similar approach, allowing 24/7 access to regular users of the space. “*The hours of operation; they are unlimited*” (Pristav manager). Due to Animika operation specificity, they only receive workers with appointments and reservations to events.

Pristav managers engage with universities to gather young coworkers in their environment in terms of partnerships. “*We've had students from the school come to see us because they were supposed to design coworking centres*” (Pristav manager). Instead, Design Friendly relies on renting rooms as a financial source to keep the space going on. “*Our space is rented by TV stations and photographers, even for celebrity photoshoots*”. (Design Friendly manager). Animika managers point out that they collaborate with other organisations based on shared concerns, not directly related to the business. For instance, they assert: “*we've had a couple of charity events like that, but it's not like it's a regular thing*” (Animika manager).

The activity-based approach to organising the environment is a common point among them. The three spaces offer rooms for interaction, areas of silence, smoking/not smoking areas, and so on. As pointed out by Appel-Meulenbroek et al. (2020, p. 292), “workers should have the opportunity to isolate themselves from distraction, when necessary, by providing various types of workplaces that support concentration (e.g. cell-offices, quiet areas, private spaces) and/or clear use-protocols in more open environments.”

4.3 Discussion

From the category work, we highlight the tensions among coworking spaces. As expected, the dimensions of business, tasks to be completed, and money to be made are evident in the three spaces. Nonetheless, the blur/ overlapping between what is defined as work and non-work is also relevant for two of the spaces. In that sense, we have noticed efforts to centre attention on people, approaching work beyond business as an important source of self-development and learning. Therefore, we can find interesting avenues to understand the social fabric-building process through work. In a snowball effect, the definition of work supports each space's translation of what is coworking. The tension remains between gathering people to get along with each other and delivering something business-oriented. From these two categories, we might presume that the experience of time and space will vary among the coworkers. Therefore, what balance means to them and how to achieve it will differ. Considering managers' views on

the provided services, we assume there is no obvious connection between services and work-life balance. In that sense, further studies should advance the understanding of how these two dimensions meet and entangle each other. The main finding from the fieldwork relies on the space configuration following the activity-based approach. The three spaces offer different sorts of rooms to meet task requirements. For instance, if someone needs to focus, he/she can access individual rooms. Again, the understanding of work and coworking influences the access and how coworkers may occupy the space. If they are residents, meaning they have a monthly contract, they can use the available rooms, when necessary, regardless of the time of day. Thus, the autonomy to choose how to organise the day assumes another level, beyond business hours, but following situations and personal preferences.

5 CONCLUDING REMARKS

The qualitative study was conducted in three coworking spaces in Prague, Czech Republic, where the rise of community-oriented spaces with social entrepreneurship led by local communities has been seen. From the literature review, we proposed an iterative process. We start from the standard view on WLB, which is incorporated by CWS studies based on the offered services. Next, we assess three Czech Republic managers' perspectives to identify possible routes to promote a holistic approach to WLB. The answer to our research question was partially anchored on the literature review, pointing out amenities, location, services, and networking as relevant tools to support WLB in CWS. We advance our response based on the data collected in the field. From the managers' perspective, we learn that those tools are adapted to the aimed community. We also recognise a tension among perspectives. For instance, the cooperation with other organisations is mainly oriented to making additional funding to maintain the space or charity. Another insight emerging from our study enlarges the binary approaches to WLB and unfolds into two inter-related yet different faces of the phenomenon. One is related to the business strategy, and the other is the impact on coworkers' lives. If we take the services offered as a basis, we can follow many directions. For instance, it can support views on competitiveness sustained on the position of the space frames in the market. It also can be the materiality that engenders work practices. Of course, these faces are imbricated, but the weight invested in each defines the experience people will enact. The main limitations of the paper are the number of interviews and the focus on only one type of CWS. Future research can overcome both constraints and provide further insights regarding new ways of working peculiarities. If we look for a deeper understanding of environments oriented to co-creation, innovation, and creativity, it is also vital to promote dialectic approaches, considering the individual as an integral being that not only executes tasks, but mobilises all levels of knowledge to respond to what is requested by the environment.

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REFERENCES

Abendroth, A.-K., den Dulk, L. (2011), Support for the work-life balance in Europe: The impact of state, workplace and family support on work-life balance satisfaction. *Work, Employment and Society*, 25(2), 234–256. <https://doi.org/10.1177/0950017011398892>

- Akhavan, M., Hölzel, M., Leducq, D. (2022), Exploring immediate effects of the COVID-19 Pandemic on New Working Spaces: Worldwide narratives by the academia and media (Working paper1/ Series no001; p. 48). COST ACTION – CA18214 The Geography of New Working Spaces and the Impact on the Periphery.
- Appel-Meulenbroek, R., Voordt, T. van der, Aussems, R., Arentze, T., Le Blanc, P. (2020), Impact of activity-based workplaces on burnout and engagement dimensions. *Journal of Corporate Real Estate*, 22(4), 279–296. <https://doi.org/10.1108/JCRE-09-2019-0041>
- Bednář, P., Mariotti, I., Rossi, F., Danko, L. (2021), The Evolution of Coworking Spaces in Milan and Prague: Spatial Patterns, Diffusion, and Urban Change. In M. Orel, O. Dvouletý, & V. Ratten (Eds.), *The Flexible Workplace* (pp. 59–78). Springer International Publishing. https://doi.org/10.1007/978-3-030-62167-4_4
- Bednář, P., Danko, L. (2020), Coworking spaces as a driver of the post-fordist city: A tool for building a creative ecosystem. *European Spatial Research and Policy*, 27(1), 105-125.
- Bouncken, R. B., Laudien, S. M., Fredrich, V., Görmar, L. (2018), Coopetition in coworking-spaces: Value creation and appropriation tensions in an entrepreneurial space. *Review of Managerial Science*, 12(2), 385–410. <https://doi.org/10.1007/s11846-017-0267-7>
- Bukowska, U., Tyrańska, M., Wiśniewska, S. (2021), The Workplace and Work-Life Balance during the COVID-19 Pandemic. *Annales Universitatis Mariae Curie-Skłodowska*, 55(2), 19–32. <https://doi.org/10.17951/h.2021.55.2.19-32>
- Cochis, C., Mattarelli, E., Bertolotti, F., Scapolan, A. C., Montanari, F., Ungureanu, P. (2021), How Perceptions of Work-Life Balance and Technology Use Impact upon Creativity in Collaborative Spaces. In C. Metallo, M. Ferrara, A. Lazazzara, & S. Za (Eds.), *Digital Transformation and Human Behaviour* (Vol. 37, pp. 217–234). Springer International Publishing. https://doi.org/10.1007/978-3-030-47539-0_16
- Felstead, A., Henseke, G. (2017), Assessing the growth of remote working and its consequences for effort, well-being and work-life balance. *New Technology, Work and Employment*, 32(3), 195–212. <https://doi.org/10.1111/ntwe.12097>
- Gandini, A., Cossu, A. (2021), The third wave of coworking: ‘Neo-corporate’ model versus ‘resilient’ practice. *European Journal of Cultural Studies*, 24(2), 430–447. <https://doi.org/10.1177/1367549419886060>
- Guest, D. E. (2002), Perspectives on the Study of Work-life Balance. *Social Science Information*, 41(2), 255–279. <https://doi.org/10.1177/0539018402041002005>
- Haubrich, G. F. (2021), Mediation Matters: The Role of Staff in Coworking Constitution. In: Orel, M., Dvouletý, O., Ratten, V. (eds) *The Flexible Workplace*. Human Resource Management. Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-62167-4_9
- Haworth, J., Veal, A. (2004), *Work and Leisure*. Routledge. <http://www.taylorfrancis.com/books/edit/10.4324/9780203489321/work-leisure-john-haworth-anthony-veal>
- Howell, T. (2021), Coworking Spaces Offer a Post-Pandemic Office Alternative. MIT Sloan Management Review. <https://sloanreview.mit.edu/article/coworking-spaces-offer-a-post-pandemic-office-alternative/>
- Ivaldi, S., Pais, I., Scaratti, G. (2018), Coworking(s) in the Plural: Coworking Spaces and New Ways of Managing. In S. Taylor & S. Luckman (Eds.), *The New Normal of Working Lives* (pp. 219–241). Springer International Publishing. https://doi.org/10.1007/978-3-319-66038-7_11
- Kelliher, C., Richardson, J., Boiarintseva, G. (2019), All of work? All of life? Reconceptualising work-life balance for the 21st century. *Human Resource Management Journal*, 29(2), 97–112. <https://doi.org/10.1111/1748-8583.12215>

- Kingma, S. F. (2017), Coworking, shared workplaces, and the future of work: From the front lines. *Leader to Leader*, 60-62.
- Mayerhoffer, M. (2020), Growth factors of the coworking industry: The case of Prague. *Journal of Property Investment & Finance*, 38(3), 203–212. <https://doi.org/10.1108/JPIF-12-2019-0164>
- Mitev, N., de Vaujany, F.-X., Laniray, P., Bohas, A., Fabbri, J. (2019), Co-working Spaces, Collaborative Practices and Entrepreneurship. In K. Riemer, S. Schellhammer, & M. Meinert (Eds.), *Collaboration in the Digital Age* (pp. 15–43). Springer International Publishing. https://doi.org/10.1007/978-3-319-94487-6_2
- Morisson, A. (2019), A typology of places in the knowledge economy: Towards the fourth place. In Calabrò, F., Della Spina, L., & Bevilacqua, F. *International symposium on new metropolitan perspectives* (pp. 444-451). Springer.
- Orel, M. (2022), Guest editorial: The pandemic-driven metamorphosis of a modern workplace. *Journal of Corporate Real Estate*, 24(2), 73–75. <https://doi.org/10.1108/JCRE-03-2022-074>
- Schwartz, Y. (2020), *Activité(s) et usages de soi: Quel(s) « milieu(x) » pour l’humain ?* *Les Études philosophiques*, 132(1), 93–123. <https://doi.org/10.3917/leph.201.0093>
- Shaik, F., Fusulier, B. (2015), *Academic Careers and Gender Inequality: Leaky Pipeline and Interrelated Phenomena in Seven European Countries* (GARCIA Working Papers n. 5, p. 255). University of Trento. <http://hdl.handle.net/2078.1/168170>
- Sirgy, M. J., Lee, D.-J. (2018), *Work-Life Balance: An Integrative Review*. *Applied Research in Quality of Life*, 13(1), 229–254. <https://doi.org/10.1007/s11482-017-9509-8>
- Smith, T., Butts, M., Courtright, S., Duerden, M., Widmer, M. (2021), *Work–Leisure Blending: An Integrative Conceptual Review and Framework to Guide Future Research* (SSRN Scholarly Paper No. 3862034). <https://papers.ssrn.com/abstract=3862034>
- Spinuzzi, C. (2012), *Working Alone Together: Coworking as Emergent Collaborative Activity*. *Journal of Business and Technical Communication*, 26(4), 399–441. <https://doi.org/10.1177/1050651912444070>
- Weijs-Perrée, M., Appel-Meulenbroek, R., Gauger, F., Pfnür, A., Orel, M. (2020), Differences in user preferences across European coworking spaces. *Proceedings of the Transdisciplinary Workplace Research (TWR) Conference 2020*, 14–25. http://www.twrnetwork.org/wp-content/uploads/2020/11/TWR2020_Future_Workspaces_Ed2.pdf

Wellbeing at work in coworking spaces: an overview

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ABSTRACT

The negative effects on the wellbeing of homeworkers have been widely discussed in the current literature. In terms of physical risks, these increase in the case of homeworking due to a lack of ergonomic equipment, poor lighting conditions and safety measures for trips and falls that can be normally found in an office environment. As for psychosocial risks, a worsened balance between work and private life has been reported, together with the so-called zoom fatigue and the feeling to be never able to disconnect from work duties. In this context, coworking spaces may have emerged as a valid solution to tackle occupational risks, overcoming for instance social isolation and favouring a better work-life balance, but at the same time guaranteeing quieter spaces for working compared to traditional third places such as cafes. These latter arguments were mentioned already among the drivers for joining coworking spaces in possibly the most cited paper in the coworking literature by Clay Spinuzzi (2012). However, no overview of the literature on coworking spaces looking specifically at the topic of wellbeing at work has been conducted up to now. Therefore, this literature review paper aims to look at how coworking spaces may affect users' wellbeing at work. The discussion will be based on a structured review of academic literature looking at how the physical and the social environment of coworking spaces (i.e., presence of ergonomic equipment and social interaction) may help workers to enhance their individual wellbeing.

Keywords

Coworking spaces, Wellbeing, Occupational risks, Work-life balance.

**SESSION 4C: WORK ENVIRONMENTS BETWEEN VIRTUAL AND PHYSICAL
ACTIVITIES**

Differentiation of Work-tasks at Homes and Offices

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ABSTRACT

This paper aims to show the different possibilities of both work environments: the traditional office and the home office. Both places provide different opportunities to fulfil the daily work tasks. The authors argue that both work spaces are suited for specific kinds of work, which plays an important role when it comes to a further development of the hybrid office. Unrevised and higher productivity while working from home is valuable evidence within emerging workplace trends towards hybrid work. Due to the expected anticipation of a great majority of companies to adopt hybrid working, a differentiation of potentials of both workplaces seems immanent. Based on a survey from 2017, an intensive literature research was enrolled. A revised survey was then conducted and a total of 44 answers were given by managers in top and middle management. The spaces of the traditional office and at home, both assumed to be valid workplaces, were then put into comparison. Tasks performed in both work spaces were analysed, as well as the workplace at home and eventual disturbances while working from home. Concentrated, focused and independently fulfilled work tasks are best supported when working from home. Activities that require communication among teams are best supported in the office. Observations on the subject of the hybrid office are limited due to the newness of this development. Empirical studies don't show long-term observations on the topic yet.

Keywords

Hybrid office, New ways of working, Working from home, Productivity.

1 INTRODUCTION

The last two years were exceptional in regards to experiencing new ways of working. Employers sent their employees home as a safety regulation, one response to calm the widespread of the Coronavirus. As a result, many employees found themselves in a completely new, but in the same way very familiar, work environment: their own home. Wherever business sectors allowed, employees worked from home to ensure work to be in a continuous flow, even without presence at the office. Austria underwent a lockdown in March 2020. The governmental regulations at that time stated that „(...)a professional activity should preferably take place outside the workplace, if this is possible and employers and employees find an agreement on this.” (Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz 19/3/2020). Starting with these nationwide restrictions, times for new ways of working made their way, as well as in other countries like Germany and Switzerland. During our research activities there were no restrictions from the government regarding work in traditional offices, but there were recommendations for companies to work from home wherever possible (Steigende Virus-Zahlen: Regierung und Sozialpartner empfehlen Home Office 2020). During this time working from home boomed not only in Austria and the other countries of the DACH-region (Austria, Germany and the German speaking part of Switzerland), but around the whole world. Now, almost 2 years after the first decisions on

sending a broad range of people home to work from there, many employees still remain working from home, even though many lockdowns are already over. This way a comparison of workplaces at the office and at home is possible. This results in the following scientific questions:

- Which place is the better workplace? Is work better to be done at the office, at home or even at both places?
- Where do employees prefer to do different kinds of work? Does the preference of a work environment rely on the kind of work, which needs to be done? Does productivity differ looking at the diverse work tasks in comparison with the work environments?

The paper starts to set a context on recent workplace topics, which allows a view into empirical findings around COVID-19 influenced developments. Including results from literature research, the paper shows results on a rolled-out survey, in which tendencies of the future workspaces in the DACH-region emerge. For reasons of better readability, the term “work from home” will be shown as the abbreviation WFH.

2 METHODOLOGY

2.1 Research design

In 2017 we, scientists of the department of Real Estate and Facility Management at TU Wien, conducted a survey on “Home Office” addressing managers from different companies in Austria (Hax-Noske, Redlein 28/6/2017-1/7/2017). Due to recent developments (disproportionate number of employees working from home as one effect of the COVID-19 crisis), we decided to renew our survey, to shed light on changes in opinions in 2020. Additionally, a literature research was carried out to include the current status quo of scientific research and publications of influential advisors in the update of the questionnaire. Including new questions, we carried out a 22-question survey addressing managers of top and middle management from different companies. We received 44 fully completed responses from managers in the DACH-region.

2.2 Literature research

We conducted an intense unsystematic literature research, including the following combination of words: WFH, social interaction, productivity, belonging to the firm, amount of days in office and home, work tasks in office and home etc. Answers were searched in published academic papers and publications from property management companies and real estate consultants, to get a broader picture on the status quo.

2.3 Survey content

Our questionnaire contained several categories examining fields of WFH but also of work at the office. In this paper we concentrate on the following research areas:

- general experiences with WFH;
- practices with different kinds of work tasks in the office and at home; and
- comparison of the office and home as work environments.

The questionnaire started questioning about general experiences with WFH. Due to the recent work situation, it therefore also covers questions like experiences and extents with WFH in comparison with the times before the crisis and during the crisis (Waldhauser 2020, p. 10). Furthermore, the respondents were asked for their opinion on the further use of WFH after the crisis. In order to answer the second research question, we decided to diversify work tasks of a common office workday, assuming it to be performed at both homes and offices, starting with main work tasks, such as concentrated work, meetings and routine tasks. In a next step we asked where and how the polled participants expected to perform these tasks usually (Hax-Noske, Redlein 28/6/2017-1/7/2017). Finally, the questionnaire seeks answers about the home

as a workspace, including space conditions, equipment and possible disturbances working in this most private space.

2.4 Survey conduction

The conduction of the survey took place between 28/7/2020 and 17/9/2020. During this period a number of 44 fully completed surveys were collected. The measurement period was selected because the nationwide COVID-19-reasoned lockdowns in each DACH-region ended a few weeks before. It was therefore assumed that the employees had already dealt with the new way of working – either WFH, or even the hybrid office.

2.5 Survey sample

Table 1. Descriptive statistics

	<i>n = 44</i>	Sample (%)
Gender	Female	31.8
	Male	68.2
Management Level	Top Management	22.7
	Middle Management	77.3
Generation	Y	18.2
	X	59.1
	Baby Boomers	22.7

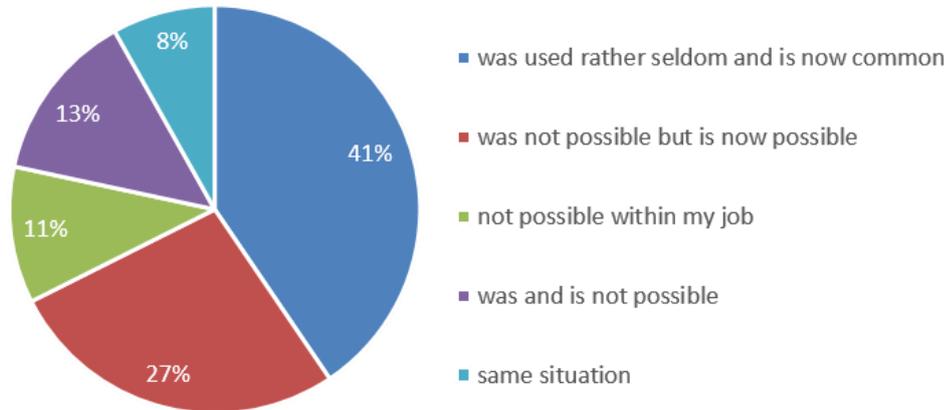
Our questioned partners were sampled among a pool of corporations the researchers have connections with. The majority of the people asked to work in the service industry like auditing, consulting, IT services and legal services. The advantage of surveying people from different organisations is hoped to give a broader picture on the diverse implementation of work tasks. The sample of respondents consisted of 44 participants, out of which were 14 female and 30 male persons. The survey was addressed to top (10) and middle managers (34) from differing companies in the DACH-region. The average age of all participants measured 48,9 years, splitting up into 18% Generation Y, 23% Baby Boomers and the largest Generation X with 59% (see table 1).

3 RESULTS

A look into statistics shows a high tendency of Austria's employees to WFH and the trend is not new. According to numbers by Eurostat, the number from total employed Austrians who experienced WFH, was higher than the EU-average already before the crisis. For the last ten years the rate was at a constant level of 10,2%, while the EU-average was constant at a value of 5%. In 2020 the rate increased up to 18,1%, following countries like Finland, Luxembourg and Ireland, which had even higher levels of employees working from home (Eurostat 2022). Even though workplace trends showed a turnaround towards less WFH and more work in offices (Beaudoin et al. 2020). With the emerging COVID-19 crisis at the beginning of 2020, this development achieved even higher levels. According to our participants, WFH was one of the most often chosen responses to face the COVID-19 restrictions. 41% of the survey participants named that the possibility of WFH was used rather seldomly before the COVID-19 pandemic and then became common. There was an amount of 13% who stated that WFH was not possible before the crisis and still is not possible (see figure 1). 11% of all respondents stated that within their jobs WFH was and still is not possible within their jobs. A discussion around WFH can only happen when considering that not every person is able to WFH. Reasons can be found within the professional requirements. Data of the Institut für empirische Sozialforschung, one of the largest market and opinion research companies in Austria, show

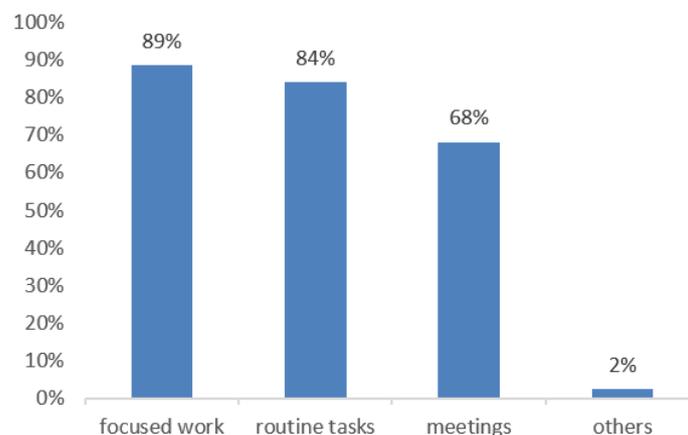
that for almost half of the questioned employees WFH is not possible in their jobs (Waldhauser 2020, p. 10).

Figure 1. Change of WFH-use before COVID-19 and now



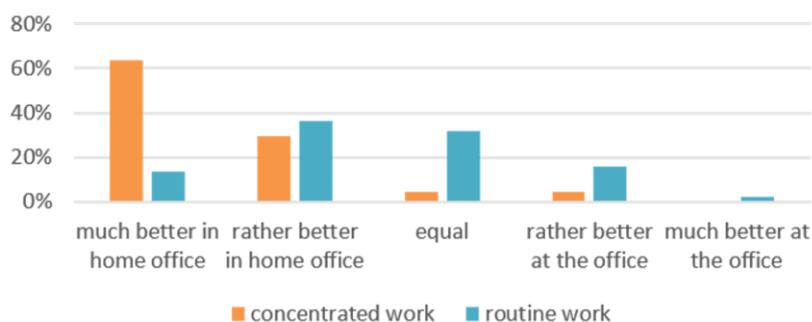
As indicated in our research questions we tried to find out about the differences of work tasks performed at home and in the office. We approached our participants asking them about the different tasks they fulfilled while working in the home office. To sum up all work tasks performed while WFH, we created 3 supergroups: focused work, routine tasks, meetings and others (this should give the possibility to our participants to add supplementary). The basis for our decision to focus on these three categories of WFH, laid in the former survey conducted in 2017. We expanded the answer options with another kind of communication, which seemed immanent due to the high actuality of exchanging with others: meetings. 89% of our respondents reported performing focused work while WFH. In our survey we described this activity with the following words: reading of contracts or texts etc. during working from home. We described routine work with the following words: reading/responding to emails, taking part in telephone calls and video conversations or booking business trips etc. Routine work was rated with 84% of being fulfilled while WFH. Both high results match with our observations from our survey in 2017. Participating in meetings followed up with 68% (see figure 2). Even though the hard lockdown was already over, this high rate might be reasoned in the still high degree of employees WFH. With a high level of people WFH, employees had to fulfil all their different tasks during WFH.

Figure 2. Tasks carried out at home 2020



While trying to shed light on the differences of work tasks, we decided to focus on direct comparisons between the workplace at the traditional office and at the home office. One of the most important questions in regards to work performance is seen in the productivity of employees. There are divergent answers to the question of whether the productivity of employees at the home office is higher than in the traditional office or not. According to a report by OWL Labs and Global Workplace Analytics, 75% of people are the same or more productive during COVID-19 while working from home (Owl Labs 2020, p. 11). The exact opposite of the statement mentioned is given by the Institut für Wirtschaftsforschung in Germany. According to their research, only 18% of people who WFH say to be more productive when working from there. A third of the people who WFH even complain of deterioration (Dribbusch 2021). The direct comparison of productivity in these very different places of work makes it possible to see which place is better suited for which activity. Asking our participants about their experiences on productivity at both offices and homes, we could see that there was a clear preference of performing concentrated work tasks at home (see figure 3). While the question of concentrated work conveyed a clear preference towards WFH, the statements about routine work were somewhat lower. Respondents decided that routine work was rather better at home or equally performed from home or the office. This may result from the fact that routine activities often take place in coincidental cooperation with other colleagues, without actual meetings. According to Kellner et al. communication and cooperation among teams is not easily feasible from home. An exchange among teams needs to be consciously planned. The authors name virtual meetings, which can easily be fulfilled while working from home, because they support more efficient and time-saving work. Also, the authors give cause for concern that group dynamics, active discussions and creative work are way more complicated to put into practice – random gatherings are not as easily possible when WFH (Kellner et al. 2020). These gatherings need to willingly be organised by the employees themselves. Also, it needs to be taken into consideration that remote workers often feel left out while working from home. That is why the feeling of belonging to a team needs to be strengthened (Redlein 2020, p.186). Therefore, the implementation of suitable IT-systems and effective solutions to support communication helps to increase productivity while WFH (PricewaterhouseCoopers 2020, p. 9).

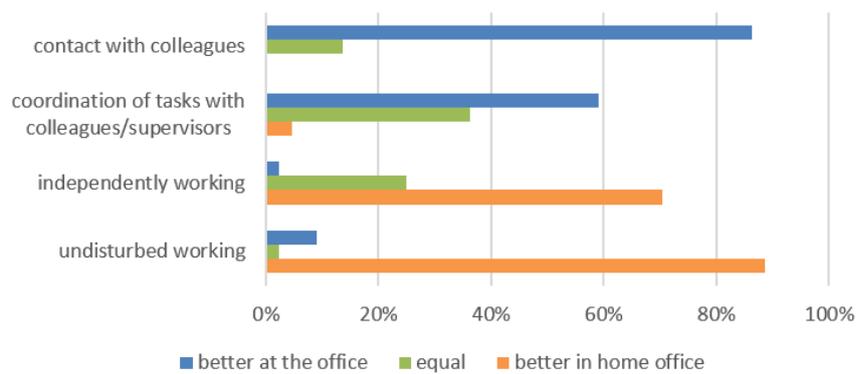
Figure 3. Productivity at the office and while working from home



A differentiation between work that needs to be done in teams and individual work is necessary. Due to the missing immediate spatial proximity of employees, which is given in the case of work at home, we were interested in our respondents' experiences with their contact with colleagues from distance. Our participants showed a clear preference towards work at the office for its increased possibility to exchange with their colleagues (86,4%). According to their

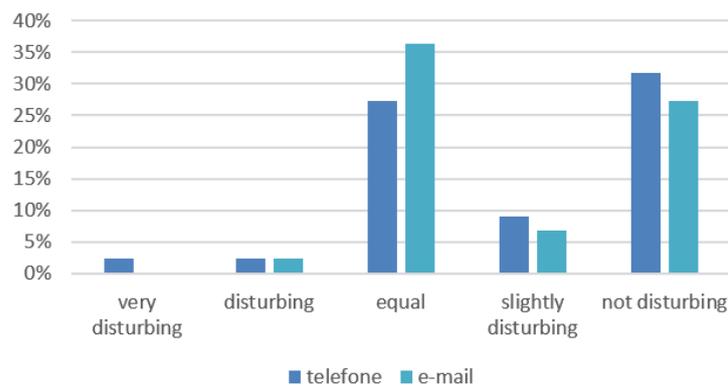
responses, almost two thirds (59,1%) answered that the coordination of work tasks with colleagues and supervisors was better at the office than from home. More than a third (36,4%) said that equally the office and the home office are suited for this kind of exchange (see figure 4). Direct, immediate contact between colleagues without distance seems to be a clear advantage of office spaces, but equally shows negative aspects: “Office structures such as open-plan offices often do not offer the necessary peace and quiet to be able to work in a particularly concentrated manner on a task” (Kellner et al. 2020). Furthermore, the authors point out the majority of unplanned interruptions in the office. Looking into the preferences of our survey participants, 88,6% decided that WFH shows a clear advantage of possible undisturbed working.

Figure 4. Tasks preferred to be done at the office or at home 1



Certainly, disturbances in the workflow can equally be found both in traditional offices and home offices. Asking our participants on their experiences with distractions, we found out that disturbances through work related communication showed the highest results (see figure 5). 36% of our participants answered that they were most interrupted doing their tasks because of e-mails they received or/and they had to answer. 27% reported that they get equally interrupted through telephone calls. Reasons for this could be that often working from home had to significantly increase accessibility to be able to exchange with supervisors and team colleagues.

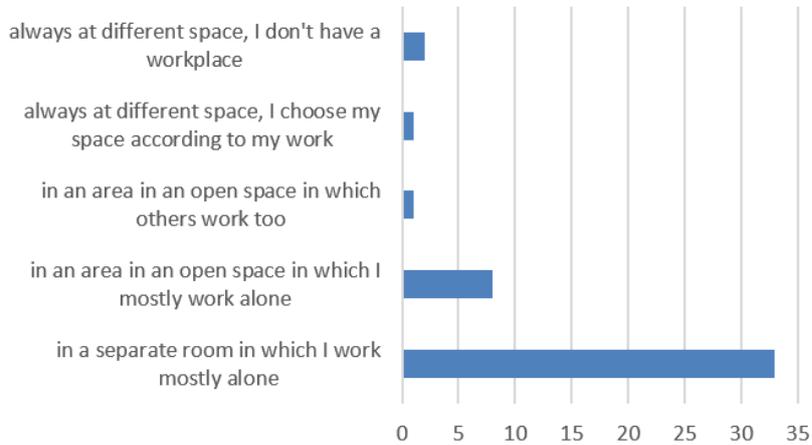
Figure 5. Disturbance through work related communication



Working from home generates questions on the space employees are working in. In order to differentiate both spaces of work, we wanted to learn from the different work settings our participants work in. We learned that 33 respondents had a separate room in which they mostly work alone. Eight of our questioned managers named a separate area in an open space, in which they work mostly alone. Only one participant said that he had to share this workspace. Another participant reported that he always had to look out for another workspace depending on the

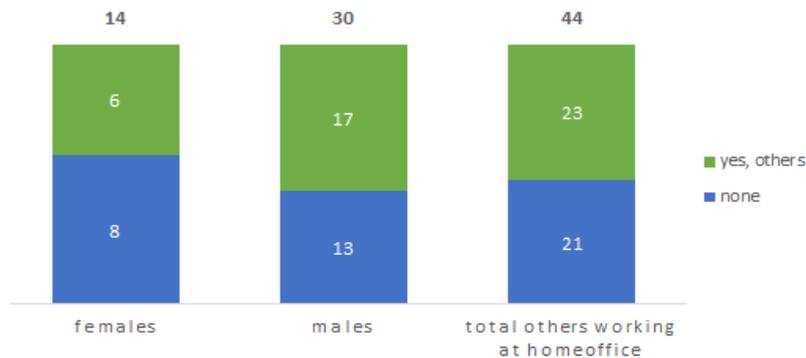
kind of work he is doing. Two participants stated that they had to change their spaces they work in, because they didn't have a proper one (see figure 6). What we can see from these results is that most of our participants have a large enough home to fit in their workspace.

Figure 6. Spaces to perform work from home



In Addition to the available spaces of work, the survey analysed the number of other people working at our managers' home offices. Half of our participants reported that they either worked alone or with at least one other person in the home office. Compared to the number of participating women and men, we have identified a relatively large proportion of women who work in the home office without additional residents: these make up one third of the questioned persons who worked alone within their home office and half of all participating women (see figure 7).

Figure 7. Others working at home office



When focusing on the differing workspace options, the results of possible disturbances immediately come back to mind. Interestingly the respondents who felt interrupted in their work due to their spatial surroundings were not the same as the ones who did not have a proper workspace. Compared to mentioned disturbances through work equipment, our results show that there was a very low disturbance due to the environment or other people (see figures 8 and 9). Reasons for these results could be found in our questions about the WFH spaces. As described in figure 6, over one third of our participants mostly work alone within their workspace.

Figure 8. Disturbance through spatial surroundings

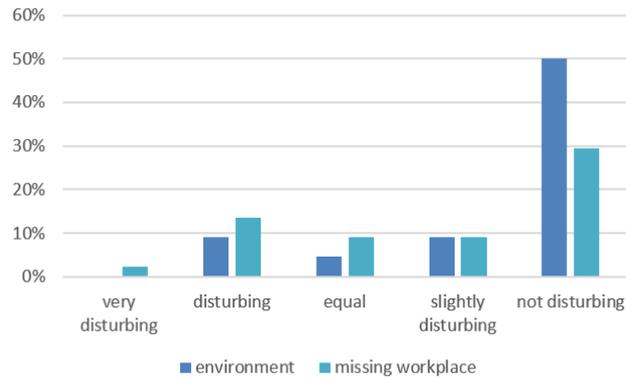
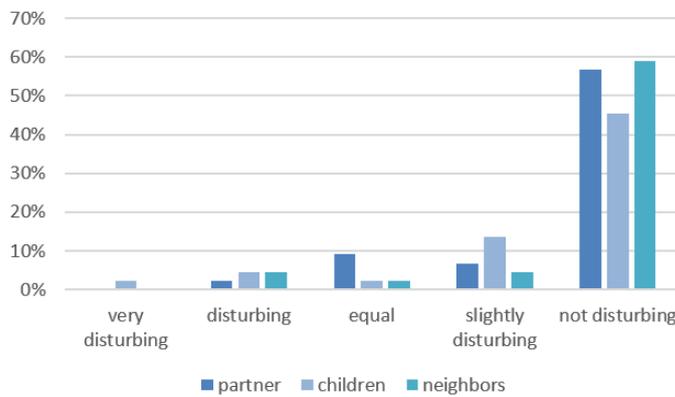
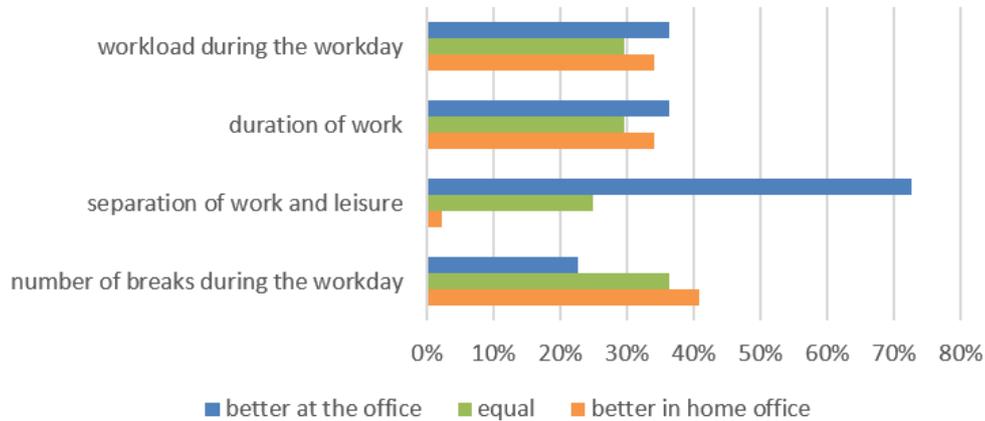


Figure 9. Disturbance through other people



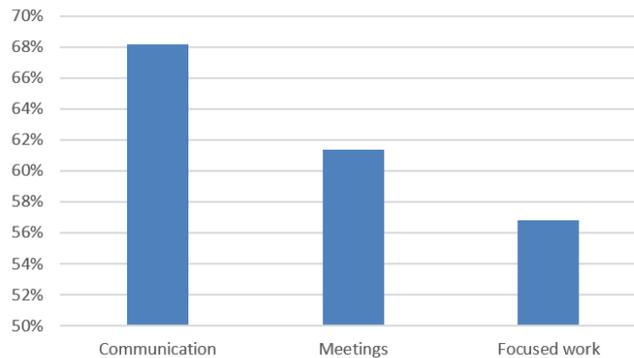
Working from home in the most private space creates challenges for employees with their private life. According to CBRE Research in Austria the top 1 missed thing when WFH is a clear separation between work and home (CBRE Research 2020). Asking our participants about their experiences with this extraordinary situation, we found out that the separation of work and leisure is the most challenging fact while WFH: 72,7% preferred working at the office for its better possibility of separating work and leisure (see figure 10). Responses to our questions on the number of breaks during the workday showed that 40,9% preferred WFH. Some reasons for these results can be the cessation of commuting and the possibility to include private matters within a workday. The option of including private matters has consequences to the wellbeing of employees WFH. Rocco Palumbo describes that this situation involves a greater willingness to work during unusual times. HR management would have to tailor practices to the needs of remote workers and find an equilibrium to support employees to manage their work-life interface when WFH (Palumbo 2020, p. 786).

Figure 10. Tasks preferred to be done at the office or at home 2



Wondering about the future development of different work contents after the COVID-19 crisis, we asked our survey participants on their vision. 68,2% of our participants said that they would expect communication mostly to happen in offices. 61,4% named meetings to happen in offices and 51,6% expect focused work would happen inhouse. These high estimations underline general experiences of offices to be places of exchange. PricewaterhouseCoopers confirms with a survey conducted in November and December 2020 that 87% of employees say that the office is important to support team collaboration (PricewaterhouseCoopers 2021).

Figure 11. Tasks carried out in the office after COVID-19



4 CONCLUSION

Common publications indicate a development towards the hybrid office. Through our research, we were able to make an approach towards the latest development of working environments. We started off with an intense literature research, which helped us extend an own prior survey from 2017, but also to underpin our research results and to widen our focus on differing results. Creating a second edition of our survey, we could compare results from 2017 to 2020, especially looking at developments due to the COVID-19 crisis. Within our paper we wanted to focus on the different opportunities spaces like the traditional office and the home office provide. Focusing on our scientific questions, we can provide answers of our participants on their general experiences with WFH. We learned that in one DACH country, Austria, the number of people WFH for many years is higher than the EU average. The majority of our participants reported that WFH was one response to the COVID-19 restrictions and was either used rather seldom or never before the crisis and then became possible, whereas one fourth responded that WFH is not possible in their situation. In our second research question we

approached the different work tasks carried out in the differing work environments. Our participants concluded that WFH is best suited for concentrated work tasks, firmly followed by routine work tasks for its independent and undisturbed workability. They even consider being more productive working on concentrated tasks WFH than in the office. There was a lower motivation for meetings performed from home as it was described to work best at the traditional office due to the proximity to other colleagues. In our last research questions, we tried to differentiate the two work environments. Most of our participants worked in a proper room for their workplace, but also mentioned doubts about a separation of work and leisure. A further step would be to enlarge the sample and analyse the results according to gender and organisational position of the interrogated persons. Due to the small sample size, it is not possible to make conclusions based upon these characteristics at the moment. Else, further observations upon generational specifics could add another perspective on the discussion about certain preferences. Finally, the question of which workspace is better suited cannot be answered with a strict monodirectional answer. The combination of workspaces in offices and homes gives a broader range of spaces, where work can be put forward. Each of these spaces has its own peculiarities that can support specific activities. WFH allows quiet, concentrated, undisturbed work, e.g. without distractions of passing colleagues. Productivity while doing concentrated work is expected to be higher when working from home than in the office. Working in the office shows the opposite: it supports exchange among teams and colleagues. The office promotes communication and provides settings for meetings – be they in person or virtually. Distractions, such as emails and phone calls happen in both work spaces regularly. A solution for home workers might be employee availability agreements. Doubts about an unhealthy work-life balance attitude can be countered by corresponding agreements with the employer, which regulates availability and working hours.

REFERENCES

- Beaudoin, C., Georgules, J., Raicht, T. (2020), *Tenant needs in a post-pandemic world. 2020 Forecast Series. Part Four: Navigating Post COVID-19*, edited by Jones Lang Lasalle IP, Inc. US. Available online at <https://www.us.jll.com/content/dam/jll-com/documents/pdf/research/2020-Forecast-Series---Tenant-needs-in-a-post-pandemic-world.pdf> (accessed 7 February 2022).
- Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz (3/19/2020): *Bundesgesetzblatt für die Republik Österreich: 108. Verordnung: Änderung der Verordnung gem, §2 Z1 des COVID-19-Maßnahmengesetzes*. BGBlA_2020_II_108 2020, available online at https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBlA_2020_II_108/BGBlA_2020_II_108.pdfsig (accessed 3 February 2022).
- CBRE Research (2020), *Work from Home Survey 2020*, Flipping the Paradigm. CEE & SEE. In *CBRE Research*. Available online at http://cbre.vo.llnwd.net/grgservices/secure/CBRE_CEE%20and%20SEE_Work%20from%20Home%20Survey%20Special%20Report.pdf?e=1621427939&h=dc2be948e8b524bfbfb1a66c17db66a2 (accessed 19 May 2021).
- Dribbusch, B. (2021), *Folgen von Corona für die Arbeitswelt: Heimarbeit als Elitemodell*, available online at <https://taz.de/Folgen-von-Corona-fuer-die-Arbeitswelt!/5760095/>, updated on 4/1/2021 (accessed 19 April 2021).
- Eurostat (Ed.) (2022), *Employed persons working from home as a percentage of the total employment, by sex, age and professional status (%)*, available online at https://ec.europa.eu/eurostat/databrowser/view/lfsa_ehomp/default/table?lang=en (accessed 3 February 2022).

- Hax-Noske, C., Redlein, A. (2017), *Home office - Show me your Workplace*. ERES European Real Estate Society, Delft, 28/6/2017-1/7/2017. Available online at https://publik.tuwien.ac.at/files/publik_261021.pdf (accessed 3 February 2022).
- Kellner, B., Korunka, C., Kubicek, B., Wolfsberger, J. (2020), *Wie COVID-19 das Arbeiten in Österreich verändert. Flexible Working Studie 2020*, edited by Deloitte Consulting GmbH. Available online at https://www2.deloitte.com/content/dam/Deloitte/at/Documents/human-capital/Deloitte-Flexible-Working-Studie-2020.pdf?logActivity=true&utm_campaign=Final_DF_Studiendownload_Flexible_Working_Studie_20200721&utm_source=newsletter&utm_medium=newsletter (accessed 9 February 2021).
- Owl Labs (2020), *State of remote work: How employees across the U.S. feel about working remotely in a post-COVID-19 world, their new workplace expectations and what employers need to know to recruit and retain top talent*, Covid edition, available online at https://www.owl-labs.com/hubfs/website/sorw/2020/owl-labs_sorw-2020_report-download_FINAL_07oct2020.pdf (accessed 30 October 2020).
- Palumbo, R. (2020), *Let me go to the office! An investigation into the side effects of working from home on work-life balance*, In *IJPSM* 33 (6/7), 771–790. DOI: 10.1108/IJPSM-06-2020-0150
- PricewaterhouseCoopers (Ed.) (2020), *Mehr Home, weniger Office. PwC-Studie zu Corporate Real Estate Management. Wann sich eine Flächenoptimierung für Nutzer rechnet*, available online at <https://www.pwc.de/de/real-estate/mehr-home-weniger-office.pdf> (accessed 19 April 2021).
- PricewaterhouseCoopers (2021), *PwC's US Remote Work Survey. It's time to reimagine where and how work will get done*, edited by PricewaterhouseCoopers. Available online at <https://www.pwc.com/us/en/library/COVID-19/us-remote-work-survey.html> (accessed 10 March 2022).
- Redlein, A. (Ed.) (2020), *Modern facility and workplace management. Processes, implementation and digitalization*, Springer Nature Switzerland AG. Cham: Springer (Classroom Companion).
- Steigende Virus-Zahlen: Regierung und Sozialpartner empfehlen Home Office (2020), In *Kleine Zeitung*, 14/9/2020. Available online at https://www.kleinezeitung.at/international/corona/5866585/Steigende-VirusZahlen_Steigende-VirusZahlen_Regierung-und (accessed 3 February 2022).
- Waldhauser, A. (2020), *Homeoffice: Von vielen gut angenommen, aber Verbesserungsbedarf*, with assistance of Stefan Friesenbichler, Christoph Hochwarter, Anna Schiff. Edited by Institut für empirische Sozialforschung GmbH. Available online at <https://www.ifes.at/aktuelles/homeoffice-studie2020> (accessed 31 January 2022).

What do knowledge workers actually do? A framework to develop a new taxonomy for knowledge workers' activities

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ABSTRACT

Activity based working environments (ABW) are supposed to facilitate various work processes and work patterns. Upcoming ways of working, such as Agile and experience with working from home during COVID-19, suggest that office buildings need to change to fit new trends. The experience with compulsory working from home has made people think differently about where they can perform their work activities. Employees indicate that they want to work from home more often. This is expected to lead to different activity patterns in the office, in turn leading to a host of subsequent questions. How were activities of knowledge workers defined precisely in the pre-COVID period? Does the partly changing location of knowledge work call for changed definitions of activities? Which new work patterns can be distinguished and what is their effect on possible adaptations of office buildings and other physical environments aimed to 'fit' the individual knowledge worker? A clear answer to these questions is crucial for making sure that the activity-based environment meets the requirements of knowledge workers. In this paper we focus on providing a framework for defining activities. With this way aim to start the discussion about the intricate post-COVID relation between worker, workplace and activity.

Keywords

Work patterns, Activities, Work environments, Activity-based working, Taxonomy, Knowledge work.

1 INTRODUCTION

In the first stage of the evolution of the office, work environments in office buildings were designed as 'white collar factories' (van Meel, 2000). In the course of the 20th century the ideas about the most suitable configuration of the office started to change. From the 1990's onwards, the leading idea became that offices should be configured in an 'activity-based' way, meaning that various workplaces should be designed in order to support various activities (Engelen, et al., 2019). During the first two decades of the 21st century, activity-based working (ABW)

became a highly popular theory, the ‘rise’ of which will not be followed (quickly) by a subsequent ‘fall’ (Leesman, 2017). The COVID-19 pandemic further strengthened the idea that it is possible to work at a variety of places, including home (Appel-Meulenbroek, Kemperman, Van de Water, Weijs-Perrée, & Verhaegh, 2022). The experience with working from home during the COVID-19 pandemic led to the idea that ‘hybrid’ ways of working – meaning: working partly in the shared office, partly elsewhere – can be applied in a more structural manner (Appel-Meulenbroek, Looijen, Hoekstra, Jongens-van der Schaaf, & Weijs-Perrée, 2021). This development leads to a series of interesting questions. As the ruling flexibility-paradigm in offices is based on the notion of ‘activity’, it is – firstly – interesting to recapitulate how the different activities of office workers are defined and underpinned in theories about the activity-based workplace. Secondly, it is interesting to test whether these definitions of activities still meet the requirements in the post-COVID office. Does the (partly) changing physical environment for office work call for new definitions of the activities of office workers? Lastly, it may be worthwhile to rethink the actual translation of activities in the physical configuration of various activity based workplaces. Does the changing way of working urge practitioners to change the way in which they design offices and other places meant to support knowledge workers? In this paper we aim not so much to provide definite answers to all these questions. Rather, our objective here is to provide some material on the basis of which this discussion can be started and carried on in a structured manner. In order to meet this aim, we will firstly elaborate on some of the existing classifications of activities and theories dealing with the alignment between individual office workers and workplaces (section 2). In section 3 we will treat some theories and ideas that have been put forth – or can be used – in order to provide a theoretically grounded taxonomy of the several activities that are (supposed to be) performed by knowledge workers.

2 ‘ACTIVITIES’ IN THE LITERATURE

2.1 Activities

The development of new offices and ABW-environments have received a lot of attention in the academic literature (Duffy & Powell, 1997) (Appel-Meulenbroek, Groenen, & Janssen, 2011) (Hoendervanger, 2021) (Van Meel, 2020) (Engelen, et al., 2019). In this context, various authors have written about activities. An often-used classification in this respect is the basic distinction between *individual* and *collaborative* activities (Drucker, 1996) (Duffy & Powell, 1997) (Duffy & Tanis, 1999) (Appel-Meulenbroek, Groenen, & Janssen, 2011) (Worthington, 1997) (Beckers, 1997) (Haynes, Suckley, & Nunnington, 2019). Some add more detail to this basic distinction, adding ‘a mixture of both’ to the concepts of ‘concentration’ and ‘communication’ (Appel-Meulenbroek, Kemperman, Van de Water, Weijs-Perrée, & Verhaegh, 2022) or using this basic bifurcation for a fivefold distinction ‘highly collaborative’, ‘collaborative’, ‘balanced’, ‘individual’ and ‘highly individual’ (Leesman, 2020). Still, it is clear that the basic distinction is upheld. A lot of distinguished activities by different authors (see table 1) can be divided in this basis distinction. Yet, the apparent agreement concerning this distinction is not to say that there are no divergencies in the different classifications of activities. Consider table 1:

Table 1. Distinguished activities by various authors

Author	Beckers (1997)	Fruytier (2002)	CFPB (2016)	Leesman (2017)	Measurement (2021)	Van Gelder et al. (2022)
Individual activities	Individual/process activities	Individual process activities	General deskwork	Individual routine tasks	Individual low concentrated work	Activities which need a broad focus

	Concentration work		Concentrated deskwork	Individual focused work, desk based	Individual high concentrated work	Activities which need a deep focus
	Individual work	Individual innovative/creative activities with a high difficulty level				Asynchronous activities
		Individual process activities outside the office				
	Outside of the office/account management (i.e. outside of the office meaning; working at clients etc, not teleworking)	Individual innovative/creative activities with a high difficulty level outside the office		Individual focused work away from your desk		
			Reading	Reading		
				Thinking/creative thinking		
			Telephone conversations /Calling	Telephone conversations		
	Management activities					
			Document management			
Group orientated activities	Group orientated work	Group orientated process activities				Synchronous activities
	Dynamic group work/project work	Individual and group orientated innovative/creative activities with a high difficulty level	Interactive deskwork	Collaborating on creative work		Activities which need a broad focus
				Collaborating on focused work		Activities which need a deep focus
	Outside of the office/account management (i.e. outside of the office meaning; working at clients etc, not teleworking)	Group orientated process activities outside the office				

		Individual and group orientated innovative/creative /management activities with a high difficulty level outside the office				
			Planned (formal) meetings	Planned meetings	Physical meetings	
				Larger group meetings or audiences		
			Unplanned (informal) meetings	Informal unplanned meetings		
				Informal Social interaction		
				Audio conferences		
				Hosting visitors, clients or customers		
				Video conferences	Digital meetings	
				Business confidential discussions		
				Private conversations		
				Learning from others		
					Hybrid meetings	
Other activities	Transactional work					
				Relaxing/taking a break	Taking a break	
				Spreading out paper or materials	Other	
				Using technical/specialist equipment or materials		

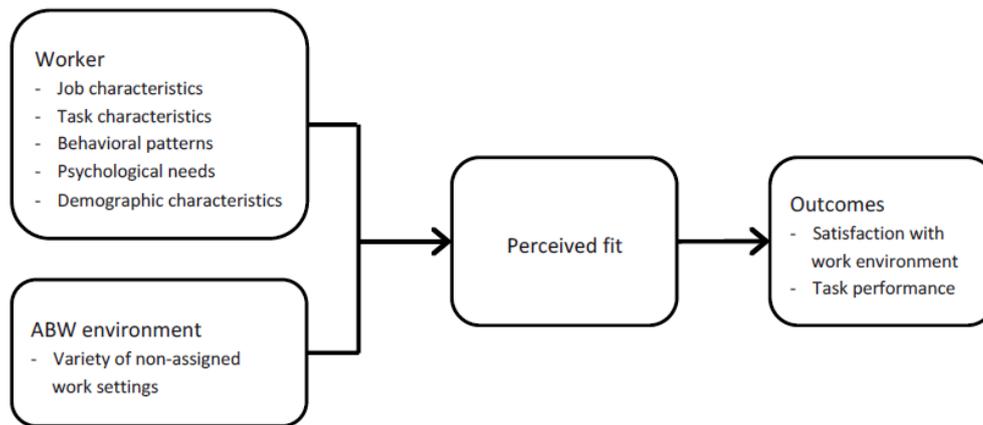
Table 1 shows that there is considerable divergence in the terms that are used in order to describe activities by office workers. There appears to be no clear and validated foundation for the terms used by various authors. Even though most of the activities mentioned are intuitively accurate, the terms lack theoretical clarity. Is the distinction between ‘individual activities’ and ‘collaborative activities’ indeed synonymous to the distinction between ‘concentration’ and ‘communication’? Is it really possible to distinguish between ‘concentration work’ and ‘group-oriented work’? Is ‘creative work’ necessarily different from ‘focussed work’? And what do

the distinguished activities mean for the configuration of the actual workplaces designed to meet the needs of knowledge workers?

2.2 P-E Fit Theory

An answer to this latter question may be provided by P-E Fit Theory. This theoretical perspective has contributed considerably to activity-based workplace design (Armitage & Nassor Amar, 2021). Still, it must be noted that activities play a relatively subdued role in P-E Fit Theory. Consider the following research model, designed by (Hoendervanger, 2021):

Figure 1. Research Model 'On Workers' Fit with Activity-Based Work Environments', (Hoendervanger 2021).



Hoendervanger is not blind to the importance of activities performed by the worker. But a fundamental analysis of activities is not provided (nor intended) in his thesis. The main concepts of the model are the *worker* and the *environment*. The concept 'activities' does not have the same conceptual status as either 'worker' or 'ABW environment'. A similar stance can be recognized in the meta-analysis of person-environment interaction by Kristof-Brown et al. (2005). They analyse 'four critical domains of PE-Fit': person–job, person–organisation, person–group, and person–supervisor fit (Kristof-Brown, Zimmerman, & Johnson, 2005). The relation between worker and activity is not specified as a relevant unit of analysis.

2.3 The activity-worker-workplace triangle

The relatively little attention paid to a systematic and validated classification of activities is somewhat surprising, considering the fact that the activity-based office carries the very term 'activity' in its name. This at least suggests that the definition of activities is crucially important for establishing a fit between person and environment. Indeed, the suitability of an activity-based workspace appears to depend on at least *three* equally important factors:

1. the fit between the worker and the various workplaces provided by the organisation
2. the fit between the worker and the activity
3. the fit between a workplace and the activity that is to be performed.

This basic idea can be expressed in the following way:

Figure 2. The activity-worker-workplace triangle



This triangle aims to convey that the concept ‘activity’ is crucially important in providing ‘fit’ between worker and workplace. Take for example a speed skater entering a hall with a swimming pool. It is clear that this particular workplace is only ‘fit’ for the worker if the activity the speedskater aims to perform is ‘swimming’. For indeed, if the intended activity is ‘speedskating’, the situation leads to results that probably would be defined as sub-optimal by the speedskater. A similar example can be constructed for the case of a knowledge worker. Let us say that a knowledge worker who defines herself as a ‘design aficionado’ enters a beautifully designed lounge space in an office building. *Prima facie* the fit between the person and the environment appears to be optimal in this situation. However, one aspect was still left out of the equation here: the intended activity. If the knowledge worker intended to have nice conversations with her colleagues, the fit between person and environment could perhaps not have been better. But if it was her explicit aim to work on an important presentation that needs to be delivered tomorrow morning, the lounge area – well-designed as it may be – is clearly suboptimal for the task at hand. A clear definition of what the intended activity amounts to is crucial for making sure that an activity-based environment meets the requirements of knowledge workers. This is all the more important in a context in which hybrid ways of working gain ground. As the growing popularity of hybrid working is expected to lead to a partial shift in the physical workplaces used by knowledge workers (Appel-Meulenbroek et al., 2022), it is necessary to critically (re)consider the activities which are likely to be performed by knowledge workers.

3 TOWARDS A NEW TAXONOMY OF ACTIVITIES

3.1 Activity Theory

In order to underpin the importance of designing a systematic taxonomy of clearly defined activities, it may be instructive to return to the example of the speed skater entering the swimming pool once more. Let us suppose that before visiting the swimming pool the speed skater makes a phone call asking the proprietor of the hall whether it is possible to visit the hall this afternoon in order to do some ‘sporting activities’. In this case the answer of the proprietor of the hall would probably be: ‘this is absolutely possible, as our hall is suitable for sporting activities’. Despite this valid answer, there still is the danger of a serious mis-fit. For if the speed skater intends to skate this afternoon, the fit between worker, workplace and activity remains questionable. The designation ‘sporting activities’ was not precise enough to establish the fit between the worker and the workplace. Even though there may have been a good fit in

terms of the four critical domains distinguished by Kristof-Brown et al. (2005), the P-E Fit in this example is not ideal. The fit between worker, workplace and activities requires a clear and well-defined division and subdivision of activities. In this respect Activity Theory (AT) provides a good guideline. AT is based on the idea that there is in fact a close connection between the conscious mind of the actor and the activity she aims to perform (Leont'ev, 1978) (Babapour, Cobaleda-Cordero, & Karlsson, 2021). In the context of this theory, 'activity' can be defined as 'a goal directed system, where cognition, behaviour and motivation are integrated and organised by the mechanism of self-regulation toward achieving a conscious goal' (Karwowski, 2004). Crucially, AT distinguishes three hierarchical layers: 'activity', 'action' and 'operation' (Leont'ev, 1978) (Babapour, 2019). Distinguishing these layers allows for a more detailed description of activities, enabling a suitable alignment between worker and workplace.

In the case of the speedskater, this subdivision can be made in the following way:

Activity: Sporting

Action: Speedskating

Operation: Creating a forward movement by putting force on ice

A similar subdivision can be made for the case of the knowledge worker, aiming to prepare a presentation. This particular activity can be subdivided tentatively in the following way:

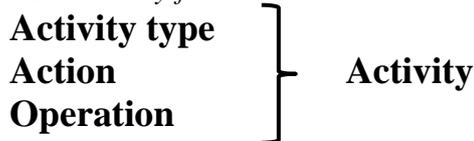
Activity: Individual work

Action: Writing

Operation: Making a report with clever remarks and attractive features

To be sure, this is only an example. The proper categories can only be established after empirical research. Moreover, in its present rendering, there is the danger of a conceptual mix up, as the term 'activity' appears to be somewhat equivocal: it can be used in order to designate two distinct concepts: the highest hierarchical layer in the proposed conceptual framework, *and* the hierarchical structure in its entirety. In order to prevent any possible conceptual mix up, the highest hierarchical layer in our framework will be denoted with the term 'activity type'; the term 'activity' will be used as a general designation, comprising all hierarchical layers. Hence, we propose the following basic framework:

Figure 3. The activity-framework



3.2 An existing taxonomy

Figure 3 shows the skeleton (so to speak) of the framework we aim to present in this paper. Clearly, in order to fulfil its intended purpose – i.e. to provide the basis for developing a validated taxonomy of knowledge workers' activities – this theoretical skeleton needs to be fleshed out. In this regard the report 'A Taxonomy of Office Activities for Business and Education' by Huffman et al. (1968) provides us with additional conceptual resources. In this report, Harry Huffman and his colleagues at Ohio State University aim to provide 'systematic guidance for observing and analysing office activities, a common language for describing office activities, a basis for consolidating data from many locations and occupations, and a basis for writing performance goals' (Huffman, Brady, Peterson, & Lacy, 1968). Interestingly, the authors base their taxonomy on a classification of action verbs. They claim that 'with a properly selected list of verbs, an all-inclusive list of office tasks and activities can be developed by adding nouns, adjectives, and phrases to the verbs'. (Huffman, Brady, Peterson,

& Lacy, 1968). The resulting taxonomy incorporates three different dimensions: the *operating* dimension, consisting of verbs which all centre around the idea of processing data; the *interacting* dimension, consisting of verbs which somehow express the idea of interaction with either people or the immediate environment; and the *managing* dimension, consisting of what they call ‘administering verbs’. These three domains encompass what the authors call ‘primary division verbs’, which describe a general activity (see table 2).

Table 2. Primary division verbs in three dimensions (Huffman, Brady, Peterson, & Lacy, 1968).

	Operating	Interacting	Managing
Primary division verbs	Arranging Calculating Collecting Comparing Composing Indexing Manipulating Modifying Purging Recording Storing Transmitting Verifying	Communicating Assisting Copying	Planning Organising Actuating Controlling

Apart from these ‘primary division verbs’, the authors distinguish so-called ‘secondary division verbs’, describing all forms of specific activity which can be grouped under the primary division verbs (see the examples in table 3 and 4).

Table 3. Secondary division verbs of action verb ‘arranging’ (Huffman, Brady, Peterson, & Lacy, 1968).

Primary division verb (Operating dimension)	Secondary division verbs
Arranging	Batch Collate Compile Sort Rank Other

Table 4. Secondary division verbs of action verb ‘communicating’ (Huffman, Brady, Peterson, & Lacy, 1968).

Primary division verb (Interacting dimension)	Secondary division verbs
Communication	Affirm Answer Canvass Consult Debate Demand Describe Detail Discuss Elicit Emphasise

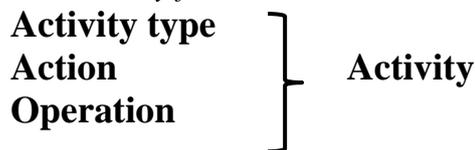
	Explain Express Inquire Invite Listen Negotiate Page Persuade Question Quote Repeat Request Reveal Suggest Summarise Thank Other
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Several things come to mind with respect to this intricately designed taxonomy. Firstly, it cannot escape our notice that Huffman et al. (1968) distinguish hierarchical layers of activities. In this respect, Huffman’s method meets our aims. As is clear from the proposed activity-framework (Figure 3), a new taxonomy of activities does not only provide a comprehensive list of singular operations, but also – and perhaps even more importantly – provides a grounded classification of these singular operations into more general groups of actions, which can in turn be grouped under comprehensive classes of activity-types. Another interesting aspect of the methodology used by Huffman et al. is their choice to use action verbs. Verbs express an activity, action or operation and can be enriched by using additional expressions so as to pinpoint what is meant specifically when describing and categorising a certain activity (Huffman, Brady, Peterson, & Lacy, 1968). This perspective appears to be very promising with respect to the aim to flesh out the framework proposed in figure 3. The advantages of their method may lead to the question why it would still be necessary to design a new taxonomy. Does it not suffice to make use of the taxonomy put forth by Huffman et al.? There are good reasons to answer this question with ‘no’. Firstly, this theory dates back to 1968. This taxonomy was designed in an age during which knowledge work, for obvious reasons, differed considerably from today’s *modus operandi*. This has possible implications for the action verbs that are to be distinguished in order to denote operations, actions and activity types within our proposed activity-framework. Moreover, it can be doubted whether the general division in the operating, the interacting, and the managing dimension is still apt to describe and classify activities in the activity based office accurately. A second problem with the taxonomy of Huffman et al. (1968) is its complexity. As became clear with respect to the secondary division verbs in the class of ‘communication’, in certain cases the list of action verbs is so long that it is highly questionable whether the taxonomy still provides practitioners with the theoretical means on the basis of which they can design an environment which indeed fits the knowledge worker. Ideally, combined with the proposed activity-framework (figure 3), the method used by Huffman et al. (1968) leads to a new taxonomy which on the one hand clearly and unequivocally defines and describes all activity-types, actions and operations while on the other hand provides practitioners with sufficient theoretical clarity and simplicity to translate the taxonomic theory into everyday practice.

4 CONCLUSION

The activity-based office has developed into the leading principle in configuring offices. But remarkably enough no clear, unequivocal and up-to-date taxonomy of office activities can be found in the literature. Various authors and institutions have developed tenable classifications of activities. But these classifications lack a systematic empirical basis. Moreover the different classifications diverge considerably, leaving practitioners with relatively little substantive theoretical guidance in designing work environments which can be expected to fit the needs of knowledge workers. This problem becomes even more pressing now that organisations – due to the COVID 19-experience – expect a rapid shift in the use of work locations. In order to provide practitioners with theoretical guidance we propose to design a new and systematically grounded taxonomy of knowledge workers' activities. In this paper we have provided a structured outline for a route to develop such a new taxonomy. This proposed route consists of two main elements: a systematic framework, and an empirical method on the basis of which the theoretical structure can be fleshed out. Activity Theory served as an inspiration for the following systematic framework:

Figure 4. The activity-framework



The proposed way of fleshing out this framework is inspired by Huffman et al. (1968). Their taxonomy, consisting of hierarchical layers of action verbs, provides methodological inspiration for turning this theoretical construct into a practical tool – a new taxonomy of knowledge workers' activities – which can be used by practitioners to design and facilitate fitting activity-based environments.

5 LIMITATIONS AND RECOMMENDATIONS

In this paper we have presented a tentative framework with which it is possible to construct a new taxonomy of knowledge workers' activities. The goal of such a taxonomy is to provide practitioners with a systematic and unequivocal conceptual tool on the basis of which they are able design and facilitate environments for knowledge workers. Evidently, apart from a proposed framework and method, a lot more is needed before it is possible to present a full blown taxonomy. The lack of structured empirical data at this point is a clear limitation. Fleshing out the proposed framework in the indicated way requires considerable additional empirical study as well as a more detailed treatment of the indicated method. Another evident – and deliberate – limitation of the present paper is the strict focus on activities. As was made clear in section 2.3, a satisfying fit between worker, workplace and activities is only possible if all three aspects are taken into account. So the focus in this paper does not imply that the other two factors of the activity-worker-workplace triangle (figure 3) – or indeed the knowledge developed in the context of P-E Fit Theory – are deemed to be less important. A word on activity based working. Our present proposal for a new taxonomy is based on the observation that ABW is the leading principle in office-related work. However, this is not to say that this paradigm cannot be contested at all. The suboptimal fit between worker and workplace – often reported in the academic literature – may very well find its cause (partly) in the fact that the ABW-principle is not (entirely) apt to satisfy the present and future needs of knowledge workers. Additional research – from various angles – is needed to provide a satisfying answer to this fascinating question.

REFERENCES

- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), "An end-user's perspective on activity-based office concepts", *Journal of Corporate Real Estate*, 13, 2, 122-135.
- Appel-Meulenbroek, R., Kemperman, A., Van de Water, A., Weijs-Perrée, M., Verhaegh, J. (2022), "How to attract employees back to the office? A stated choice study on hybrid working preferences", *Journal of Environmental Psychology*, 81, 1-12.
- Appel-Meulenbroek, R., Looijen, J., Hoekstra, B., Jongens-van der Schaaf, P., Weijs-Perrée, M. (2021), "Analysing perceived communication and productivity of different office workers while working fully from home due to COVID-19 restrictions", *The 20th EuroFM Research Symposium*, 13-22.
- Armitage, L., Nassor Amar, J. (2021), "Person-Environment Fit Theory. Application to the design of work environments", Appel-Meulenbroek, R. & Danivska, V., *A handbook of theories on designing alignment between people and the office environment*, Routledge, London, 14-26.
- Babapour, M. (2019), *The Quest for the Room of Requirement. Why some activity-based flexible offices work while others do not*, Chalmers University of Technology, Gothenburg.
- Babapour, M., Cobaleda-Cordero, A., Karlsson, M. (2021), "Activity Theory. A framework for understanding the interrelations between users and workplace design", Appel-Meulenbroek, R., Danivska, V. *A handbook of theories on designing alignment between people and the office environment*, Routledge, London, 236-247.
- Beckers, R. (1997), "Kantoorinnovatie: 'place predicts productivity'", *Facility Management Magazine*, Aug/Sept 1991, 23-25.
- De Been, I., Buis, A., den Hollander, D., & Thoolen, F. (2016), *De fysieke werkomgeving Rijk eerste ervaringen en lessen*. Delft: CFPB available at: 20160428_Eindrapportage_Evaluatie_FWR.pdf (cfpb.nl) (accessed 31 March 2022).
- Drucker, P. (1996), *Landmarks of Tomorrow*, Transaction Publishers, New Brunswick.
- Duffy, F., Powell, K. (1997), *The New Office*, Conran Octopus.
- Duffy, F., Tanis, J. (1999), "A Vision of the New Workplace Revisited", *Site Selection Magazine*, September 1999.
- Edwards, J., Caplan, R., Harrison, R. v. (1998), "Person-Environment Fit Theory. Conceptual Foundations, Empirical Evidence, and Directions for Future Research", *Theories of organisational stress*, Oxford University Press, Oxford, 28-67.
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, A. (2019), "Is activity-based working impacting health, work performance and perceptions? A systematic review", *Building Research & Information*, 47, 4, 468-479.
- Fruytier, B. (2002), "Kantoororganisatie en kantoorgebouw: op zoek naar een fit", *Tijdschrift voor Methoden, Technieken en Analyses van Personeelsbeleid*. 1.6.7.2, 701-733.
- Van Gelder, M., Van Der Kruijssen, D., Kersten, A., van Veldhoven, M. (2022), "Freedom within a Framework: A framework for shaping the hybrid Way of Working", Tilburg University, Veldhoen + Company.
- Haynes, B., Suckley, L., Nunnington, N. (2019), "Workplace alignment", *Facilities*, 37, 13/14, 1082-1103.
- Heerwagen, J., Kampschroer, K., Powell, K., Loftness, V. (2004), "Collaborative knowledge environments", *Building Research & Information*, 32,6, 510-528.
- Hoendervanger, J. (2021), *On Workers' Fit with Activity-Based Work Environments*, Groningen.
- Huffman, H., Brady, M. M., Peterson, M., Lacy, A. (1968), *A Taxonomy of Office Activities for Business and Office Education*, Ohio State University, Columbus.

- Huhtelin, M., Nenonen, S. (2021), “Organisational knowledge creation and knowledge workplaces”, Appel-Meulenbroek, R. & Danivska, V., *A handbook of theories on designing alignment between people and the office environment*, Routledge, London, 261-271.
- Karwowski, G. Z. (2004), “Activity theory as a basis for the study of work”, *Ergonomics*, 47, 2, 134-153.
- Leesman (2017), *The rise and rise of activity-based working*, Leesman.
- Leesman (2020), *Your workplace of the future*, Leesman.
- Measuremen (2021), *Annual workplace report*, Measuremen
- Leont’ev, A. N. (1978), *Activity, consciousness, and personality*. Prentice-Hall, Englewood Cliffs.
- Lloyd, B. (1993), “The future of offices and office work”, Duffy, F., *The Responsible Workplace* London, 44-54.
- Pyöriä, P. (2005), “The concept of knowledge work revisited”, *Journal of Knowledge Management*, 9, 3, 116-127.
- Sekiguchi, T. (2004), “Toward a dynamic perspective of person-environment fit”, *Osaka Keidai Ronshu*, 55, 1, 177–190.
- Van Meel, J. (2000), *The European Office*, 010 Publishers, Rotterdam.
- Van Meel, J. (2020), *The Activity-Based Working Practical Guide (second edition)*, Copenhagen.
- Van Meel, J. (2020), “The origins of new ways of working”, *Facilities*, 29, 9/10, 357-367.
- Worthington, J. (1997), *Reinventing the Workplace*, University of York, Oxford.

The Virtual Reality Workplace

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ABSTRACT

The paper conceptually debates the extent to which the adaptation of immersive virtual reality (“VR”) technology could enable employees to overcome the distractions associated with working from home, increase their visibility on team projects, build stronger relationships with co-workers, reduce feelings of isolation due to social distancing, and facilitate their engagement in collaborative work processes. VR as an emerging technology demonstrates a high potential to improve the effectiveness and job satisfaction of remote workers. The previous debates on the potentials of VR for optimal employee collaboration are limited, and as such, the following paper presents a ground-start for further research on the visually enhanced and immersive tools for remote working.

Keywords

Virtual Reality, VR, Workplace, Remote work, Remote collaboration.

Planning the academic workspace: Transitioning to new ways of working

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ABSTRACT

Academic workspace is an emotive subject. The private faculty office has long been the de facto norm on campus and has long been aligned with status in an often fiercely competitive hierarchy. However, the higher education sector is experiencing mounting calls for operational efficiency, which stand at odds with the typically low-space utilisation of academic workplaces. For universities the pandemic has heightened debates on the future of on-campus space use by their academic staff and accelerated explorations of new models of working, such as hybrid, shared open-plan and agile working. Arguably, we are seeing a new chapter in the planning, design and functionality of academic workspaces. But this is coming with a range of new demands and challenges for those responsible for designing and implementing projects. The introduction of new approaches to organising academic workspace is frequently viewed by its future users with anxiety, hostility and negative preconceptions; outcomes of new physical models have been identified as decreased productivity, institutional belonging and job satisfaction and higher-than-desired time spent working off campus. There is evidence, though, that if transition is managed well, staff can thrive in new working environments. This paper addresses how to manage the shift to new academic workplace models in a twenty-first-century context. Using research findings from a series of ethnomethodologically informed interviews and photo observations and supported by a literature review, this research seeks to give a clearer understanding of the faculty experience in transitioning to new workspace models and what measures universities have taken to consider and improve this experience. The authors use this research to distil practicable lessons for those involved in the design and delivery of new academic workspaces.

Keywords

Workspace design, Change management, Implementation.

1 INTRODUCTION

Raise the topic of open-plan offices to almost any academic, and it soon becomes clear that academic workspace is an emotive subject. For time immemorial, the private office has been their domain, closely entwined with matters of identity and hierarchy. However, the higher education sector is undergoing a period of significant change that is fostering ambitions for increased collaboration and, furthermore, increased operational efficiency. It is a widely quoted axiom that private faculty offices are characterised by markedly low utilisation levels (Pinder et al, 2009). Emulating commercial examples, many universities were already exploring new ways of working and new models of workplaces that embraced open-plan layouts, fewer and smaller cellular offices, agile or activity-based working, hybrid working and more, when the COVID-19 pandemic hit. The abrupt switch in working patterns that ensued in 2020

accelerated questions around the future of on-campus space use by academic staff and how their workplaces should be designed and organised. This is, though, a loaded debate. The significant variations in how academics work, even within a single school, makes the design of their working environments much more challenging than a typical commercial organisation. There is a small but growing body of literature on new approaches to organising workspace in academia. Whilst some studies draw attention to potential gains in collaboration through open-plan approaches (Van Marrewijk and Van Den Ende, 2018; Parkin, 2011), the overwhelming tenor is one of hostility amongst academics towards its introduction. The loss of individual offices in particular is perceived as symptomatic of the commodification of higher education, propelled by budgetary considerations and a lack of understanding of the nature of academic work by the facilities teams that are masterminding the changes (Baldry and Barnes, 2012; Vitasovich et al, 2016). Case studies identify the outcomes of open-plan environments as decreased productivity (Parkin, 2011; Barnes et al, 2020), a lowered sense institutional belong (Barnes et al, 2020; Berthelsen et al, 2018), increased time spent working from home (Barnes et al, 2020; Gorgievski, 2010) and a fall in general job satisfaction (Berthelsen et al, 2018). There is, however, also evidence that, if transition is managed well, staff can thrive in new working environments (Doshi and Clay, 2017; Berthelsen et al, 2018). Staff pre-empt much dissatisfaction before moving (Jermine et al, forthcoming), thus addressing this dissatisfaction before the event can yield much more successful outcomes. This paper addresses how to manage the shift to new academic workplace models in a twenty-first-century context.

2 METHODOLOGY

The methodology adopts a two-pronged approach: ethnomethodologically informed interviews and photo observations are supported by a literature review that examines factors in the perceived success of new academic workspace concepts and workspace change. The authors have applied ethnographic research methods to understand the experience of academic staff in higher education workplaces and their transition to new models of workplaces. Often, when organisations undertake planning for workplaces, assumptions are made on how occupants will use this space and what they require for it to be a success. This is contradictory to ethnographic approaches, which provide the opportunity to observe and understand how people operate within their environment (Celikoglu and Hamarat, 2022; Hammersley and Atkinson, 2019; O'Reilly, 2012). The application of this discovery-based lens was selected as the best means of giving insight into the daily lived experiences and culturally embedded practices of staff within the local ecology and environment of their workplace. This research presents qualitative findings from a series of photo observations and semi-structured interviews with eight staff members (academic and professional) from five universities in the UK, Australia and US that have recently undertaken the construction of projects that include academic workspace. Each project has introduced a change from cellular offices to shared open-plan working for at least a portion of users. Projects spanned different departmental uses in order that the findings transcended disciplinary nuances. To ensure a degree of consistency, an interview protocol identifying key themes framed the interaction with the participants, but conversational direction was responsive to the participants' own narratives (Burgess, 1988). Interviews (lasting 60-90 minutes each) were recorded, transcribed verbatim and thematically and axially coded. The objective of the research is to give a clearer understanding of the faculty experience in transitioning to new workspace models and what measures universities have taken to consider and improve this experience. The authors suggest the potential for greater use of ethnographic tools in the planning of academic workplaces and the transition to new ways of working, and seek to use this research to distil practicable and implementable lessons for those involved in the design and delivery of new academic workspaces.

3 THE IMPORTANCE OF SECURING STAFF BUY-IN

An opinion uniformly expressed by the interviewees was that transitioning to a new model of workplace is a time of anxiety for academics, the degree of which, they often feel, is not necessarily appreciated by university leadership or facilities teams. The relationship between the physical environment and the day-to-day experience of work is a complicated one (Baldry and Barnes, 2012), particularly within the academic workplace. For academics, the importance of space transcends simply a physical place in which to work. It is a fiercely territorial issue, closely bound with identity and status within a frequently intensely competitive hierarchy. The loss of ownership of an individual space – notably a cellular office – can be felt as a threat to the marrow of professional identity. This emotionally charged context can be a breeding ground for tension (Berthelsen et al., 2018). Negative preconceptions can doom a new workplace project to failure before its doors even open. When faced with a change in their working environment, especially when this change involves the loss of private space, staff tend to focus on what they will lose rather than what they will gain. Academics find it difficult to conceptualise how they work being compatible with others, and, therefore, struggle to conceive how they would work successfully in a shared space. According to Beltman and van Diermen (2016), the built environment or the technology within it has little determining impact upon the ultimate success of a new workplace model relative to the behaviour of its occupants. Staff are never simply passive actors, but actively shape, uphold, neglect or reconstruct their workplace environments and the norms and codes of conduct attached to them (Van Marrewijk and Van den Ende, 2018). The repercussion of this is that success of a new workspace model is significantly dependent upon staff buy-in (Beltman and van Diermen, 2016). A common finding of research on this topic is that academic staff feel that they lack influence over the outcome of workspace changes (Gorgievski et al, 2010; Wilhoit et al, 2016), whereas enabling staff to socialise the new approach to ‘make it their own’ before it becomes a reality can positively shape how employees experience the new workspace (Meerbeek et al, 2009); Doshi and Clay, 2017; Babapour and Rolfö, 2019). Thus, a key lesson for higher education institutions implementing cultural workplace changes is that it should be an inclusive process. Listening to staff concerns, providing meaningful opportunities for feedback and input into the design process and communicating regularly were found by the interviewees to be positive mechanisms for assuaging the significant anxiety that accompanied their workspace changes and for shaping expectations about the new environment. The two-way dialogue should, furthermore, begin early before assumptions or misconceptions can take root.

4 UNDERSTANDING STAFF NEEDS IS THE KEY TO ENSURING THE BEST USE IS MADE OF WORKSPACE

That academics work, meet and collaborate in a different way to other knowledge workers is a theme repeated both in the interviews and literature review (Baldry and Barnes, 2012; Pinder et al, 2009; Vitasovich et al, 2016). Individual needs and disciplinary cultures can vary widely, meaning that there will never be a single solution when it comes to designing faculty workplaces. This renders it of critical importance that those planning workplaces have a clear appreciation of the complexities of academics’ experience. A recurring theme of previous research is that academics fail to make use of new workspace environments as intended, either purposefully or otherwise. Many studies of open-plan and activity-based work (ADW) models, for example, identify that staff rarely switch work settings during the working day or monopolise enclosed rooms intended for short-term focused work (Gorgievski et al, 2010; Lai et al, 2021; Lansdale et al, 2011; Parkin, 2011; Van Marrewijk and Van den Ende, 2018). Whilst there is likely to be a nexus of causes for this (mis)appropriation of space, it suggests

that planners do not necessarily sufficiently understand staff's daily tasks and their needs in performing these and the result is inefficient space use. A common ingredient of successful projects is a deep-rooted consideration of how the environment can best support those it is designed for (Doshi and Clay, 2017). Interviewees articulated that considerable time and energy was invested in understanding how staff worked and that this data was used in the design process.

5 METHODOLOGIES FOR ENGAGING WITH FACULTY

Within the case-study institutions, project teams used a variety of tools for engaging with faculty. Methodologies for engagement with future users need to be positively embedded into the development process, escalating in intensity as occupation nears.

Table 1. Phases of staff consultation

Design stage	Surveys
	Observation
	Focus groups/workshops
	Staff design teams/ambassadors
	Website
Preparing for change	Tours of other buildings
	Retreats/away days
	Website
	Clear milestone dates
Moving process	Website and email updates
	Collective milestone activities
	Welcome guide and events for users

Design stage: Surveys, focus groups/workshops and appointed design teams are a means of understanding staff fears, how they envisage future working practices and making them feel like they are having an input into their working environment, rather than it being something that is forced upon them. The feelings of empowerment that arise from decisional involvement can have a powerful impact upon satisfaction with working environments and, in turn, institutional belonging (Knight and Haslam, 2010; Vischer, 2008). A common error during consultation practices is to bring a near-complete design to staff. In this context, the impression made upon users is that the engagement is merely a check-box exercise, leaving them feeling disempowered. Interviewees reported greater success when engagement was initiated with staff at earlier stages. Meanwhile, the later that engagement commences, the higher the tension and resistance amongst staff. Depending upon the project and culture, the level and nature of input that staff can have will vary. Even where there is little scope for involving users in major design decisions, staff value input into small elements such as furniture. Academics are habituated to a high degree of professional autonomy; giving them a level of control in the appearance and functioning of their working environment serves to build a social and personal identity, a sense of ownership and reduces the perception of a top-down decision-making process (Babapour and Rolfö, 2019; Vischer, 2008). One interviewee related that its institution invited all affected staff to view and try out mock-ups of workstations and offices with different furniture selections, and to select their preference based on comfort, style and functionality. It engaged a working group that met fortnightly to determine matters such as what facilities the kitchens would contain. Another interviewee described how members of a school relocating to a new building were presented with four different models for office book shelving, enabling them to have direct agency over their surroundings.

Preparing for change: Most academic staff are likely going to be unfamiliar with building projects of this nature, and they are, therefore, likely also to be unfamiliar with reading building plans, the associated terminology and the potential for modern workplace design. This in itself can be a major mental block in holding onto entrenched positions or concerns surrounding the shift in working culture. Site visits to examples of different workplaces that exemplify what can be achieved through design can be highly useful in alleviating anxieties and bringing to life plans and descriptions. Two of the institutions took staff on tours of relevant buildings elsewhere to experience at first hand certain elements that would feature in their new buildings. Seeing built strategies in action served as a persuasive tool and attendees conveyed this confidence to other colleagues. As the project nears completion, anxieties amongst staff can mount, but engagement events can serve to build a sense of anticipation and positivity. Two of the case-study institutions held retreats or away days. These served as opportunities to bring together units that may never have previously been co-located, but also acted as moments of celebration that promoted the advantages of the move and concomitant innovations in working practices. One interviewee related how the head of the school used an away day to present visualisations of the staff accommodation and explain how staff input had been fed into the designs.

Moving process: Several interviewees underlined that migration from current locations to the new building can in itself be a cause of apprehension to staff members: ‘When do I need to pack? Where are my things going to go?’ Project websites and email updates are a valuable tool in communicating this information to staff at regular and timely intervals. These contain milestone dates, such as when belongings need to be packed. Several of the case-study institutions produced welcome guides and videos to distribute to staff prior to relocation, containing such information as floor plans, building amenities, work point set ups, booking processes for meeting rooms and etiquette guidelines. Workspaces should be designed to be used intuitively. Interiors should convey inherent signals to the occupants about how to behave in certain places. Nonetheless, user guidelines that articulate protocols serve as an additional tool in the arsenal to ensure that staff are best equipped to get the most out of their environment. Ideally, these should be developed with input from the occupants themselves via focus groups before and after they occupy the space. Defining workplace norms is an efficacious practice in facilitating the adoption of a new model of working (Parkin, 2011; Beltman and van Diermen, 2016). This is as much about ensuring users understand how spaces are envisaged to be used and that they meet user expectations as it is about imposing ‘rules’. This is especially necessary when it comes to the most politically charged and sensitive issues, such as office allocation and noise. One interviewee reported that colleagues in open-plan desks avoid conversation because of an implicit sense that ‘we value quietness’ and a confusion about what noise level is acceptable. Once conventions are established, it can be difficult to then encourage different ways of using the space. Determining and communicating norms around appropriate behaviours in particular spaces can eliminate user uncertainty and minimise discord.

6 LEADING BY EXAMPLE

It can, however, prove challenging to get academic staff to engage with these processes. Employees are not necessarily open to participating within formal channels (Jermine et al, 2020), fuelled in part by perceived conflicting priorities between faculty and facilities teams (Jermine et al, forthcoming). For the academic departments that will occupy the environments, the facilities teams that are responsible for delivering the schemes can be seen as too focused on cost efficiency at the expense of an understanding of the nature of academic work. Facilities teams, conversely, can consider academics as being inimical to change and blind to institutional ‘big picture’. One interviewee stressed the positive gains in forging relationships that can be

achieved through the appointment of a senior faculty member to a workplace champion or ambassador role (Pinder et al, 2009). The role of a workplace champion may include guiding consultation processes; adjudicating space and other conflicts; keeping the faculty community informed of progress and issues; representing user priorities in discussions; and, importantly, providing motivation and influence to their academic colleagues at leadership level. In order to do so, it is essential that the appointee is of sufficient seniority to command the respect of the faculty, and, furthermore, are enthusiastic about the project and the ambitions that underpin the workplace model. The impact of senior faculty upon the receptiveness to change of other members should not be underestimated. One interviewee anecdotally recounted that if design reference groups had a leader around the table who was negatively minded towards the changes, the whole room became negative; a positive leader had the opposite effect. Leading by example is an influential means of encouraging the acceptance of new working practices. When faculty leadership is seen to surrender their own office or exhibit an openness to change their own practices (eg. digitise their book collection to accommodate reduced shelving provision), for instance, it sends a powerful positive message to the rest of the faculty. Another interviewee identified the rewards associated with the Head of School leading focus groups with staff. The perception that leadership was listening and being receptive to their concerns and ideas strongly influenced preconceptions about the change process. For benefits to be achieved, though, the leadership (including the workplace champion) must be enthused about the project's objectives and have been trained in implementing the new approach to working (Beltman and van Diermen, 2016).

7 PILOT PROJECTS

Amongst the points most reiterated by interviewees was the tremendous value of pilots when projects represent a step change in workplace provision. During the planning of projects and the transition process, they are a means to test design ideas and collect feedback, refine project briefs, alleviate staff anxiety, challenge preconceived ideas and shape protocols. This is supported by several other studies (Parrish and Parks, 2018; Pinder et al, 2009). Pilots may be of particular importance at the present moment in understanding how attitudes towards working cultures and patterns have been altered by COVID-19. Several of the case-study institutions constructed pilots that either demonstrated key elements of the planned workspace for stakeholders to view and appraise during drop-in sessions or were put into use as fully functioning workspaces with rotating occupants. Whilst pilot projects do entail an investment of time and money, the insights they provide can yield transformational advantages. Data collected was used by the project teams to inform the design of elements including visual and auditory privacy, storage, security and workstation strategy. Furthermore, they helped to engage users in the possibilities of a new working environment and manage expectations. Stakeholders often find it challenging to visualise spaces, and preconceptions based upon misunderstandings can create lasting negative bias. By bringing spaces and practices to life, pilots can take staff on a journey in a tangible way and help to alleviate anxieties surrounding change. A key lesson outlined during the interview process, however, is the need to ensure that pilot spaces accurately represent the future design. A poorly executed pilot can do more harm than good. The school of one interviewee established a mock-up of proposed new postgraduate workspace furniture within an old, vacant building. The shabby setting of the pilot immediately elicited hostility from faculty members, creating a negative bias.

8 CONCLUSION

The literature review and ethnographic research clearly identified that introducing new models of workplace within academia is a complex and sensitive undertaking. There is no 'one size

fits all' design nor a single 'right' approach to how the process should be managed; each project requires its own distinct approach reflective of the needs and endeavours of its future occupants and their institutional culture. Processes, protocols and spaces will very likely require ongoing revision after occupation. Nonetheless, some general conclusions can be made to optimise successful outcomes:

- Securing staff buy-in should be considered a priority. Investing time into establishing a two-way dialogue will reap rewards in enabling staff to feel that they have a stake in the changes being made and therein look on the experience more positively.
- Staff should be engaged with during the design process. Work with staff to understand how they work, the types of spaces that best support them and then to define the values and norms that will steer behaviours to enable a new way of working. The later and less that staff are engaged, the more resistance is encountered.
- The involvement of leadership can bring significant gains in shaping preconceptions and receptiveness to change. Focus groups led by heads of schools, for example, signal that staff concerns are considered a matter of importance to the university. Meanwhile, creating a workplace champion role can provide leadership, oversight and communication amongst the campus community in a way that the project team themselves cannot achieve. The person undertaking the position must have sufficient departmental standing to command the respect of colleagues.
- Use visual tools to shape expectations and assuage anxiety. Academics are unlikely to be well acquainted with reading building plans or with best practice for contemporary workplace design. Investing in tours or physical mock-ups is the best means of bringing to life the vision for the project and potentially allaying staff concerns.
- Running pilots is one of the most effective tools in realising a successful workplace project, especially when the project represents a step-change in workplace provision. They provide opportunities to test new designs and policies, identify issues that need to be resolved, help to ensure that the requirements of different cohorts are properly represented and met and improve understanding amongst staff of the principles and practicalities of the new workplace environment.

The findings of this paper are limited by the small scale of the research, but the study brings focus to practical approaches to managing the shift to new academic workplace models. Further research, conducted at larger scale, is needed. This could explore, for instance, discipline-specific responses and practices.

REFERENCES

- Babapour, M. C., Rolfö, L. (2019), 'Policies in Activity-Based Flexible Offices - 'I Am Sloppy with Clean-Desking. We Don't Really Know the Rules'', *Ergonomics*, 62(1), 1–20.
- Baldry, C., Barnes, A. (2012), 'The open-plan academy: Space, control and the undermining of professional identity', *Work, Employment and Society*, 26(2), 228-245.
- Barnes, J., Wineman, J., Adler, N. (2020), 'Open office space: the wave of the future for academic health centers?', *Academic Medicine*, 95(1), 52-58.
- Beltman, S., van Diermen, O.G. (2016), 'Managing working behaviour towards new ways of working: a case study', *Journal of Corporate Real Estate*, 18(4), 270-286.
- Burgess, R. (1988). 'Conversations with a purpose: The ethnographic interview in educational research', *Studies in Qualitative Methodology*, 1, 137–55.
- Celikoglu, O. M., Hamarat, M. (2022). 'Looking for ethnography in design research through three decades', *The Design Journal*.

- Doshi, A., Clay, C. (2017). 'Rethink space: (Re)designing a workspace using human-centered design to support flexibility, collaboration, and engagement among clinical and translational research support services', *Journal of Clinical and Translational Science*, 1(3), 160-166.
- Gorgievski, M.J., van der Voordt, T.J.M., van Herpen, S.G.A., van Akkeren, S. (2010), 'After the fire: New ways of working in an academic setting', *Facilities*, 28(3/4), 206-224.
- Hammersley, M., Atkinson, P. (2019). *Ethnography: Principles in Practice*, Abingdon: Routledge.
- Hoendervanger J.G., De Been I, Van Yperen N.W., Mobach M.P., Albers C.J., (2016), 'Flexibility in use: Switching behaviour and satisfaction in activity-based work environments', *Journal of Corporate Real Estate*, 18(1), 48-62.
- Jemine, G., Dubois, C. Pichault, F. (2020), 'When the Gallic Village Strikes Back: The Politics Behind "New Ways of Working" Projects', *Journal of Change Management*, 20(2), 146-170.
- Jemine, G., Pichault, F., Dubois, C. (Forthcoming), 'New Ways of Working in academia: maneuvering in and with ambiguity in workspace design processes', *M@n@gement*.
- Knight, C., Haslam, S. A. (2010), 'The Relative Merits of Lean, Enriched, and Empowered Offices: An Experimental Examination of the Impact of Workspace Management Strategies on Well-Being and Productivity', *Journal of Experimental Psychology: Applied*, 16(2), 158-172.
- Lai, C., Bobillier Chaumon, M., Vacherand-Ravel, J., Abitan A. (2021), 'Thinking activity-based work environment throughout situated acceptance', *Journal of Workplace Learning*, 33(1), 10-25.
- Lansdale, M., Parkin, J., Austin, S., Baguley, T. (2011), 'Designing for interaction in research environments: A case study', *Journal of Environmental Psychology*, 31(4), 407-420.
- Marzban, S., Candido, C., Mackey, M., Engelen, L., Zhang, F., Tjondronegoro, D. (2022), 'A review of research in activity-based working over the last ten years: lessons for the post-COVID workplace', *Journal of Facilities Management*, ahead-of-print.
- Meerbeek, M., Randolph, K., Rasmus, D., van Wilgenburgh, J., van Meer, H., Witkamp, J., Kompier, H. (2009), 'A New Way of Working: the 7 Factors for Success, Based on Microsoft Netherlands Experience', Microsoft Corporation, Amsterdam.
- O'Reilly, K. (2012). *Ethnographic methods*, Abingdon: Routledge.
- Parkin, J., Austin, S., Pinder, J., Baguley, T., Allenby, S. (2011), 'Balancing collaboration and privacy in academic workspaces', *Facilities*, 29(1), 31-49.
- Parrish, J., Parks, R. (2018), 'Workspace: The Final Frontier', *College and University*, 93(1), 41.
- Pinder, J., Parkin, J., Austin, S., Duggan, F., Lansdale, M., Demian, P., Baguley, T., Allenby, S. (2009), 'The case for new academic workspaces', Loughborough University.
- Van Marrewijk, A., Van den Ende, L. (2018), 'Changing academic work places: the introduction of open-plan offices in universities', *Journal of Organizational Change Management*, 31(5), 1119-1137.
- Vischer, J. (2008), 'Towards an environmental psychology of workspace: How people are affected by environments for work', *Architectural Science Review*, 51(2), 97-108.
- Vitasovich, A., Kiroff, L., Boon, J. (2016), 'The adoption of modern office workspaces by tertiary education institutes: a case study of unitec', paper presented at The 40th Australasian Universities Building Education Association (AUBEA) Conference, 6-8 July, Cairns, Australia.
- Wilhoit, E., Gettings, P., Malik, P., Hearit, L., Buzzanell, P., Ludwing, B. (2016), 'STEM faculty responses to proposed workspace changes', *Journal of Organizational Change Management*, 29(5), 804-815.

SESSION 5A: COVID-19 AND WORK OUTCOMES

Comparing Home Office Determinants on Personal and Organisational Outcomes in Germany and the U.S.

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ABSTRACT

The world of work is undergoing constant change worldwide. In addition to the increasing demand for flexibility, the COVID-19 pandemic reinforced working from home. Little is known so far on the mechanisms and factors that influence work success at the workplace at home. It is also unclear whether the influencing workplace characteristics vary between different nations due to country-specific circumstances. The aim of this study is to obtain a deeper understanding of these factors that influence organisational outcomes in the home office. The research model builds on the Job Demands-Resources and Environmental Demands-Resources models using German ($n = 429$) and United States ($n = 507$) survey samples. Partial least squares structural equation modelling is used to analyse the influence of workplace characteristics and a multi-group analysis is employed to explore group differences in the factors influencing personal and organisational outcomes between Germany and the United States. The results reveal that significant determinants of productivity and turnover intention include housing characteristics (equipment/facilities), skill variety, isolation, and family–work interference. Isolation and equipment/facilities are identified as the most important workplace factors. Some significant differences are found between the two nations with regard to the degree of influence of isolation and family–work interference on burnout, which lead to altered effects on satisfaction, productivity and turnover intention in both nations. The study reveals new insights into the impact of workplace factors on work success. To the best of the author’s knowledge, this is the first study that analyses workplace factors on home office using a multigroup analysis.

Keywords

Home office, Personal outcomes, Organisational outcomes, Workplace, PLS-SEM MGA.

1 INTRODUCTION

The workforce is increasingly demanding new ways of working with flexible work design like working from home (Nijp et al., 2016). Moreover, an environment that is optimally adapted to the employees’ work is advantageous in order to complete tasks effectively (Armitage/Nassor Amar, 2021) and to be satisfied and productive. To increase business success by providing good workplaces, it is important for companies to understand the relevant factors that influence their employees’ productivity and turnover intention when they work from home (Carnevale/Hatak, 2020; Gigauri, 2020; Donthu/Gustafsson, 2020). Millions of people worldwide working from home for the first time provides an unprecedented opportunity for research on the resulting impact of home office on organisations (Contreras et al., 2020). Historical, cultural and work organisation differences between Germany and the U.S. with respect to work from home provide reason to believe that there are significant differences in

the level of influence between the workplace characteristics of the two nations. Some research of different disciplines shows evidence of an increase in satisfaction and a decrease in turnover intention while working from home (Bloom et al. 2015; Kröll/Nüesch 2019). But not every employee rates their productivity higher at home (Pfnür et al., 2021). The small number of robust pre-pandemic cross-sectoral research and evidence suggests a need for research specifically on home-based work concepts. Research and practice need to understand the factors influencing employees' personal resources, like burnout and satisfaction, with an impact on organisational outcomes.

To address this research gap, this study investigates the impact of the home office on organisational outcomes during COVID-19 by examining which factors influence productivity and turnover intention through satisfaction and burnout. Based on a quantitative survey conducted among knowledge workers in Germany and the U.S., partial least squares structural equation modelling (PLS-SEM) and a multigroup analysis (MGA) are used to analyse the relationships. The assessment of MGA enhances the ability to identify meaningful differences in multiple relationships across group-specific results (Schlägel/Sarstedt, 2016; Cheah, 2020).

2 HOME OFFICE AS A NEW WORKPLACE AROUND THE WORLD

In addition to the COVID-19 pandemic, the world of work is constantly exposed to new challenges due to the social, economic and technological developments of the last 20 years (Cascio, 2010; Gauger/Pfnür, 2019). Organisations are forced to make changes to be successful in global competition due to the challenges of the working world. One approach introduced in many organisations worldwide, enabled by ICTs and dedicated to flexible work design covering a wide range of topics, is called 'new ways of working' (NWW) (Blok et al., 2011; Nijp et al., 2016).

Since the 1990s, developments in society and technology have spurred the concept of telework as part of the working world (Mergener, 2020). Especially during the COVID-19 pandemic, the home has received increasing attention as an office. Prior to the pandemic, the establishment of flexible workplace models happened in different countries at different rates. In Germany, only 12.9% of all persons employed worked from home in 2019 (Federal Statistical Office, 2021). Of these, only 5.5% used the home office every day or at least half of the working time. In the U.S., 52% of employees claimed to work from home at least one day per week, with 17% working five days or more from home (Mlitz, 2021). During the pandemic, work from home has greatly expanded in several countries around the world in an effort to contain the spread of the virus (Belzunegui-Eraso/Erro-Garcés, 2020). In both countries under review, the proportion of home offices increased by around 20% and even for a post-pandemic future, up to 80% of companies in Germany and the U.S. signal plans to implement a flexible workplace policy (International Workplace Group, 2019). However, due to the different understandings of the terms and diverse designs of telework and home office, these figures should be viewed with caution. This paper defines the home office as knowledge workers performing a work activity from home. Furthermore, Germany and the U.S. differ in their cultural peculiarities, for example, in terms of individualism, long-term orientation and indulgence (Hofstede Insights, 2022). There are also significant differences in the work culture of the two nations, for example, the different ways in which work contacts are also seen outside the office (Körber, 2018). Thus, the two nations offer an exciting starting point to compare the strength of different factors influencing organisational outcomes in the home office. Whereas a variety of research disciplines have examined environmental conditions, interactions and success factors of office real estate on the workplace as well as of the physical work location on employee performance (e.g. Appel-Meulenbroek et al., 2013; Clippard, 2020; Roskams et

al. 2021), there is sparse scientific knowledge on the effects on organisational outcomes in home offices.

3 THEORETICAL BACKGROUND AND DERIVATION OF HYPOTHESES

Workplace characteristics are classified as demands or resources (Bakker/Demerouti, 2007). These characteristics exert an influence on employees' personal outcomes as well as their level of burnout/satisfaction through parallel health impairment and motivational processes. In addition, Bakker/Demerouti (2017) show that burnout has a negative and positive impact on organisational outcomes for productivity and turnover intention. The job demands-resources (JD-R) model (Bakker/Demerouti, 2007) and its application to the workplace environment, and the environmental demands-resources (ED-R) model (Roskams et al., 2021) are used as the theoretical background of the research model presented in Figure 1.

In this paper, **Isolation** symbolises the subjective feeling of loneliness as an adaptive response to isolation. Studies have identified social isolation as a hazard of telework (Baruch, 2000; Klopotek, 2017). The physical isolation experienced in home offices can cause loneliness and feelings of isolation (Wang et al., 2021). The most common reasons why employees wish to return to the office are loneliness and a lack of social interaction while working from home (Bloom et al., 2015). A direct relationship between isolation and burnout, and an indirect relationship between isolation and turnover intention via burnout are documented (Bauer/Silver, 2018).

H1: Isolation has a positive impact on burnout in the home office.

Family–work interference (also called 'family–work conflict' or 'work–family conflict') is a form of inter-role conflict based on role stress theory (e.g. Grzywacz/Demerouti, 2013). Working from home increases the risk of blurring the boundary between work location and private life (Wang et al., 2021). There are three types of such family–work conflicts that can be experienced while working from home: time-based, strain-based and behaviour-based (Greenhaus/Beutell, 1985). In the consequence of cross-domain roles with frequent distractions and interruptions greater experiences of exhaustion occur (Kreiner et al., 2009). Working from home during COVID-19, children being at home and distractions while working are all associated with decreased overall physical and mental well-being (Xiao et al., 2021). Hakanen and Bakker (2017) find empirical evidence for the relationship between stressful events in an employee's personal life and job burnout. Finally, role conflict has been confirmed as a burnout predictor in a meta-analysis (Alarcon, 2011).

H2: Family–work interference has a positive impact on burnout in the home office.

In this paper, **equipment and facilities** refers to technological equipment and to an employee's available private space and workstation where they work at home, including required storage space. The access to important information and knowledge is a prerequisite for NWW approaches (Eurofound and the International Labour Office, 2017). This fact is supported by Messenger and Gschwind (2016), finding functioning technology being among the most important prerequisites for working from home. In addition, access to needed technology is even correlated positively with satisfaction (Van der Voordt, 2004). Instead, problems with equipment are found to be a job demand (Bakker et al., 2003) and inadequate tools are seen as a disadvantage for home offices (Ipsen et al., 2021).

H3: Equipment and facilities have a positive impact on satisfaction in the home office.

Skill variety describes the amount of skill a person needs to be able to do a job (Hackman/Oldham, 1980). Working at home in private spaces can make it more difficult to complete monotonous tasks satisfactorily because there are more distractions in the private living space than in an office; on the other hand, there is less spontaneous help from colleagues

(Kellner et al., 2020). Meta-analytic results show that especially skill variety is positively related to satisfaction (Humphrey et al., 2007).

H4: *Skill variety has a positive impact on satisfaction in the home office.*
Burnout can be understood as a long-term consequence of stress and is triggered by situational and individual factors (Bakker et al., 2014). Burnout represents the JD-R's health impairment process in this research model (e.g. Hakanen et al., 2006; Hakanen et al., 2008; Crawford et al., 2010). Burnout is considered to be one of the most important predictors of job satisfaction and turnover intention (Lu/Gursoy, 2016). Schaufeli/Bakker (2004) also confirm that burnout is related to turnover intention. High rates of turnover are associated with high costs to the organisation in part due to associated reduced productivity (Jackson/Maslach, 1982; Leiter, 1988). Furthermore, some empirical studies show that there is a negative causal relationship between burnout and job satisfaction (Wolpin et al., 1991; Baruch-Feldman et al., 2002; Ybema et al., 2010). **Satisfaction** is a multi-faceted construct in this paper as it expands the concepts of job and work satisfaction to include additional dimensions like satisfaction with life overall or an employee's financial situation (Siddiqui, 2015). Employees who are dissatisfied with their work situation develop the intention to quit. Dissatisfaction triggers a series of steps that lead employees to develop turnover intention (Porter/Steers, 1973). Studies already confirm this observation and report a negative correlation between job satisfaction and employee turnover (e.g. Mobley, 1977). In contrast, in a study of teleworkers, Dubrin (1991) even shows that higher satisfaction increases productivity. A positive relationship between job satisfaction and productivity is also found in the 'Happy-Productive Worker Thesis' by Landy (1985, revisited by Zelenski et al., 2008). In this paper, **turnover intention** is the conscious and deliberate self-motivation to leave the organisation. **Productivity** is the self-estimated productivity in the home office of the employee compared to in the office workplace.

H5: *Burnout has a negative impact on satisfaction in the home office.*

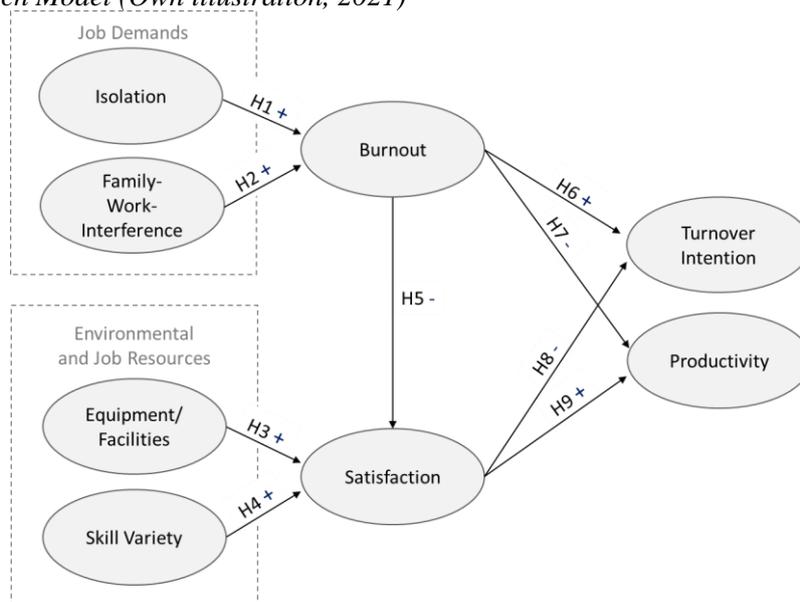
H6: *Burnout has a positive impact on turnover intentions in the home office.*

H7: *Burnout has a negative impact on productivity in the home office.*

H8: *Satisfaction has a negative impact on turnover intentions in the home office.*

H9: *Satisfaction has a positive impact on productivity in the home office.*

Figure 1. Research Model (Own illustration, 2021)



4 METHODOLOGY

The analysis of this research is based on a survey among 2,000 office and knowledge workers who performed at least part of their activities from home during the COVID-19 pandemic. More specifically, on average over the entire data set, more than 4 days per week were spent working in a home office. Thus, the amount of work from home is substantial and therefore causes genuine effects. From the aggregated dataset, which consists of the responses generated from three survey waves (in June, August and October 2020), only data from the second survey are analysed in this paper. The survey was conducted from 10–14 August 2020. After data cleaning, the dataset comprised a cohort of respondents from Germany ($n = 429$) and a cohort from the U.S. ($n = 507$). Missing values do not occur. PLS-SEM is chosen for the statistical analysis. The analysis follows the guidelines of Hair et al. (2017), Hair et al. (2019) and Cheah (2020).

4.1 Data Sample

Items are combined from existing survey instruments wherever possible. Appendix A provides a detailed list of items with associated sources. A five- or seven-point Likert scale is used for all items to measure perceived fit. The employees' characteristics are reported in Table 1.

Table 1. Sample Descriptive Statistics

Demographic Characteristic	Germany		U.S.	
	Frequency ($N = 429$)	Percentage (%)	Frequency ($N = 507$)	Percentage (%)
Gender				
Male	262	61.1	327	64.5
Female	166	38.7	179	35.3
Diverse Gender	1	0.2	1	0.2
Age				
18-20	13	3.0	1	0.2
21-39	257	60.0	350	69.0
40-55	131	30.5	126	24.9
56-68	28	6.5	30	5.9
Relationship Status				
Divorced	12	2.8	14	2.8
Married	142	33.1	331	65.3
Relation	163	38.0	57	11.2
Single	102	23.8	102	20.1
Widowed	1	0.2	3	0.6
N/A	9	2.1	14	2.8
Level of Education				
Hauptschule	7	1.6	27	5.3
Realschule	85	19.8	47	9.3
Higher School Certificate (Abitur)	121	28.2	7	1.4

Bachelor	82	19.1	259	51.1
Master craftsmen	6	1.4	28	5.5
Master	113	26.3	129	25.4
Promotion	15	3.5	-	-
Professional Status				
Employee	353	82.3	479	94.5
Self-employed	47	11.0	15	3.0
Civil servant	15	3.4	4	0.8
Freelancer	14	3.3	9	1.8
Position				
Entrepreneur/Freelancer	46	10.7	12	2.4
Managing director	5	1.2	11	2.2
Management	65	15.2	333	65.7
Project manager	45	10.5	62	13.0
Employee	244	56.9	77	15.2
Temporary staff	4	0.9	4	0.8
Apprentice	10	2.3	-	-
Intern	2	0.5	1	0.2
Other	-	-	7	1.4
Managerial Responsibility				
Yes	92	21.4	374	73.8
No	337	78.6	133	26.2

Note: Maximum values per demographic are printed in **bold**

5 RESULTS

5.1 Measurement Models

First, the quality of the measurement models is analysed before the structural model is presented (Hair et al., 2013). The results (see Appendix B) show loadings above 0.708 for all indicators, which demonstrates a satisfactory degree of reliability (Chin 2010). The results of Cronbach's α , composite reliability and ρ_A analysis are satisfactory.

5.2 Structural Model

The structural model shows no signs of multicollinearity and no assumptions of VIFs are violated (see Appendix C). The variance explained in each of the constructs is reviewed by analysing R^2 , which shows satisfactory values (see Table 2) (Shmueli/Koppius, 2011; Rigdon, 2012; Dolce et al., 2017).

Table 2. R^2 Values

	R^2
Burnout	0.302
Satisfaction	0.479
Productivity	0.248
Turnover intention	0.179

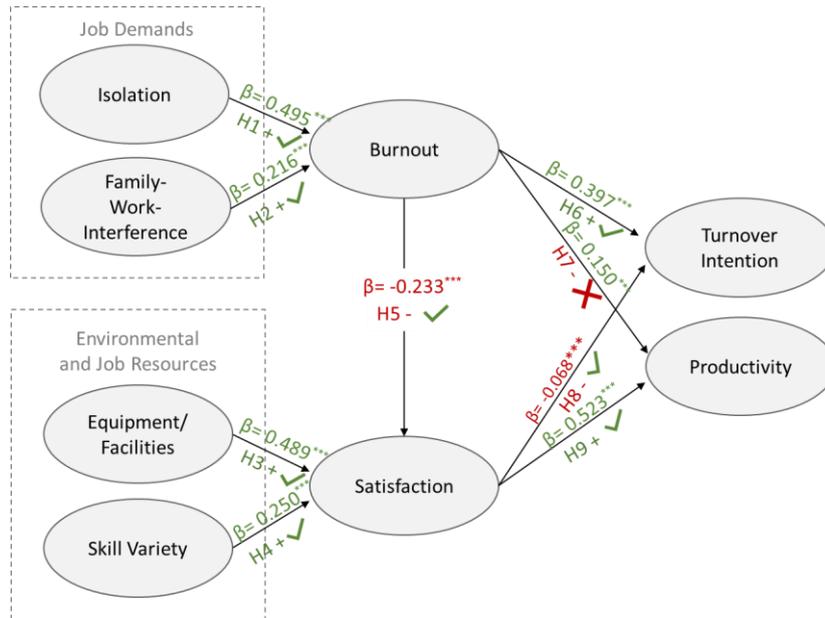
The research model has seven path coefficients, five of which have a positive value and suggest a positive relationship (see Table 3). The path between satisfaction and productivity has the strongest relationship (0.523). Two path coefficients indicate a negative relationship: between burnout and satisfaction (-0.233) and between satisfaction and turnover intention (-0.068). The results show for all path coefficients significant coefficients on a 1% level. According to the path coefficients and their significance except for H7, all hypotheses can be confirmed (see Figure 2). The values presented show that the model setup meets the quality criteria of the structural model and that the results can, therefore, be evaluated with valid content.

Table 3. Path Coefficients

<i>Hypothesis</i>	<i>Hypothesised Path</i>	<i>Path Coefficient</i>	<i>Confidence Intervals [2.5%, 97.5%]</i>
Burnout			
H1	Isolation \square Burnout	0.495***	[0.436; 0.547]
H2	Family-Work Interference \square Burnout	0.216***	[0.153; 0.277]
Satisfaction			
H3	Equipment/Facilities \square Satisfaction	0.489***	[0.437; 0.536]
H4	Skill Variety \square Satisfaction	0.250***	[0.186; 0.311]
H5	Burnout \square Satisfaction	-0.233***	[-0.278; -0.186]
Turnover Intention			
H6	Burnout \square Turnover Intention	0.397***	[0.333; 0.459]
H7	Satisfaction \square Turnover Intention	-0.068***	[-0.133; -0.001]
Productivity			
H8	Burnout \square Productivity	0.150***	[0.089; 0.207]
H9	Satisfaction \square Productivity	0.523***	[0.467; 0.578]

Note: ***Significant at 0.01 level (2-sided), **significant at 0.05 level (2-sided), *significant at 0.1 level (2-sided)

Figure 2. Research Model including Hypothesis and Structural Model Results (Own illustration, 2021)



5.3 Multigroup Analysis

After analysing the full sample and data preparation, data groups are generated for the nation as a variable of interest. This procedure is intended to uncover possible differences between Germany and the U.S. that can be assumed on the basis of historical, cultural and work organisation aspects with regard to home office. The three steps of the measurement invariance of composite models (MICOM) procedure are done. Thereby, the assessment of the configural invariance (Step I) and the compositional invariance (Step II) are established successfully (see Table 4). Partial measurement invariance is confirmed according to the test for composite equality (Step III).

Table 4. MICOM Step II Results

	Original Correlation	5.0%	Permutation p-values	Compositional Invariance Established?
Isolation	0.999	0.999	0.090	Yes
Family-Work Interference	1.000	0.998	0.942	Yes
Equipment/Facilities	0.999	0.996	0.581	Yes
Skill Variety	1.000	0.998	0.914	Yes
Burnout	1.000	1.000	0.208	Yes
Satisfaction	1.000	0.997	0.818	Yes
Turnover Intention	1.000	0.999	0.545	Yes
Productivity	0.999	0.999	0.185	Yes

The test for multigroup comparisons follows to compare standardised path coefficients across groups. Because the results of different assessment approaches are quite similar, the results of the parametric test (Keil et al., 2000), are taken into account (see Table 5). PLS-MGA uses a one-tailed test whereby the *p*-values show whether the path coefficient is significantly larger in the first group (Germany) than in the second group (U.S.). The results show that the path coefficient difference (labelled as H_{diff}) is significant for $H1_{diff}$, $H2_{diff}$, $H5_{diff}$, $H6_{diff}$ and $H7_{diff}$.

Table 5. Multigroup Comparison – Parametric Test and Bootstrapping Results

Hypothesis	Hypothesised Path	Bootstrapping Path Coefficients Original		Path Coefficient Difference (DE-U.S.)	p-value
		DE	U.S.		
Burnout					
H1 _{diff}	Isolation \square Burnout	0.288	0.599	-0.311	0.000
H2 _{diff}	Family-Work Interference \square Burnout	0.387	0.129	0.258	0.000
Satisfaction					
H3 _{diff}	Equipment/Facilities \square Satisfaction	0.428	0.526	-0.098	0.055
H4 _{diff}	Skill Variety \square Satisfaction	0.255	0.216	0.039	0.550
H5 _{diff}	Burnout \square Satisfaction	-0.335	-0.168	-0.167	0.001
Turnover Intention					
H6 _{diff}	Burnout \square Turnover Intention	0.151	0.490	-0.340	0.000
H7 _{diff}	Satisfaction \square Turnover Intention	-0.263	-0.043	-0.220	0.002
Productivity					
H8 _{diff}	Burnout \square Productivity	0.130	0.165	-0.036	0.572
H9 _{diff}	Satisfaction \square Productivity	0.529	0.497	0.032	0.593

6 DISCUSSION AND CONCLUSION

Drawing on JD-R and ED-R theories, this research has tested the relationship between several workplace characteristics, employees' personal outcomes and organisational outcomes. This comparative, cross-national study seeks to expand the body of knowledge by testing hypotheses related to workplace factors on the home office of U.S. and German knowledge workers. To the best of the author's knowledge, this is the first study that analyses these effects in an MGA study. The results reveal that overall isolation and equipment/facilities are identified as the most important factors affecting productivity and turnover intention through satisfaction and burnout in the home office during COVID-19. This is in line with previous literature dealing with effects of the pandemic (Hwang et al., 2020; Lengen et al., 2021). The novelty of this paper lies in the empirical confirmation of these effects with their influence on further personal and organisational outcomes. All presumed path relationships are significant and, apart from H7, all expected influences occur. Surprisingly, the impact is positive for burnout on productivity.

Comparison of the two nations for differences in path coefficients yields some significant findings. The two demands, isolation and family-work interference, show different strong effects on burnout in the two countries. While the path coefficient difference of isolation on burnout shows a negative value, indicating that the effect is significantly stronger in the U.S. than in Germany (with a positive path relation), family-work inference shows a significantly stronger positive effect on burnout in Germany than in the U.S. In addition, similar effects are visible on the path between burnout and satisfaction (significantly stronger negative relation in Germany), burnout on turnover intention (significantly stronger positive effect in the U.S.) and satisfaction on turnover intention (significantly stronger negative effect in Germany).

The findings fit into a body of research in both countries. Even before the pandemic, high levels of loneliness were found in the U.S. population overall (Weissbourd et al., 2021). This trend seems to have been reinforced within the pandemic and could explain the significantly higher impact of isolation on burnout in the U.S. compared to Germany. In the U.S., the lower

frequency of integration of work colleagues into one's private life, i.e. beyond the daily work routine, could also contribute to the fact that burnout was intensified during the pandemic. This is because without the social contacts of the workday and the limited opportunity to hold private meetings with friends, the exhaustion from the workday may have been perceived more acutely. The lower influence of family-work-interference on burnout in the U.S. could be related to the fact that it is the country where the term work-life balance was founded and this topic has been discussed since the early 1990s (Hillmann, 2019); hence, there could be a greater awareness of the topic among U.S. workers. Furthermore, home offices in the U.S. have historically been more established. The fact that U.S. knowledge workers might draw on their experience with this work location makes it conceivable that conflicts between family and work can be better resolved through greater experience with this form of work and would explain the weaker influence of this environmental demand on burnout.

The finding that housing characteristics (equipment/facilities)—the second strongest influencing factor of personal and organisational outcomes—does not show a significant difference across nations suggests its general importance. For this reason, it is one of the most important starting points for practitioners who want to improve the home office as a workplace for their employees.

Corporates that plan to adopt flexible workplace policies with the ability to work from home or the office can focus future efforts on developing strategies to reduce workplace demands (isolation and family-work interference) and enhance workplace resources (equipment/facilities and skill variety) to support employees to work efficiently. Having the choice between different workplaces can help manage the feeling of loneliness. In addition, the possibility to choose the work location that has the appropriate equipment and facilities for the task can increase satisfaction and productivity, and discourage turnover intention.

After the exceptional pandemic situation has been overcome and a new normality has taken hold in the working world, further research could capture the effect of workplace characteristics in the home office in more detail and assess the differences in the 'before and after' comparison. Therefore, additional follow-up data collection is required.

REFERENCES

- Alarcon, G.M. (2011), "A Meta-Analysis of Burnout with Job demands, Resources, and Attitudes", *Journal of Vocational Behaviour*, 79, 2, 549–562.
- Allen, T.D. (2001), "Family-Supportive Work Environments: The Role of Organisational Perceptions", *Journal of Vocational Behaviour*, 58, 3, 414–435.
- Amérigo, M., Aragonés, J.I. (1990), "Residential Satisfaction in Council Housing", *Journal of Environmental Psychology*, 10, 4, 313–325.
- Appel-Meulenbroek, R., Vries, B., Weggeman, M. (2013), "How CREM can Measure Added Value of Building Design; Knowledge Sharing in Research Buildings", Martens, B. (Ed.), *Book of Proceedings/20th Annual Conference of the European Real Estate Society*, ÖKK-Ed, Vienna, 133–151.
- Armitage, L.A., Nassor Amar, J.H. (2021), "Person-Environment Fit Theory. Application to the Design of Work Environments", Appel-Meulenbroek, R./Danivska, V. (Eds.), *A Handbook of Theories on Designing Fit Between People and the Office Environment*, Routledge, London, 14–26.
- Bakker, A.B., Demerouti, E. (2007), "The Job Demands-Resources Model: State of the Art", *Journal of Managerial Psychology*, 22, 3, 309–328.
- Bakker, A.B., Demerouti, E. (2017), "Job Demands-Resources Theory: Taking Stock and Looking forward", *Journal of Occupational Health Psychology*, 22, 3, 273–285.

- Bakker, A.B., Demerouti, E., De Boer, E., Schaufeli, W.B. (2003), "Job Demands and Job Resources as Predictors of Absence Duration and Frequency", *Journal of Vocational Behaviour*, 62, 2, 341–356.
- Bakker, A.B., Demerouti, E., Sanz-Vergel, A. (2014), "Burnout and Work Engagement: The JD-R Approach", *Annual Review of Organisational Psychology and Organisational Behaviour*, 1, 1, 389–411.
- Bauer, S.C., Silver, L. (2018), "The Impact of Job Isolation on New Principals' Sense of Efficacy, Job Satisfaction, Burnout and Persistence", *Journal of Educational Administration*, 56, 3, 315–331.
- Baruch, Y. (2000), "Teleworking: Benefits and Pitfalls as Perceived by Professionals and Managers", *New Technology, Work and Employment*, 15, 1, 34–49.
- Baruch-Feldman, C., Brondolo, E., Ben-Dayana, D., Schwartz, J. (2002), "Sources of Social Support and Burnout, Job Satisfaction, and Productivity", *Journal of Occupational Health Psychology*, 7, 1, 84–93.
- Belzunegui-Eraso, A., Erro-Garcés, A. (2020), "Teleworking in the Context of the COVID-19 Crisis", *Sustainability*, 12, 9, 1–18.
- Blok M., Groenesteijn L., Van den Berg C., Vink P. (2011), "New Ways of Working: A Proposed Framework and Literature Review", Robertson, M.M. (Ed.), *Ergonomics and Health Aspects of Work with Computers. EHAWC 2011. Lecture Notes in Computer Science*, 6779, Springer, Berlin, 3–12.
- Bloom, N., Liang, J., Roberts, J., Ying, Z. J. (2015), "Does Working from Home Work? Evidence from a Chinese Experiment", *The Quarterly Journal of Economics*, 130, 1, 165–218.
- BMFSFJ (2017), "Digitale Vereinbarkeit. Home-Office und mobiles Arbeiten – eine Toolbox für Unternehmen und Beschäftigte mit Familienaufgaben", available at: <https://www.bmfsfj.de/resource/blob/118752/909122f7ce343f454f3ff5c37e482a5c/digitale-vereinbarkeit-home-office-und-mobiles-arbeiten-eine-toolbox-fuer-unternehmen-und-beschaeftigte-mit-familienaufgaben-data.pdf> (accessed 31 January 2022).
- Bowling, N.A., Hammond, G.D. (2008), "A Meta-Analytic Examination of the Construct Validity of the Michigan Organisational Assessment Questionnaire Job Satisfaction Subscale", *Journal of Vocational Behaviour*, 73, 1, 63–77.
- Cammann, C., Fichman, M., Jenkins, G.D., Klesh, J. (1979), "The Michigan Organisational Assessment Questionnaire", Unpublished Manuscript, University of Michigan, Ann Arbor.
- Cammann, C., Fichman, M., Jenkins, G.D., Klesh, J. (1983), "Michigan Organisational Assessment Questionnaire", Seashore, S.E., Lawler, E.E, Mirvis, P.H., Cammann, C. (Eds.), *Assessing Organisational Change: A Guide to Methods, Measures, and Practices*, Wiley-Interscience, New York, 71–138.
- Carnevale, J.B., Hatak, I. (2020), "Employee Adjustment and Well-Being in the Era of COVID-19: Implications for Human Resource Management", *Journal of Business Research*, 116, 183–187.
- Cascio, W.F. (2010), "The Changing World of Work", Linley, P. A., Harrington, S., Garcea, N. (Eds.), *Oxford Handbook of Positive Psychology and Work*, University Press, Oxford.
- Cheah, H., Thurasamy, R., Ali Memon, M., Chuah, F., Ting, H. (2020), "Multigroup Analysis using SmartPLS: Step-by-Step Guidelines for Business Research", *Asian Journal of Business Research*, 10, 3, 1-19.
- Chin, W.W. (2010), "How to Write Up and Report PLS Analyses", Esposito Vinzi, V., Chin, W.W., Henseler, J., Wang, H. (Eds.), *Handbook of Partial Least Squares: Concepts, Methods and Applications*, 2, Springer, Heidelberg, 655–690.

- Clippard, M.S. (2020), “Steigerung der Immobilienperformance durch Nutzerorientierung. Möglichkeiten und Grenzen der Performancebewertung von Büroarbeitsplätzen”, Dissertation, Darmstadt.
- Contreras, F., Baykal, E., Abid, G. (2020), “E-Leadership and Teleworking in Times of COVID-19 and Beyond: What we Know and Where do we go”, *Frontiers in Psychology*, 11, 590271, 1–11.
- Crawford, E.R., LePine, J.A., Rich, B.L. (2010), “Linking Job Demands and Resources to Employee Engagement and Burnout: A Theoretical Extension and Meta-Analytic Test”, *Journal of Applied Psychology*, 95, 5, 834–848.
- Diener, E., Emmons, R.A., Larsen, R.J., Griffin, S. (1985), “The Satisfaction with Life Scale”, *Journal of Personality Assessment*, 49, 1, 71–75.
- Dolce, P., Esposito Vinzi, V., Lauro, C. (2017), “Predictive Path Modelling Through PLS and Other Component-Based Approaches: Methodological Issues and Performance Evaluation, Latan, H., Noonan, R. (Eds.), *Partial Least Squares Path Modelling: Basic Concepts, Methodological Issues and Applications*, Springer International Publishing, Cham, 153–172.
- Donthu, N., Gustafsson, A. (2020), “Effects of COVID-19 on Business and Research”, *Journal of Business Research*, 117, 284–289.
- Dubrin, A.J. (1991), “Comparison of the Job Satisfaction and Productivity of Telecommuters versus in-House Employees: A Research Note on Work in Progress”, *Psychological Reports*, 68, 3, 1223–1234.
- Eurofound and the International Labour Office (2017), “Working Anytime, Anywhere: The Effects on the World of Work, Publications Office of the European Union, Luxembourg, and the International Labour Office, Geneva”, available at: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1658en.pdf (accessed 31 January 2022).
- Federal Statistical Office (2021), “Arbeitskräfteerhebung”, available at: <https://www.destatis.de/DE/Themen/Arbeit/Arbeitsmarkt/Qualitaet-Arbeit/Dimension-3/home-office.html> (accessed 31 January 2022).
- Gauger, F., Pfnür, A. (2019), “Coworking Spaces”. *Zeitschrift Führung und Organisation*, 88, 1, 9–15.
- Gauger, F., Voll, K., Pfnür, A. (2020), “Corporate Coworking Spaces – Determinants of Work Satisfaction in Flexible Workspaces”, Kämpf-Dern, A., Will-Zocholl, M. (Eds.), *Future Workspaces. Proceedings of the Transdisciplinary Workplace Research (TWR) Conference 2020*, TWR Network, Frankfurt am Main, 174–189.
- Gigauri, I. (2020), “Effects of COVID-19 on Human Resource Management from the Perspective of Digitalization and Work-Life-Balance” *International Journal of Innovative Technologies in Economy*, 4, 31, 1–10.
- Grawitch, M.J., Maloney, P.W., Barber, L.K., Mooshegian, S.E. (2013), “Examining the 57 Nomological Network of Satisfaction with Work-Life Balance”, *Journal of Occupational Health Psychology*, 18, 3, 276–284.
- Gray, D. (2014), “Financial Concerns and Overall Life Satisfaction: A Joint Modelling Approach”, *Sheffield Economic Research Paper Series*, 2014008, The University of Sheffield.
- Greenhaus, J.H., Beutell, N.J. (1985), “Sources of Conflict Between Work and Family Roles”, *Academy of Management Review*, 10, 1, 76–88.
- Grzywacz, J.G., Demerouti, E. (Eds.). (2013). *New Frontiers in Work and Family Research*, Psychology Press, Hove.
- Hackman, J.R., Oldham, G.R. (1980), *Work Redesign*, Addison- Wesley, Reading.

- Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M. (2017), *A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM)* (2nd ed.), Sage, Thousand Oaks.
- Hair, J.F., Ringle, C.M., Sarstedt, M. (2013), “Partial Least Squares Structural Equation Modelling: Rigorous Applications, Better Results and Higher Acceptance”, *Long Range Planning*, 46, 1/2, 1–12.
- Hair, J.F., Risher, J.J., Sarstedt, M., Ringle, C.M. (2019), “When to use and How to report the Results of PLS-SEM”, *European Business Review*, 31, 1, 2–24.
- Hakanen, J.J., Bakker, A.B. (2017), “Born and Bred to Burn Out: A Life-Course View and Reflections on Job Burnout”, *Journal of Occupational Health Psychology*, 22, 3, 354–364.
- Hakanen, J.J., Bakker, A.B., Schaufeli, W.B. (2006), “Burnout and Work Engagement among Teachers”, *Journal of School Psychology*, 43, 6, 495–513.
- Hakanen, J.J., Schaufeli, W.B., Ahola, K. (2008), “The Job Demands-Resources Model: A Three-Year Cross-Lagged Study of Burnout, Depression, Commitment, and Work Engagement”, *Work & Stress*, 22, 3, 224–241.
- Hillmann, J. (2019), “Forschungsstand: Der Begriff Work-Life-Balance und dahinterstehende Konzepte“, Hillmann, J. (Ed.), *Work-Life-Balance als politisches Instrument*, 11-46, Springer, Wiesbaden.
- Hofstede Insights (2022), “Country Comparison”, available at: <https://www.hofstede-insights.com/country-comparison/germany,the-usa/> (accessed 18 February 2022).
- Humphrey, S.E., Nahrgang, J.D., Morgeson, F.P. (2007), “Integrating Motivational, Social, and Contextual Work Design Features: A Meta-Analytic Summary and Theoretical Extension of the Work Design Literature”, *Journal of Applied Psychology*, 92, 5, 1332–1356.
- Hwang, T., Rabheru, K., Peisah, C., Reichman, W., Ikeda, M. (2020), “Loneliness and social isolation during the COVID-19 pandemic”, *International Psychogeriatrics*, 32, 10, 1217–1220.
- International Workplace Group (2019), “The IWG global workplace survey”, available at: <https://assets.regus.com/pdfs/iwg-workplace-survey/iwg-workplace-survey-2019.pdf> (accessed 31 January 2022).
- Ipsen, C., Van Veldhoven, M., Kirchner, K., Hansen, J. P. (2021), “Six Key Advantages and Disadvantages of Working from Home in Europe during COVID-19”, *International Journal of Environmental Research and Public Health*, 18, 4, 18-26.
- Jackson, S.E., Maslach, C. (1982), “After-Effects of Job-Related Stress: Families as Victims”, *Journal of Organisational Behaviour*, 3, 1, 63–77.
- Keil, M., Tan, B.C., Wei, K.K. (2000), “A cross-cultural study on escalation of commitment behaviour in software projects”, *MIS Quarterly*, 24, 2, 299-325.
- Kellner, T., Albrecht, T., Löfl, J. (2020), “Wie arbeitest du heute? Veränderungen von Arbeits- und Organisationsstrukturen durch die Einführung von Home-Office in Zeiten der COVID-19 Pandemie”, Ergebnisbericht, Technische Hochschule Ostwestfalen-Lippe University of Applied Sciences and Arts Institut für Wissenschaftsdialog, Lemgo.
- Klopotek, M. (2017), “The advantages and disadvantages of remote working from the perspective of young employees”, *Organisation and Management Scientific Quarterly*, 4, 40, 39-49.
- Körber, M (2018), “Deutschland tickt anders als die USA”, available at: <https://www.sueddeutsche.de/karriere/arbeitskultur-deutschland-tickt-anders-als-die-usa-1.3931898> (accessed 18 February 2022).
- Kreiner, G., Hollensbe, E., Sheep, M. L. (2009), “Balancing Borders and Bridges: Negotiating Work-Home Interface via Boundary Work Tactics”, *Academy of Management Journal*, 52, 4, 704–730.

- Kröll, C., Nüesch, S. (2019), "The Effects of Flexible Work Practices on Employee Attitudes: Evidence from a Large-Scale Panel Study in Germany", *International Journal of Human Resource Management*, 30, 9, 1505–1525.
- Krupper, D. (2013), "Nutzerbasierte Bewertung von Büroimmobilien. Eine Post-Occupancy Evaluation auf Basis umweltsychologischer Aspekte unter besonderer Berücksichtigung von Zufriedenheit, Gesundheit und Produktivität", Dissertation, Darmstadt.
- Landy, F.W. (1985), *The Psychology of Work Behaviour* (3rd ed.), Dorsey Press, Homewood.
- Leiter, M.P. (1988), "Burnout as a Function of Communication Patterns", *Group & Organisation Management*, 13, 1, 111–128.
- Lengen, J.C., Kordsmeyer, A., Rohwer, E., Harth, V., Mache, S. (2021), "Soziale Isolation im Homeoffice im Kontext der COVID-19- Pandemie", *Zentralblatt für Arbeitsmedizin, Arbeitsschutz und Ergonomie*, 71, 63–68.
- Lu, A.C.C., Gursoy, D. (2016), "Impact of Job Burnout on Satisfaction and Turnover Intention", *Journal of Hospitality and Tourism Research*, 40, 2, 210–235.
- Maarleveld, M., Volker, L., Van der Voordt, T.J. (2009), "Measuring Employee Satisfaction in New Offices – the WODI Toolkit", *Journal of Facilities Management*, 7, 3, 181–197.
- Maslach, C., Jackson, S.E. (1986), "Maslach Burnout Inventory Manual" (2nd ed.), Consulting Psychologists Press, Palo Alto.
- Mergener, A. (2020), "Homeoffice in Deutschland - Zugang, Nutzung und Regelung", Ergebnisse aus der BIBB BAuA-Erwerbstätigenbefragung 2018, Bundesinstitut für Berufsbildung, Bonn.
- Messenger, J.C., Gschwind, L. (2016), "Three Generations of Telework: New ICTs and the (R)evolution from Home Office to Virtual Office", *New Technology, Work and Employment*, 31, 3, 195–208.
- Mlitz, K. (2021), "Change in remote work trends due to COVID-19 in the United States in 2020", available at: <https://www.statista.com/statistics/1122987/change-in-remote-work-trends-after-covid-in-usa/> (accessed 31 January 2022).
- Mobley, W.H. (1977), "Intermediate Linkages in the Relationship Between Job Satisfaction and Employee Turnover", *Journal of Applied Psychology*, 62, 2, 237–240.
- Moen, P., Kelly, E.L., Fan, W., Lee, S.-R., Almeida, D., Kossek, E.E., Buxton, O.M. (2016), "Does a Flexibility/Support Organisational Initiative Improve High-Tech Employees' Well-Being? Evidence from the Work, Family, and Health Network", *American Sociological Review*, 81, 1, 134–164.
- Møller-Jensen, L., Jensen-Butler, C., Madsen, B., Millard, J., Schmidt, L. (2008), "A Web-Based Study of the Propensity to Telework Based on Socio-Economic, Work Organisation and Spatial Factors", Jensen-Butler, C., Sloth, B., Marott Larsen, M., Madsen, B., Anker Nielsen, O. (Eds.), *Road Pricing, the Economy and the Environment*, Springer, Berlin, 385–408.
- Newman, C., Delaney, L., Nolan, B. (2008), "A Synamic Model of the Relationship Between Income and Financial Satisfaction: Evidence from Ireland", *The Economic and Social Review*, 39, 2, 105–130.
- Nijp, H.H., Beckers, D.G., Van de Voorde, K., Geurts S.A, Kompier, M.A. (2016), "Effects of New Ways of Working on Work Hours and Work Location, Health and Job-Related Outcomes", *Chronobiology International*, 33, 6, 604–18.
- Porter, L.W., Steers, R.M. (1973), "Organisational, Work, and Personal Factors in Employee Turnover and Absenteeism", *Psychological Bulletin*, 80, 2, 151–176.
- Pfnür, A., Gauger, F., Bachtal, Y., Wagner, B. (2021), "Homeoffice im Interessenkonflikt", In: Pfnür, A. (Ed.), *Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis*, 41, Darmstadt.

- Rigdon, E.E. (2012), "Rethinking Partial Least Squares Path Modelling: In Praise of Simple Methods", *Long Range Planning*, 45, 5/6, 341–358.
- Roskams, M., McNeely, E., Węziak-Białowolska, D., Białowolski, P. (2021), "Job Demands-Resources Model: Its Applicability to the Workplace Environment and Human Flourishing", Appel-Meulenbroek, R., Danivska, V. (Eds.), *A Handbook of Theories on Designing Fit Between People and the Office Environment*, Routledge, London, 27–38.
- Schaufeli, W.B., Bakker, A.B. (2004), "Job Demands, Job Resources, and Their Relationship with Burnout and Engagement: A Multi-Sample Study", *Journal of Organisational Behaviour*, 25, 3, 293–315.
- Schlägel, C., Sarstedt, M. (2016), "Assessing the measurement invariance of the four-dimensional cultural intelligence scale across countries: A composite model approach", *European Management Journal*, 34, 6, 633–649.
- Shmueli, G., Koppius, O.R. (2011), "Predictive Analytics in Information Systems Research", *MIS Quarterly*, 35, 3, 553–572.
- Siddiqui N.N. (2015), "An Empirical Study on Job Satisfaction among Faculties in Selected Personal Universities of Uttar Pradesh", *International Journal of Management Research and Reviews*, 5, 4, 238–245.
- Stegmann, S., Van Dick, R., Ullrich, J., Charalambous, J., Menzel, B., Egold N., Tai-Chi Wu, T. (2010), "Der Work Design Questionnaire: Vorstellung und erste Validierung einer deutschen Version", *Zeitschrift für Arbeits- und Organisationspsychologie*, 54, 1, 1–28.
- Van der Voordt, T.J.M. (2004), "Productivity and Employee Satisfaction in Flexible Workplaces", *Journal of Corporate Real Estate*, 6, 2, 133–148.
- Van Praag, B.M.S., Frijters, P., Ferrer-i-Carbonell, A. (2003), "The Anatomy of Subjective Well-Being", *Journal of Economic Behaviour & Organisation*, 51, 1, 29–49.
- Wang, B., Liu, Y., Qian, J., Parker, S.K. (2021), "Achieving Effective Remote Working During the COVID-19 Pandemic: A Work Design Perspective", *Applied Psychology*, 70, 1, 16–59.
- Weissbourd, R., Batanova, M., Lovison, V., Torres, E. (2021), "Loneliness in America: How the Pandemic Has Deepened an Epidemic of Loneliness and What We Can Do About It", Harvard's Making Caring Common, Harvard Graduate School of Education.
- Wolpin, J., Burke, R.J., Greenglass, E.R. (1991), "Is Job Satisfaction an Antecedent or a Consequence of Psychological Burnout?", *Human Relations*, 44, 2, 193–209.
- Xiao, Y., Becerik-Gerber, B., Lucas, G., Roll, S.C. (2021), "Impacts of Working From Home During COVID-19 Pandemic on Physical and Mental Well-Being of Office Workstation Users", *Journal of Occupational and Environmental Medicine*, 63, 3, 181–190.
- Ybema, J.F., Smulders, P.G.W., Bongers, P.M. (2010), "Antecedents and Consequences of Employee Absenteeism: A Longitudinal Perspective on the Role of Job Satisfaction and Burnout", *European Journal of Work and Organisational Psychology*, 19, 1, 102–124.
- Zhang, S.X., Chen, J., Afshar Jahanshahi, A., Alvarez-Risco, A., Dai, H., Li, J., Patty-Tito, R.M. (2021), "Succumbing to the COVID-19 Pandemic-Healthcare Workers Not Satisfied and Intend to Leave Their Jobs", *International Journal of Mental Health and Addiction*, in press.
- Zelenski, J., Murphy, S., Jenkins, D. (2008), "The Happy-Productive Worker Thesis Revisited", *Journal of Happiness Studies*, 9, 4, 521–537.

APPENDIX**A: Operationalisation**

<i>Item</i>	<i>Construct</i>	<i>Source</i>
reflective	Isolation	
<i>Iso_1</i>	I feel lonely at my workplace at home.	(Bloom et al., 2015)
<i>Iso_2</i>	I feel isolated at my workplace at home.	(Bloom et al., 2015)
<i>Iso_3</i>	At my workplace at home, I lack opportunities to socialise at and after work.	(Bloom et al., 2015)
reflective	Family–Work Interference (inverted)	
<i>FWI_1</i>	In most ways, my work–life balance is close to my ideal.	(Diener et al., 1985)
<i>FWI_2</i>	So far, I have gotten the important things regarding my work–life balance.	(Diener et al., 1985; Grawitch et al., 2013)
reflective	Equipment/Facilities	
<i>EF_1</i>	I have a full-fledged workplace in terms of furniture (including storage space).	(Maarleveld et al., 2009; BMFSFJ, 2017)
<i>EF_2</i>	The technological equipment of your home office. – I have full information and communication technology equipment (computers, printers, etc.).	(Møller-Jensen et al., 2008; Maarleveld et al., 2009; BMFSFJ, 2017)
<i>EF_3</i>	The available rooms (equipment, furniture) support the work optimally.	(Maarleveld et al., 2009; Gauger et al., 2020)
reflective	Skill Variety	
<i>SV_1</i>	The job requires a variety of skills.	(Hackman/Oldham, 1980; Stegmann et al., 2010)
<i>SV_2</i>	The job requires me to utilise a variety of different skills in order to complete the work.	(Hackman/Oldham, 1980; Stegmann et al., 2010)
<i>SV_3</i>	The job requires me to use a number of complex or high-level skills.	(Hackman/Oldham, 1980; Stegmann et al., 2010)
<i>SV_4</i>	The job requires the use of a number of skills.	(Hackman/Oldham, 1980; Stegmann et al., 2010)
reflective	Burnout	
<i>Burn_1</i>	I feel emotionally drained from my work.	(Maslach/Jackson, 1986; Moen et al., 2016)
<i>Burn_2</i>	I feel burned out by my work.	(Maslach/Jackson, 1986; Moen et al., 2016)
<i>Burn_3</i>	I feel drained at the end of the workday.	(Maslach/Jackson, 1986; Moen et al., 2016)
reflective	Satisfaction	
<i>Satis_1</i>	All in all, I am satisfied with my job.	(Cammann et al., 1979; Cammann et al., 1983; Bowling/Hammond, 2008; Allen, 2001)
<i>Satis_2</i>	I am satisfied with my home office.	Amérgo/Aragonés, 1990; Gauger et al., 2020)
<i>Satis_3</i>	Your satisfaction with your life overall.	(Diener et al., 1985; Bowling/Hammond, 2008)

<i>Satis_4</i>	Your satisfaction with your financial situation.	(Van Praag et al., 2003; Newman et al., 2008; Gray, 2014)
reflective	Turnover Intention	
<i>TI_1</i>	I intend to leave my job in the next 6 months.	(Cammann et al.,1979; Zhang et al. 2021)
<i>TI_2</i>	I will actively look for a new job in the next 6 months.	(Cammann et al.,1979; Zhang et al. 2021)
<i>TI_3</i>	I will probably be working for another organisation for the next 6 months.	(Cammann et al.,1979; Zhang et al. 2021)
reflective	Productivity	
<i>Prod_1</i>	Working in my home office makes it easier for me to do my work.	(Own research following Krupper, 2013)
<i>Prod_2</i>	Working in my home office increases my effectiveness at work.	(Own research following Krupper, 2013)
<i>Prod_3</i>	Working in my home office improves my productivity.	(Own research following Krupper, 2013)
<i>Prod_4</i>	I have the feeling that working at home is more productive than working at my professional office workstation.	(Own research following Krupper, 2013)

B: Measurement Models Results

Indicator Loadings, Mean Values and Standard Deviations

	<i>Outer Loading</i>	<i>Mean Value</i>	<i>Standard Deviation</i>
Isolation			
Iso_1	0.913	2.494	1.215
Iso_2	0.909	2.547	1.206
Iso_3	0.851	2.846	1.196
Family-Work Interference			
FWI_1	0.949	3.130	1.438
FWI_2	0.938	5.042	1.431
Equipment/Facilities			
EF_1	0.748	4.884	1.664
EF_2	0.764	5.365	1.480
EF_3	0.817	5.472	1.327
Skill Variety			
SV_1	0.873	5.350	1.215
SV_2	0.871	5.368	1.250
SV_3	0.839	5.228	1.330
SV_4	0.838	5.236	1.339
Burnout			
Burn_1	0.906	2.669	1.070
Burn_2	0.893	2.870	1.056
Burn_3	0.898	2.786	1.030
Satisfaction			
Satis_1	0.723	5.302	1.376
Satis_2	0.754	5.219	1.375
Satis_3	0.754	5.268	1.212
Satis_4	0.710	4.672	1.374
Turnover Intention			
TI_1	0.917	2.841	1.947
TI_2	0.932	3.093	2.031
TI_3	0.897	3.137	2.078

Productivity			
Prod_1	0.871	4.848	1.528
Prod_2	0.896	5.042	1.431
Prod_3	0.903	5.005	1.471
Prod_4	0.769	5.025	1.459

Internal Consistency Reliability and Convergent Validity

	<i>Internal Consistency</i>			<i>Convergent Validity</i>
	<i>Cronbach's α</i>	ρ_A	<i>Composite Reliability</i>	<i>AVE</i>
Isolation	0.870	0.870	0.921	0.794
Family–Work Interference	0.877	0.884	0.942	0.890
Equipment/Facilities	0.677	0.695	0.820	0.604
Skill Variety	0.878	0.884	0.916	0.731
Burnout	0.881	0.882	0.927	0.808
Satisfaction	0.724	0.734	0.825	0.541
Turnover Intention	0.904	0.909	0.940	0.839
Productivity	0.883	0.885	0.920	0.742

HTMT Ratios

	Burnout	Equipment/ Facilities	Family–Work Interference	Isolation	Productivity	Satis- faction	Skill Variety	Turnover Intention
Burnout								
Equipment/Fa- cilities	0.165 CI ⁹⁵ =0.247							
Family–Work Interference	0.271 CI ⁹⁵ =0.345	0.524 CI ⁹⁵ =0.599						
Isolation	0.577 CI ⁹⁵ =0.636	0.3206 CI ⁹⁵ =0.287	0.060 CI ⁹⁵ =0.085					
Productivity	0.052 CI ⁹⁵ =0.080	0.564 CI ⁹⁵ =0.646	0.396 CI ⁹⁵ =0.470	0.139 CI ⁹⁵ =0.255				
Satisfaction	0.385 CI ⁹⁵ =0.458	0.815 CI ⁹⁵ =0.875	0.715 CI ⁹⁵ =0.767	0.257 CI ⁹⁵ =0.333	0.561 CI ⁹⁵ =0.631			
Skill Variety	0.054 CI ⁹⁵ =0.092	0.468 CI ⁹⁵ =0.556	0.322 CI ⁹⁵ =0.399	0.047 CI ⁹⁵ =0.063	0.264 CI ⁹⁵ =0.348	0.536 CI ⁹⁵ =0.614		
Turnover Intention	0.466 CI ⁹⁵ =0.528	0.141 CI ⁹⁵ =0.189	0.068 CI ⁹⁵ =0.134	0.418 CI ⁹⁵ =0.483	0.069 CI ⁹⁵ =0.089	0.219 CI ⁹⁵ =0.290	0.150 CI ⁹⁵ =0.221	

Note: CI⁹⁵ presents the upper bound of the 95% bias-corrected and accelerated confidence interval

C: Structural Model Results

VIF Values

	Burnout	Productivity	Satisfaction	Turnover Intention
Burnout		1.104	1.018	1.104
Family–Work Interference	1.002			
Isolation	1.002			
Equipment/Facilities			1.174	
Building			1.155	
Satisfaction		1.104		1.104

Functions and relevance of spatial co-presence: learnings from the corona pandemic for workplace management

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ABSTRACT

The study aims to analyse how service provision, internal processes, and culture have been affected by lockdowns and mandatory work from home periods due to the Covid 19 pandemic and what function social co-presence might play in this regard. A theoretical framework that considers individual, team, and organisational perspectives on task performance and social/community aspects is outlined. In a single organisation qualitative case study, five focus group interviews including 19 employees of an IT consultancy were conducted to identify the effects of Covid19 Pandemic. Results show that individual performance was assessed to have increased while internal processes remained at similar levels compared to pre-pandemic levels. Culture, however, was reported to have considerably deteriorated in the view of the participants. The study shows that for a company that was very experienced with distributed working, the reduction of co-presence had important effects on performance and culture. Findings suggest that the scarce resource of copresence must be carefully managed in the future. This could become a new priority for workplace and human capital management.

Keywords

Workplace management, Co-presence, Qualitative case study, Productivity, Organisational culture.

1 INTRODUCTION

The Covid19-crisis is a disruption for workplace management. It forced many organisations to switch almost completely to remote working within a very short period of time. Among them were organisations that had not previously allowed this form of work. During lockdowns and mandatory work-from-home periods, employees have become accustomed to using digital collaboration infrastructures and got used to working remotely. Recent surveys (e.g. Barrero, Bloom & Davis, 2021; Ipsen et al., 2021) indicate that the desire to extend work-from-home is widespread and that employees feel they are more productive in the home office. This usually implicitly refers to individual productivity and neglects productivity at other levels (team, department, organisation) (but see Tagliaro & Migliore, 2022). Looking at the different levels of organisational productivity, which is more than the sum of individual performance (cf. Klein & Kozlowski, 2000, Rousseau, 1985), there are many reasons to emphasise the importance of co-presence in the office:

- Collaboration and teamwork are essential to the success of an organisation. How well teams function and work together depends on factors such as social and task cohesion (Dey and Ganesh, 2020; West, 2012).
- Opportunities for interaction and physical proximity have a positive impact on team dynamics (Allen, 2007).

- Spatial proximity supports the establishment and maintenance of social relationships and the development of sympathy (Shin et al., 2019).
- Copresence facilitates spontaneous coordination (Heath & Luff, 1992; Suchman, 1997).
- Copresence supports knowledge transfer in teams and organisations (Kaschig et al., 2016).
- Culture is transmitted through actions, most of which are not intentionally targeted at transmitting culture in organisations but occur as work activities or routines (Schein, 2004).
- Socialisation (and other forms of organisational learning) takes place through listening to and observing the actions of colleagues (Cerasoli et al., 2018).

With the increasing trend towards spatially distributed, virtual work, organisations need to consider how they will manage functions of co-presence and what spatial and organisational means they will use or develop to do so. Some studies suggest that in the future, offices will serve much more than before the pandemic as meeting places where teams and individuals come together in search of interaction (Marzban et al., 2021; Tagliaro & Migliore, 2022). Therefore, the question is how the role of the office is currently changing and will change in the future, especially in its social dimension (Fayard et al., 2021). In this context, it is also necessary to examine to what extent the above-mentioned points can be supported by workplace and human capital management practices and where co-presence brings a unique advantage. To explore these questions, we conducted a qualitative case study.

2 METHOD

The research was conducted as a single-organisation case study. The main goal of the research was to explore the role of co-presence in the particular context of a medium sized company. The organisation studied is a software engineering and consultancy company with about 300 employees. The majority of employees are software engineers and consultants. Employees are used to distributed work since most of them spend the biggest part of their work time with clients and at clients' premises. In order to identify the role and functions of co-presence from the employees' point of view and against the background of the Covid19 crisis, five focus group interviews with four employees each were conducted in August 2021. The focus group interviews covered 3 perspectives related to the role of co-presence:

- service provision,
- internal processes, and
- culture.

The topics were briefly introduced, and the participants were invited to discuss them from two perspectives: before and during the Covid19 pandemic. Participants were asked to reflect on and compare strengths and weaknesses of the two working situations (before and during pandemic) in relation to the topics and the effects of the pandemic on the topics. The discussions lasted between 90-120 minutes. At the end of the sessions, participants were asked to give a summative quantitative statement by sticking stickers on scales drawn on flipcharts. During the focus group interviews both researchers took notes. Notes were integrated into a protocol after each session and the protocols served as data for the subsequent qualitative analysis. Thematic analysis was used to analyse the interview data. Braun and Clarke (2006, p. 79) describe thematic analysis as "a method for identifying, analysing and reporting patterns (themes) within data". The authors read through the focus group discussion notes multiple times to identify underlying themes and through multiple iterative, parallel counter-readings formed a common understanding. This process resulted in a thematic category system with core examples.

3 RESULTS

In terms of service provision, the results of the focus group interviews revealed seven topics affected by the corona pandemic and with a distinct role of co-presence (table 1). Since service provision refers to the core business of the company, it was the most intensely discussed of all topics. The first theme that emerged from the data analysis was productivity. This theme refers to the output of work and tends to be discussed positively. However, some participants stated some concerns that the quality of the output may have suffered from providing services in a remote mode during lockdowns and mandatory work-from-home periods. What concerns efficiency, the second theme of the service provision topic, participants agreed that saving time of commuting and travelling to clients positively contributed to efficiency. Working remotely also increased flexibility in service provision since employees of the company could compose teams more flexibly since they did not have to travel to clients' premises. Some concerns regarding efficiency were mentioned for communication: due to the lack of informal communication possibilities with clients, communication became more formal and "all information exchange needs to be scheduled" as one participant mentioned. Similarly, integration with the client organisation – the third theme - was considered more difficult. Working from a distance made it difficult to identify key people in the client organisation and to deliberately build up a network. Participants reported major changes in the communication with clients: ad hoc and informal information exchange was massively reduced and had to be replaced through more formal, scheduled meetings. When communication occurred, the quality was experienced as different because nonverbal and visual feedback were reduced. Participants reported that this impaired mainly non-routine communication. Status updates and similar routine communication was considered to work well in online settings. However, conversations with difficult content, such as potentially conflictual strategic topics, conflict, criticism, controversy, or creativity should take place in co-located settings. What concerns the collaboration with the clients, participants mentioned that generally, team spirit was reduced or missing and that "there was less energy in the processes". Work tasks that are dependent on visualisations were considered more difficult. As a consequence, such tasks were less developed jointly in the team. Innovation was considered to be impaired through the forced remote settings. Some participants considered co-presence as a prerequisite for innovation. A participant mentioned, referring to processes, practices, and routines: "Nothing new has emerged in the last few months; we may [only] have become more productive. One tries to find one's way in the existing". Finally, cross-selling was reported to have become more difficult because employees from the consultancy did not overhear potential client needs.

Table 1. Themes of the service provision topic

Theme	Core example (service provision topic)
Productivity	"Output was even better during the pandemic."
Efficiency	"Efficiency was higher, partly because of saving the time of commuting." "Less time with the client is a big advantage, but you also experience less of the client."
Integration with client organisation	"The team in the client's organisation is much more isolated, no longer integrated."
Communication with client	"Before, much more informal information, now much more facts." "Now you have to do more formal meetings with clients. Cool office grapevine information is falling away." "Conflict, controversy, creativity should happen with the client."

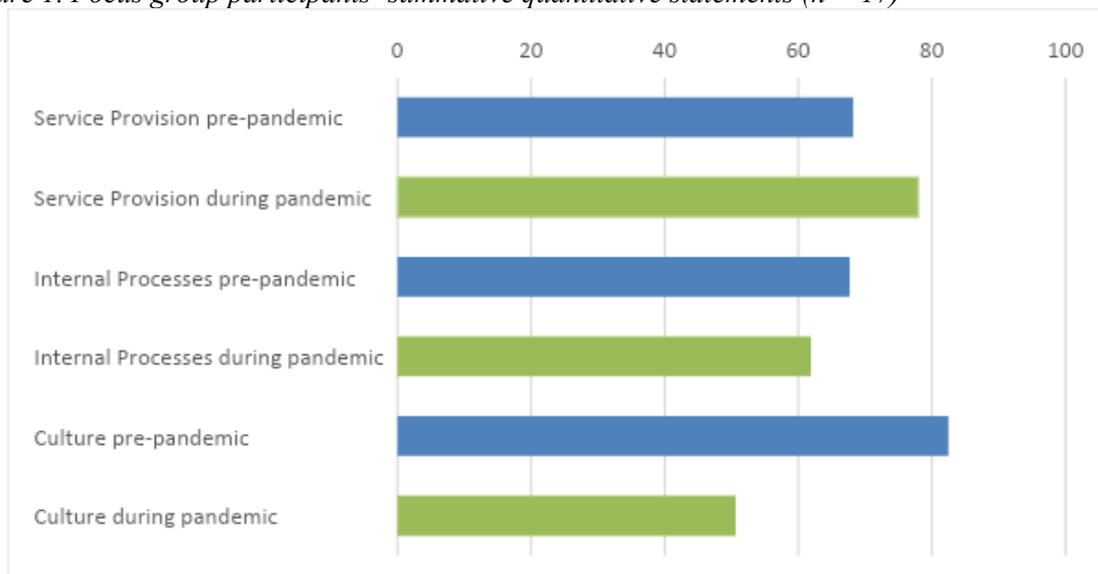
Collaboration with client	“Problem solving (with visualisations) is rather more difficult.” “Client is more open in terms of how you work and flexibility.”
Innovation	“Nothing new has emerged in the last few months.” “There is less talk about improvements than before.”
Cross-Selling	“Cross-Selling has become more difficult.”

The second topic of the study is internal processes. Three themes emerged from the analysis: internal communication, human resources processes, and internal events. Participants experienced internal communication and internal meetings as better than before the pandemic because in the online mode, the meetings were more focused and shorter. This mainly applied to formal and routine meetings within the teams. For informal, sensitive, or personal content, however, participants missed the co-located meetings. Some had the impression that despite an “excess of videoconferencing, contact is rather sparse”. Furthermore, participants mentioned that colleagues and managers were generally accessible easier than before the pandemic. Generally, signalling availability in Microsoft Teams and similar platforms was considered useful, particularly to reduce interruptions and distractions. On the other hand, communications outside the team boundaries have broken down. One participant mentioned: “Spontaneous discussions across team boundaries are missing but are often the best conversations”. Some participants referred to learning activities that play an important role in the company. They noticed that technical and highly structured learning did not suffer from the shift to the online mode. However, interactive learning and training sessions suffered from the change.

Also referring to internal communication, participants stated that processes could not be abbreviated via less formal channels anymore. As an example, internal IT support was mentioned. Short routes to IT support were not possible anymore and requests had to follow the formal process via tickets which was considered much more time-consuming. The second theme pertaining to the topic is human resources processes. Here, the onboarding of new employees was reported as the major issue. Onboarding of new colleagues was considered to be very difficult because emotional bonds could not be established as quickly and naturally as before the pandemic. Internal events are the third theme in the topic. Participants mentioned internal academies, communities of practice, and workshops. They agreed that the formal and technical quality of these events remained good but co-learning and community-related work became more difficult because of the limited possibilities for social interaction. Playful and experimental sessions have fallen away. One workshop leader mentioned that “training, internal academies and workshops are a pain because you don't feel people”. Thematic analysis revealed three themes in the third topic researched, organisational culture. The themes are a sense of unity, commitment, and touchpoints. Regarding the sense of unity, participants bemoaned the perceived reduction of the collaboration culture that they identified as a core characteristic of the organisational culture. Socialising was identified as another key characteristic of the company culture. Participants mentioned that company-wide online sessions (such as virtual town hall sessions or focus days) were satisfactory content-wise but lacked the social element, e.g., with talks at the coffee machine. Furthermore, the organisation became more anonymous, as one participant mentioned: “You no longer know all your colleagues”. Some participants stated that it had become difficult to “feel” the company or that they tended to lose their attachment to the organisation. One participant summarised: “There is no longer any difference between [name of the company] and other companies. [name of the company] exists only on paper.”

The second theme of the organisational culture topic is commitment. The changing role of commitment is substantiated by statements about short-term rescheduling of priorities (“a meeting has come up...”) and participation in online meetings: “At on-site events, you can't just run away, cancellations at short notice are too easy online, something has been lost in terms of culture”. Touchpoints are the third theme of the organisational culture topic. The participants unanimously regretted that organisational events had been cancelled and they were missing company specific rituals that had shaped organisational culture. Since the employees spend lots of time with different clients, socialising events played an important role that got lost during the pandemic and left participants with the question of what the actual current company culture looked like. Some participants missed feedback-loops when events took place virtually. Furthermore, they stated that the socialisation of new colleagues used to take place via work shadowing and that it was difficult to replace this. Socialisation took much more time and participants concluded that integration of new members of the organisation generally required co-presence. The participants of the focus group interviews summarised their assessment of the topics discussed by placing stickers on scales drawn on flipcharts. These quantitative statements are displayed in figure 1 transformed on a scale from 0-100. The quantitative assessments reflect the qualitative information and show that service provision or productivity, respectively, was judged to be somewhat higher during the pandemic while internal processes were assessed slightly lower during the pandemic than before. Organisational culture, on the other hand, seems to have been negatively affected during pandemic.

Figure 1. Focus group participants' summative quantitative statements (n = 17)



4 DISCUSSION

Results from the five focus group interviews revealed a multitude of topics regarding the role and function of co-presence for service provision, internal processes, and organisational culture. Participants experiences and assessment of the themes within all three topics were ambivalent: Productivity and efficiency were assessed as more positive during the lockdowns and mandatory work from home periods than before the Covid19 pandemic. In contrast to this, integration, communication, and collaboration with the clients as well as innovation and cross-selling were assessed negatively. Thus, there seem to be some tensions between individual efficiency (saving time on travelling and commuting, reduction of interruptions and distractions) on the one hand side and team and company performance on the other hand side.

Hence, individual efficiency gains may come at the price of team effectiveness. This finding supports an understanding of organisational performance as a multi-layered concept. The impact of reduced co-presence and increased online interaction on internal processes due to the Covid19 crisis was assessed as ambiguous: participants stated that formal, technical, and structured processes improved or remained unaffected. Furthermore, Accessibility of colleagues and supervisors became easier, and participants could manage interruptions and distractions better. On the other hand, participants reported that informal meetings, conversations with personal or sensitive content, communications across team boundaries, interactive learning sessions, co-learning, community-related work, and playful or experimental sessions suffered from a lack of co-presence or fell completely away. Thus, the “social glue”, i.e. informal organisation, processes, and interactions that create attachment of employees to their colleagues, was negatively affected while formal processes remained efficient and effective or even improved. A reduction of social reflexivity in teams may reduce task effectiveness, team member well-being, and innovation in the medium term (see West, 2012). Furthermore, these findings confirm previous findings that showed the role of physical proximity and co-presence for the establishment and maintenance of social relationships. The quantitative summative statements indicate that culture was most affected by the change to working from home. Participants mentioned that the collaboration culture, previously a core element of organisational culture, suffered. This perception was correlated with a reduction of (informal) social contacts, particularly related to organisational events, and more anonymity in the organisation. One indicator that was mentioned for these changes was the reduced commitment to scheduled online events. Furthermore, socialisation, i.e. the transmission of culture to new organisational members, was considered as more difficult and time-consuming than before. This result corroborates the idea culture is transmitted through day-to-day actions that are part of work routines rather than targeted socialisation initiatives. Taken together, these results show that formal task-oriented individual and group processes are perceived as working well for the participants. However, informal processes and social connections suffered from the transition to work from home. These findings are in line with previous research (Marzban et al., 2021; Tagliaro & Migliore, 2021). While Marzban and colleagues (2021) found some considerable differences in the perceptions of employees and organisations (senior managers), most topics from their study are also reflected in the present results. The qualitative approach with the two perspectives (before and during pandemic), however, revealed more clearly, how the transition to work from home and its effects were perceived. It is important to note that the software engineers, architects, and consultants that participated in this study were used to remote work even before the pandemic. In fact, most employees of the company studied spent most of their working time with clients on clients’ premises. Thus, the lockdowns and mandatory work from home phases mainly affected the time they spent with their colleagues and supervisors within the employer organisation. This highlights the importance of co-presence for a workforce of predominantly distributed employees.

5 CONCLUSIONS

The results show that for employees of the company time spent together was precious and important in terms of social connections, onboarding and socialisation of new colleagues, experiencing and transmitting organisational culture, and formal and informal task related processes. For the organisation to maintain or re-establish these functions, spaces for socialising, meeting, and chance encounters are needed. In addition to specific functional qualities, these spaces must provide services and experience (cf. Petrulaitiene et al., 2018). One possible development for future workplace management is therefore a stronger interweaving of spatial infrastructure and services: In order for employees to actually use the social functions

as much as possible when they are in the office, it must be ensured that the right colleagues can be contacted (physically, virtually, hybrid). To ensure this, community management (Merkel, 2015) and workplace experience services can be used. Such services are common today in co-working centres and should be reviewed in terms of need, scope, quality, and effort for transfer to work organisations. Based on this, the system consisting of space, technology, employees, and services must be redeveloped for an even more mobile world of work. Since some areas of the social functions affect the area of HR management, new forms of cooperation between the support areas of workplace/facility management and HR management must also be developed. For example, specific communication skills, reflection of social interaction, and selection of corresponding tools might be a future key skill of leaders and high performing teams. Such an individual or team-based capability must deliberately be fostered and supported by HR practices (e.g. Mitchell & Brewer, 2021). More to the core of workplace management, workplace strategies should emphasise team-oriented spaces more strongly. The activity-based working (ABW) office concept has evolved as the current "standard office concept" in recent years. These concepts work well for individual work but are still suboptimal for teams. For the post-covid world of work, ABW concepts need to be further developed in such a way that they offer an infrastructure (space, technology, services) for both individual work and teamwork that optimally supports task and community related activities.

REFERENCES

- Allen, T. J. (2007), Architecture and communication among product development engineers. *California management review*, 49(2), 23-41.
- Barrero, J. M., Bloom, N., Davis, S. J. (2021), *Why working from home will stick*. Retrieved from https://www.nber.org/system/files/working_papers/w28731/w28731.pdf
- Braun, V., Clarke, V. (2006), Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 2, 77-101.
- Cerasoli, C. P., Alliger, G. M., Donsbach, J. S., Mathieu, J. E., Tannenbaum, S. I., Orvis, K. A. (2018), Antecedents and Outcomes of Informal Learning Behaviours: a Meta-Analysis. *Journal of Business and Psychology*, 33(2), 203-230. doi:10.1007/s10869-017-9492-y
- Dey, C., Ganesh, M. P. (2020), Impact of team design and technical factors on team cohesion. *Team Performance Management*, 26(7-8), 357-374. doi:10.1108/Tpm-03-2020-0022
- Fayard, A. L., Weeks, J., Khan, M. (2021), Designing the Hybrid Office. *Harvard Business Review*, 99(2), 1-11.
- Heath, C., Luff, P. (1992), Crisis management and multimedia technology in London underground line control rooms. *Journal of Computer Supported Cooperative Work*, 1(1), 24-48.
- Ipsen, C., van Veldhoven, M., Kirchner, K., Hansen, J. P. (2021), Six key advantages and disadvantages of working from home in Europe during COVID-19. *International Journal of Environmental Research and Public Health*, 18, 4, 1826.
- Kaschig, A., Maier, R., Sandow, A. (2016), The effects of collecting and connecting activities on knowledge creation in organisations. *Journal of Strategic Information Systems*, 25(4), 243-258. doi:10.1016/j.jsis.2016.08.002
- Kozlowski, S. W. J., Klein, K. J. (2000), A multilevel approach to theory and research in organisations: Contextual, temporal, and emergent processes. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organisations: Foundations, extensions, and new directions*. Jossey-Bass, San Francisco, 3-90.
- Marzban, S., Durakovic, I., Candido, C., Mackey, M. (2021), Learning to work from home: experience of Australian workers and organisational representatives during the first

- COVID-19 lockdowns. *Journal of Corporate Real Estate*, 23(3), 203-222. doi:10.1108/Jcre-10-2020-0049
- Mitchell, A., Brewer, P. E. (2021), Leading hybrid teams: Strategies for realising the best of both worlds. *Organisational Dynamics*, 100866.
- Petrolaitiene, V., Korba, P., Nenonen, S., Jylha, T., Junnila, S. (2018), From walls to experience - servitization of workplaces. *Facilities*, 36(9-10), 525-544. doi:10.1108/F-07-2017-0072
- Rousseau, D. M. (1985), Issues of level in organisational research: Multi-level and cross-level perspectives. *Research in Organisational Behaviour*, 7, 1-37.
- Schein, E. H. (2004), *Organisational culture and leadership* (3rd edition ed.). San Francisco: Jossey-Bass.
- Shin, J. E., Suh, E. M., Li, N. P., Eo, K., Chong, S. C., Tsai, M. H. (2019), Darling, Get Closer to Me: Spatial Proximity Amplifies Interpersonal Liking. *Personality and Social Psychology Bulletin*, 45(2), 300-309. doi:10.1177/0146167218784903
- Suchman, L. A. (1997), Centers of coordination: a case and some themes. In L. B. Resnick, R. Säljö, C. Pontecorvo, & B. Burge (Eds.), *Discourse, tools, and reasoning. Essays on situated cognition* (pp. 41-62). Berlin: Springer.
- Tagliaro, C., Migliore, A. (2022), "Covid-working": what to keep and what to leave? Evidence from an Italian company. *Journal of Corporate Real Estate*, 24, 2, 76-92. doi:10.1108/Jcre-10-2020-0053
- West, M. A. (2012), *Effective teamwork: Practical lessons from organisational research* (3rd ed.). Oxford: Wiley-Blackwell.

Shared workspace design: Elements of analysis for a healthy work experience in post-covid times

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ABSTRACT

This paper presents an overview of a model and a circle matrix of analysis that accounts for the main spatial design attributes which influence and produce the most relevant salutogenic outcomes. These outcomes are essential for an optimal and healthy work experience, especially during the post-covid period. This study departs from the theoretical contributions of Salutogenic approach, and principles from Supportive Design Theory and Psychosocial Supportive Design mainly. After a transdisciplinary literature review covering the fields of workspace design, environmental psychology and evidence-based design of healthcare facilities, a circular relationship matrix was created -based on a theoretical model- to overview and determine which spatial attributes enhance specific salutogenic – health and wellbeing promoting outcomes needed for a healthy work experience. The model of analysis (as theoretical element) and the circular matrix diagram (as methodological tool) are thought to assist architects, designers, workspace owners and stakeholders in their new designs or to evaluate existing ones. Studies on the definition of physical attributes and their intended salutogenic outcomes were previously done in healthcare facilities. The application of this idea not only refreshes shared workspace design, but it is necessary in post-covid times, when the revision of health standards is in discussion again. It is also expected that this health generating approach can be used to define the agenda of future transdisciplinary research.

Keywords

Shared workspace analysis, Salutogenic design, Workplace design evaluation, Health outcomes, Supportive design attributes.

1 INTRODUCTION

After the outburst of the Covid pandemic, the world started a painstaking process of adaptation that led to what is being called a new normal in which all kinds of human activities are undergoing changes in vision and practice. With increased health concerns, shared spaces have been given a lot of attention to minimise risks. Work conditions have experienced major changes too; technology allowed the surge of hybrid work, remote work, and home offices. Hybrid work, which gives the advantage of balancing home-work life, comes also with challenges for the workers and for the companies. Companies downsizing their office space due to remote work experience adaptations see the need to support their employees by providing them with suitable workspaces to be used part-time. While some companies choose to use coworking spaces, others opt to reorganise their headquarters as flexible workspaces for physical and psychological support. Even though the onset of the pandemic produced a sudden jolt, the use of shared workspaces kept on growing due to the above-mentioned work-related changes. This new flexible way of working posed the challenge of re-evaluating the design of

these spaces. Work environments should be planned bearing this question in mind: How can spatial design elements be thought of and combined not only to increase productivity but also create a healthy environment and hence a healthy work experience? The design of flexible work places in general should be considered and analysed in a way that supports physiological and psychological health and contributes to specific positive health outcomes and a higher Sense of Coherence (SOC). This last concept, SOC, is at the core of the Salutogenic perspective and comprises the concepts of comprehensibility, manageability and meaningfulness which increase our ability to cope with stressors in our lives. This paper has three major objectives; first, to discuss the fundamentals or bases for a healthy work experience, especially in shared work environments; second, to present a model of analysis that shows the theoretical relationship of the elements that interact between work and health which in turn helps to create a circular matrix that considers the main attributes for a healthy, supportive design focusing on SOC; and third, to discuss in a general way the necessity of developing specific evaluation tools that integrate all the elements of the presented circular matrix.

2 FUNDAMENTALS FOR A HEALTHY WORK EXPERIENCE

Researchers emphasise the necessity of supportive environments that consider the three dimensions of health; physical, mental and social. These three dimensions can be enhanced by the characteristics of the place itself, reducing negative impacts such as physical illness, depression and anxiety (Dilani, 2009; Morelli, Dilani, 2004; Ulrich et al., 2008). However, particularly in shared workspaces, it is necessary to design taking into account spatial attributes that lead to salutogenic outcomes. Previous studies and the post-covid circumstances demonstrate that outcomes related to physical, mental and social health for healthy experience are mainly: physical and sensory comfort, mental restoration, positive stress, positive relationships with people and space, sense of security and safety, and general sense of satisfaction, increased SOC and wellbeing.

2.1 Physical health

Physical and Sensory Comfort. Our senses are in permanent interaction with the environment. Environments we work in should respond to our sensory needs and provide physical comfort. Indoor conditions (e.g., temperature, light, air quality, noise and sounds) and other elements such as materials, odour, ceiling heights and colours used in the environment can have an effect on how we perceive our surroundings. For example, the lack of appropriate lighting or uncomfortable indoor temperature can also indirectly impair listening and even comprehension (Eberhard, 2008). Creating structured, predictable and explicable environments affects one's comfort, positively raising our comprehensibility level and leaving us room to cope with unexpected stressors of life. Research also shows the obvious relation between ergonomic support and the prevention of discomfort (Morelli, Dilani, 2007).

2.2 Mental health

Mental Restoration. It has been argued that it is increasingly tough for people to engage in difficult tasks if they are not to return to a psychologically and physiologically resting state periodically (Karasek, 1990). Direct attention which is activated when a person needs to focus on a task blocking distracting stimuli -and needed for good work performance- has been proven to cause mental fatigue as well (Moran, 2012). Opportunities to engage in informal rituals to relieve tension are needed to restore mental fatigue. The environment we work in can contribute to improve concentration by means that allow mental restoration, such as access to nature, visual contact with nature or natural elements, providing an escape from regular activities (Schepers, 2007, Kaplan, 1992).

Positive Stress. Stress has been first described in the literature as a set of physical and psychological responses to adverse conditions or influences. Negative stress (distress) leads to

negative emotions such as anxiety or worry. Eustress or “good stress” has been interpreted as having positive implications for wellbeing (Selye, 1976). The lack of distress does not indicate the presence of eustress. Stimulating events as well as stimulating environments can produce positive stress which is consistent with the “meaningfulness” component of SOC which in turns results in employee motivation and engagement.

Sense of Safety. For some people returning to their previous workplace after Covid quarantine was quite stressful because of safety concerns and fear of still getting the disease and transmitting it to their loved ones. Humans must be able to feel safe before they can experience any sense of self-fulfilment, something Maslow already proposed when he created his theory of the "hierarchy of human needs", one of the best-known approaches to human needs analysis in which lower order needs must be satisfied before moving up to the next level. In that regard, in addition to feelings of security (in relation to the external factors), emotional safety has to be created by controlling the risks caused by unintended threats. Interventions on the physical space such as improved air filtration, distancing, ventilation and other on-site measures have proved to alleviate the stress caused by the pandemic (Statista, 2020; McKinsey, 2021; Dietz et al., 2019).

2.3 Social health

Positive Relationships with People and Space. Social relationships are proven to be highly effective to fight work stress and raise work satisfaction (Heerwagen et al., 1995). Consequently, a sense of social support is an important and necessary outcome for a person’s psychological health and wellbeing. Many investigations state that workplaces should enable communication, collaboration and learning through connecting to peers and colleagues (Heerwagen et al., 1995; Oseland, 2009). Certainly, some spatial design qualities may increase this sense of support through the control over some physical environmental features as well as on the social environment. To have resources at hand and being able to control them contributes to the “manageability” capability of the occupants of the space.

2.4 Sense of Coherence and Satisfaction

General sense of satisfaction and wellbeing is the sum of all the above-mentioned outcomes. It is not an independent and unique outcome but the result of several positive ones. Research relates wellbeing with fulfilment and psychosocial health (Stokols, 1992; Heerwagen, 1995). “Wellbeing at work” is safe, healthy and productive work done by workers who see their jobs as meaningful and rewarding **resulting** in an increased “sense of coherence”. Workers evaluate their comfort, motivation, their possibility to have positive interactions, their sense of safety and conclude that their satisfaction is high. As mentioned earlier, all these elements can be altered through spatial design that responds to a specific strategy in which attributes of the space are taken into account in relation to the **health** outcomes. Fewer health and social problems have been associated with higher motivation and improved worker performance hence, a higher sense of satisfaction.

3 SALUTOGENESIS AS AN EPISTEMOLOGICAL AND THEORETICAL POINT OF DEPARTURE

Salutogenesis, which literally means “the origins of health”, is a theory put forward by Antonovsky in 1996 and it focuses on the creation of health rather than eliminating the causes of disease.

Salutogenic perspective is considered here a theoretical point of departure since it outlines the basis for health promotion and establishes the relationship between health and the environment through a “sense of coherence” which helps coping with environmental stressors through ‘comprehensibility’ (the ability of making sense and structuring the stimuli deriving from one’s environment), ‘manageability’ (the grasp of the available resources to meet the demands posed

by the stimuli) and ‘meaningfulness’ (the demands seen as challenges, worth committing and engaging to) (Antonovsky, 1982).

Later on, Dilani proposed the Psychosocial Supportive Design theory translating Salutogenic approach and its sense of coherence into environmental design factors; trying to reduce the gap between theory and application (2000). Similarly, Supportive Design Theory explores the ways a designer can utilise the built environment to reduce stress and better understand the physical needs of the users (Ulrich et al., 2004).

Designing supportive physical environments is the challenge of generating health through the achievement of salutogenic outcomes for specific users. This can only be attained by adopting a holistic view taking into account psychological and social factors that builds up SOC rather than just preventing the symptoms of diseases.

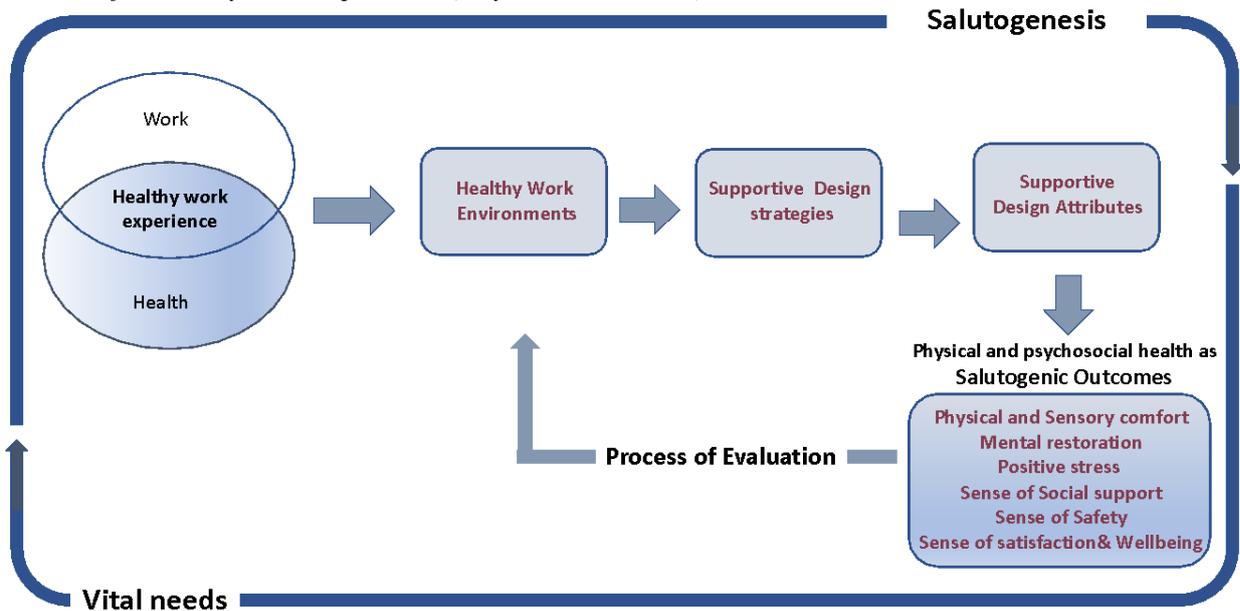
4 MODEL OF ANALYSIS

Literature on supportive environments demonstrates that health can be promoted and supported by built environments. Psychosocial Supportive Design based on Salutogenesis (Dilani, 2001), as well as Ulrich’s theory of Supportive Design deal with stress reduction through environmental design strategies (1991).

Salutogenic approach and supportive design being mostly applied in healthcare facilities led to the examination on how design enables healthy conditions. These projects emphasised the restorative and health-promoting nature of elements such as art, music, access to nature, view of nature, restorative areas, use of colour etc. of the built-environment on patients, relatives and staff in relation to recovery times, stress and satisfaction (Morelli, Dilani, 2007; Ulrich et al., 2008). These supportive design attributes defined by this holistic way of looking into health have also been used in design and user experience evaluations of healthcare facilities.

In workplace studies, although environmental psychology and studies on indoor environmental conditions provided an insight on the effects of specific physical attributes such as lighting, temperature, noise on user behavior and health problems (Vischer, 2012); the attention was mostly on mitigating the negative effects of these attributes (such as in sick building syndrome) but not on health-generation as a holistic approach. On the other hand, positive attributes such as restoration, stress decreasing properties of nature, and biophilia were discussed and demonstrated by researchers (Kaplan, Kaplan, 1989). Although salutogenesis and sense of coherence have been of interest in workplace studies, health promoting the nature of attributes of physical workplaces are addressed only by few studies (Roskam, Haynes, 2019) and applications in the real world are rare. In the understanding that a model is the theoretical representation of a given phenomenon, the model of analysis presented here depicts the relationship between the characteristics of a physical shared work environment and its potential to generate health outcomes if permeated by the application of salutogenic principles. In other words, if we place Salutogenesis at the centre of any analysis, promoting health instead of just fighting back illnesses, we must surely rethink the spatial design and related attributes of an environment according to its function and users. The principles of Salutogenesis are relevant for the design of all kinds of built environments and should be especially applied in environments where we spend hours on end. Spaces where we work can generate health and wellbeing outcomes through the interaction of different physical attributes. In this model, comfort, mental restoration, positive stress, sense of social support, safety and general satisfaction have been defined as positive health outcomes needed for an optimal and healthy work experience. Supportive design should consciously generate and interrelate diverse space attributes through a well-defined strategy since design attributes are the elements that the designer can have a direct control on.

Figure 1. Model of Analysis: Adaptation of Salutogenesis in shared work environments to generate outcomes for healthy work experience (Baykal Uluoz, 2021)

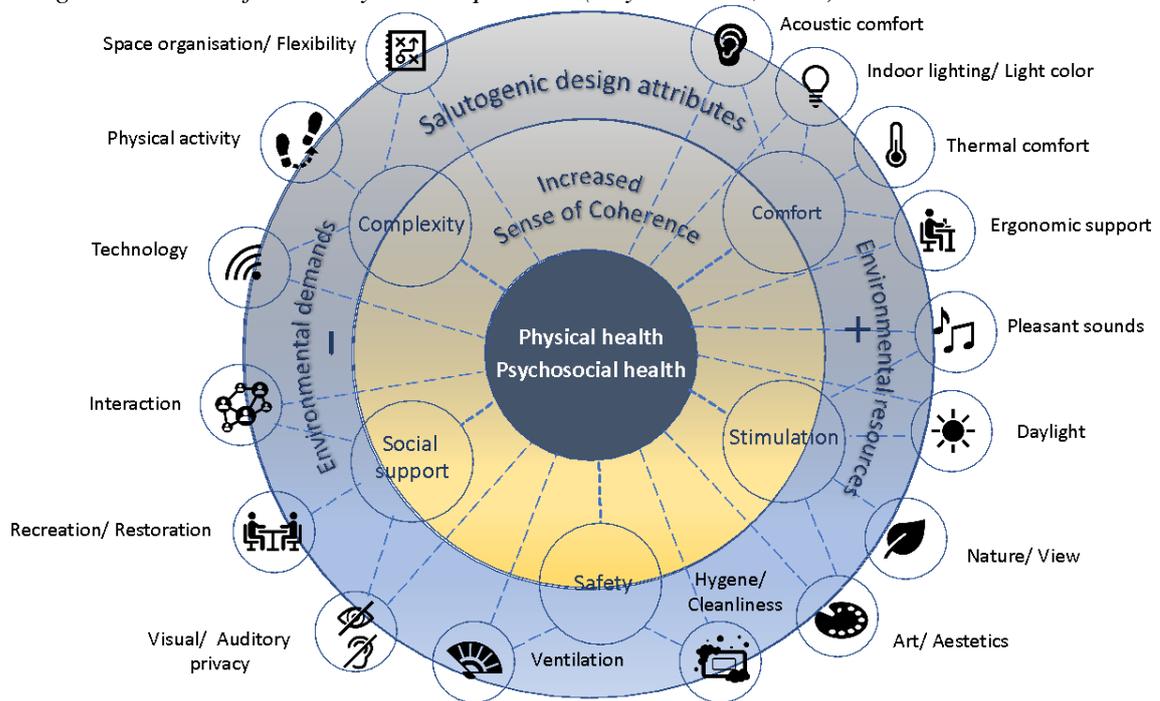


5 PROPOSED CIRCULAR MATRIX FOR THE ANALYSIS OF SHARED WORK ENVIRONMENTS

The circular matrix is a representation of relations between spatial attributes and the main salutogenic outcomes and SOC needed for users' healthy work experience. This matrix is intended to contribute to the salutogenic design of shared workspaces and the investigation of healthy work.

Therefore, the matrix has two main elements: Supportive design attributes and salutogenic/health (physical, mental and social) outcomes/SOC (figure 2). Design attributes which are spatial properties are grouped under five conceptual categories; complexity, comfort, stimulation, social support and safety. Health promoting attributes were defined by Psychosocial Supportive Design theory (Dilani, 2001). Ulrich's Supportive Design theory (1991) as well Maslow's hierarchy of needs (1943) were also an inspirational contribution to categorise the attributes. The categorization assists to the organisation and simplification of complex concepts while the attributes are the specific environmental resources that can differ according to different objects of study (schools, hospitals etc.). The outcomes are the general constitutive aspects of health (physical, social, mental). An increased "sense of coherence" is an inherent part that has been argued by researchers to positively affect all aspects of health. The way work environment has an effect on sense of coherence and on health (negative and positive) is well known (Jenny et al., 2017). Mitigating the environmental demands and enhancing the environmental resources (salutogenic resources) is argued to increase users' sense of coherence (Roskam and Haynes, 2019). Although supportive spatial attributes can be more or less standard in a built environment, their presence inside the matrix can change depending on the functionality of the environment under investigation. For instance, "wayfinding" could be an attribute of a "complexity" category if the investigated environment was a complex healthcare facility.

Figure 2. Circular matrix diagram: relationship between design attributes of work environments and the salutogenic outcomes for healthy work experience (Baykal Uluoz, 2022)



5.1 Spatial Design Attributes for health supportive workspace

Five different categories of attributes were determined: complexity, comfort, stimulation, social support and safety.

‘Comfort’ refers to the conditions of a built environment that lead to physiological and sensory comfort of the users while ‘stimulating features’ refer to positive distractions that are needed to create a moderate degree of stimulation on the users. ‘Complexity’ relates the qualities of the space with its form and functionality, while ‘social support’ refers to interaction promotion through environment design and the benefits that a worker can get out of it. ‘Safety’ mostly refers to the environmental measures that are needed to ensure the safety of the users, especially in relation to the transmission and prevention of airborne diseases.

It is important to mention that certain attributes can be assigned to more than one category (directly or indirectly); in that case, design strategies have to be thought of accordingly. For instance, “ventilation”, grouped under ‘comfort’ can at the same time be related to ‘safety enhancement’ due to Covid measures.

Comfort. The effects of environmental conditions and indoor comfort in work environments have been much investigated in the last decades. Building assessment methods have been developed to determine the relationships between these conditions and user satisfaction, performance and productivity. Inadequate lighting, thermal conditions and acoustics, for example, trigger stress, attention deficiency and other negative consequences (Evans et al., 2004; Vischer, 2007). Natural daylight has been demonstrated to be highly beneficial for the overall person’s wellbeing (Kellert, Heerwagen 2008). Interventions such as provision of height adjustable desks (between seating and standing positions) could be ergonomically effective reducing physical discomfort, musculoskeletal pain symptoms (Davis et al., 2004).

Stimulation. Built environments have to be designed in such a way that their users are motivated enough to perform different and specific activities in them. While low levels of stimulation can lead to boredom and negative feelings, high levels of stimulations can lead to

stress. Connection to nature (through access, view and/or biophilic elements) is among the most cited simulating features. While access to nature directly or indirectly ensures prolonged periods of concentration and attention (Kaplan, 1993), aesthetics and ambience also play an important role in mood and behaviour (Kaplan, 2001; Savavibool et al., 2018). With design strategies providing access to nature, daylight and pleasant views and sounds, designers can positively affect the mood and behaviour of the users and their perceived satisfaction. The use of certain colours, furnishing elements and art can also reduce or enhance concentration.

Complexity. Functionality and order can be attained through elements such as spatial organisation and configuration (the way the layout and allocation of the space is done). Workspaces require different spaces that allow individual and collaborative work to be done. Space variety offers users the convenience of choosing where to work according to their activity. Certain attributes like signalling and path-finding for instance, although not needed in small built-environments, contribute to distress alleviation. Users' environmental control (e.g., being able to control light, thermal conditions) as well as access and use of advanced technology can be regarded as functions that connect networks and encourage collaboration. Promoting physical activity through the workplace environment is also argued to help individuals dealing more effectively with stress (Zhu, 2020; Marshal, 2004).

Social Support. Workplaces are not only places where people work, but also physical spaces in which social interactions take place. Researchers have shown that personal interaction in workspaces with peers and colleagues provides social support and has positive psychological consequences for user behaviour (Antonowsky, 1996; Evans, 1998; Heroux et al., 2016; Haynes, Roskams, 2019; Dilani, 2009). Design that provides access to recreational areas such as indoor gardens and informal meeting places fosters social support. Of course, design can only encourage or hinder interaction, the quality of that interaction is up to individuals; social interactions that are beneficial to one or both parties qualify as social support (Shinn et al., 1984). Moreover, design can also help create a balanced social interaction among users by providing them spaces that enable social interaction as well as access to privacy (visual, auditory) when needed.

Safety enhancement. While workplace security means protection against deliberate threats, safety encompasses all aspects of being secure against unintended threats. Although workplace security can be provided by visual and technological privacy and other means, the pandemic highlighted the need for physiological health and users' safety in built environments. Shared workspaces easily mediate the transmission of infectious diseases. However, some qualities of work environments have been defined to be effective in fighting viral diseases. Attributes such as openable windows, suitable air filters, hygiene, reduced density and use of easy-to-clean surface materials are considered, according to the latest surveys, to create a sense of safety for the users of these communal environments (Larsson et al., 2020; Langford et al., 2006; Boyce, Pittet, 2002; Wilson, Ridgeway, 2006; Ulrich et al., 2008).

6 FINAL DISCUSSION: THE IMPORTANCE OF DESIGN EVALUATION

Although this paper remains in the theoretical arena, it is expected to provide the principles to go beyond theorization and reach the practical realm, allowing practitioners to create their own elements of analysis and relationships that need to be assessed in real-world design processes. Nonetheless, taking into account all the elements of the circular matrix diagram in a single study poses the challenge of designing a specific methodology.

Coworking spaces are complex spaces due to different users and their ever-changing needs. In addition, the adoption of hybrid work due to the pandemic has changed and diversified the user characteristics of these complex shared spaces. So, the question remains on how to analyse the design of these complex spaces in relation to health, wellbeing, safety and sense of coherence

of their users and the answer proposed here is a well-known methodology used in architectural studies: Post Occupancy Evaluation (POE).

Post-occupancy evaluation is a knowledge-gathering tool that assesses built environments after they have been occupied for some time. For over 60 years researchers have been using this method to study physical environmental conditions such as privacy, lighting, thermal comfort, especially in work environments, and the effects of the quality of the built environment on employee productivity (Bordass, Leaman, 2005; Preiser, 2002; Way, Bordass, 2005; Kooymans, Haylock, 2006). This method was also vastly used in the analysis of health and wellbeing enhancing properties of healthcare facilities.

In general there is a lack of standardised evaluation tools for collecting data and sharing the results of design evaluation. This shortcoming limits the usability and generalizability of the conducted post-use assessment tools, so every practitioner must create his own evaluation sheets according to the space function, user needs, overall goals and intended outcomes.

Considering the ever-changing innovative workplace proposals, POE knowledge should examine not only user satisfaction but also salutogenic attributes and health promotion generation as a valuable asset for evidence-based (re)design processes.

This study reviewed and compared existing tools that evaluate workspaces and health facilities and checked how they measure health outcomes and their related spatial attributes including user experience questionnaires in relation to health promoting spatial elements.

A general applicable model that understands the interaction of spatial factors and attributes which can generate health (mental, physical and social) and SOC should be the base for the development of a POE toolkit for specific shared workspaces.

In short, an appropriate theoretical perspective and a useful methodology to generate health through design are of pivotal importance. In this regard, it is expected that the model and matrix presented here, as a part of an ongoing research, can be replicated in different spaces in relation to salutogenic outcomes and, in turn, be used in the process of gathering new evidence which at the end could scrutinise and reshape the model and/or the matrix. Future research should consider the interaction of diverse design attributes according to the desired space functionality.

REFERENCES

- Antonovsky, A. (1982), "Health, stress and coping", *Jossey-Bass publishers, California, London*, Forth printing.
- Antonovsky A. (1996), "The salutogenic model as a theory to guide health promotion". *International*, 1996; Vol. 11, No. 1.
- Bordass, B., Leaman, A. (2005), "Making feedback and post-occupancy evaluation routine 1: A portfolio of feedback techniques, building *research and information*", Vol. 33, issue 4, 347-352.
- Boyce J.M, Pittet, D. (2002), "Guideline for hand hygiene in health-care settings, *American Journal of Infection Control and Infection Control and Hospital Epidemiology*", doi:10.1067/mic.2002.13039.1
- Davis, K. G., Kotowski, S. E. (2014), Postural variability: An effective way to reduce musculoskeletal discomfort in office work. *Human Factors*, 56(7), 1249–1261.
- Dietz L, Horve P.F, Coil D, Fretz M, Eisen J, Van Den Wymelenberg K. (2019), "Novel Coronavirus (COVID-19) Outbreak: A Review of the Current Literature and Built Environment Considerations to Reduce Transmission", Preprints 2020.
- Dilani, A. (2001), "Psychosocially Supportive Design: as a theory and model to promote health", *International Academy for Design and Health*.

- Dilani, A. (2009), "Psychosocially Supportive Design: A Salutogenic Approach to the Design of the Physical Environment", *1st International Conference on Sustainable Healthy Buildings; Seoul, Korea*.
- Eberhard, J.P., (2008), "Applying Neuroscience to Architecture", *Neuron*, 62, DOI 10.1016/j.neuron.2009.06.00.
- Evans G.W., Stecker, R. (2004), "Motivational consequences of environmental stress, *Journal of Environmental Psychology*", 24 (2004) 143–165.
- Haynes B, Roskams, M. (2019), "Salutogenic Workplace Design: A conceptual framework for supporting sense of coherence through environmental resources", *Sheffield Hallam University Research Archive (SHURA)*.
- Heerwagen, J.H., Haubach, J.G., Montgomery, J., Weimer, W.C. (1995), "Environmental Design, Work, and Well Being: managing occupational stress through changes in workplace environment", *Official Journal of the American Association of Occupational Health Nurses*, 43 (9) 458-468.
- Heroux, J., Norris, T., Rube, K., Nadimi, V. (2016), "The case for healthy Places", *Project for Public Spaces, Inc*.
- Jenny, G.J. et al. (2017), "The Application of Salutogenesis to Work", *The Handbook of Salutogenesis*, Chapter 20, DOI 10.1007/978-3-319-04600-6_20.
- Kaplan, R., Kaplan, S. (1989), "The Experience of Nature: A psychological perspective", *Cambridge University Press, New York*.
- Karasek, R. (1990), "Lower health risk with increased job control among white collar workers", *Wiley On-line library*, available at: <https://onlinelibrary.wiley.com/doi/10.1002/job.4030110302>
- Kaplan, R., (1993), "The role of nature in the context of the workplace", *Landscape and urban planning journal*, Vol.26, Issue 1-4, 193-201.
- Kaplan, R. (2001), "The nature of the view from home: Psychological benefits, *Sage Journal*, Vol.33, issue 4, 507-542.
- Kellert, S.R., Heerwagen, J.H., Martin L. Mador, M.L. (2008), "Biophilic design: the theory, science, and practice of bringing buildings to life", *Published by John Wiley & Sons, Inc., Hoboken, New Jersey*.
- Kooymans, R., Haylock, P. (2006), "Post Occupancy Evaluation and Workplace Productivity", *Prres.net*.
- Lankford, M.G. et al. (2006), "Assessment of materials commonly utilised in health care: Implications for bacterial survival and transmission", *14th Annual Scientific Meeting of the Society for Healthcare Epidemiology of America, Philadelphia, PA*, Abstract 238.
- Larsson, N. and 12 co-authors (2020), "Pandemics and the Built Environment", *International Initiative for a sustainable built environment, iiSBE*.
- McKinsey & Company (2021), "Consumer health Insights", June 14, 2021, available at: <https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/COVID-19-consumer-healthcare-insights-what-2021-may-hold>
- Marshall, A.L., (2004), "Challenges and opportunities for promoting physical activity in the workplace", *Journal of Science and Medicine in Sport*, Vol. 7, Issue 1.
- Moran, A. (2012), "Concentration: attention and performance," *The Oxford handbook of sport and performance psychology*, Oxford university press, chapter 6.
- Morelli, A., Dilani, A. (2004), "Health Promotion by Design in Elderly Care", *International Academy for Design and Health*.
- Morelli, A., Dilani, A. (2007), "Health Supportive Design in Elderly Care Homes: Swedish Examples and their Implication to Korean Counterparts", *Architectural research*, Vol. 9, Issue 1, 9-18.

- Oseland, N. (2009), "The impact of psychological needs on office design", *Journal of Corporate Real Estate*, Vol. 11, Issue 4.
- Preiser, W.F.E. (2002), "Continuous quality improvement through post-occupancy evaluation feedback", *Journal of Corporate Real estate*, Vol. 5 No. 1, 42-56.
- Roskam, M., Haynes, B., (2019), Salutogenic Workplace Design: A conceptual framework for supporting sense of coherence through environmental resources. *Journal of Corporate Real Estate*, DOI: 10.1108/JCRE-01-2019-0001
- Selye, H. (1976), "Forty years of stress research: principal remaining problems and misconceptions", *Can. Med. Association Journal*, 115(1): 53-56.
- Schepers, P. (2007), "Social Factors of Work-Environment Creativity", *Journal of Business and Psychology* Vol. 21, 407-428.
- Shinn, M., Lehmann, S., Wong, N.W. (1984), "Social Interaction and Social Support", *Journal of social issues*, Winter 1984.
- Statista. (2020), "Feeling of safety outdoors during the COVID-19 outbreak in Great Britain in May 2020", available at: <https://www.statista.com/statistics/1121494/feeling-of-safety-during-covid-19-outbreak-in-great-britain/> (accessed December, 2021).
- Stokols, D. (1992), "Establishing and maintaining healthy environments: Implications for Theory and Research", *American Psychologist*, 47(1), 6-22 <https://psycnet.apa.org/doiLanding?doi=10.1037%2F0003-066X.47.1.6>
- Ulrich R.S. et al. (2008), "A Review of the Research Literature on Evidence-Based Healthcare Design", *Health environments research & design journal*, Vol. 1, No. 3.
- Ulrich et al. (2004), "The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity", *The Centre for Health Design*.
- Ulrich R.S. (1991), "Effect of interior design on wellness: Theory and recent scientific research", *Journal of healthcare interior design*, 3:97-109.
- Vischer, J. C. (2007), "The effects of the physical environment on job performance: Towards a theoretical model of workspace stress", *Stress & Health: Journal of the International Society for the Investigation of Stress*, 23(3), 175-184.
- Vischer, J.C. (2012), "The changing meaning of workspace: planning space and technology in the work environment", *Enhancing Building Performance*, Chapter 7.
- Way, M., Bordass, B. (2005), "Making feedback and post-occupancy evaluation routine 2: Soft landings – involving design and building teams in improving performance, *Building research & information*, 33(4), 353-360.
- Wilson, A.P.R., Ridgway, G.L. (2006), "Reducing hospital-acquired infection by design: the new University College London Hospital", *Journal of Hospital Infection*, 62, 264-269.
- Zhu, X et al. (2020), "Healthy workplaces, active employees: A systematic literature review on impacts of workplace environments on employees' physical activity and sedentary behaviour", *Building and Environment*, Volume 168.

Group Creativity in the Workplace beyond COVID-19 Pandemic

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ABSTRACT

The COVID-19 pandemic has forced the non-essential workers to move into remote working platforms under the physical distancing measures with many workers now becoming, to some extent, stereotypical teleworkers operating from homes. This accelerated remote working trend impacts the employees' interaction with their co-workers and the workplace environment, which are key components of Group Creativity. This study aims to review the challenges and opportunities derived from the COVID-19 pandemic on group creativity in workplace and investigate its future direction. According to the Interactionist Perspective of Organizational Creativity by Woodman et al. (1993), facilitating Group composition, Group characteristics, Group process, Individual creativity and Contextual influences are key in enhancing Group Creativity. The study has conducted an online questionnaire survey and a series of semi-structured interviews with the participation of multiple stakeholder groups in the field of commercial workplace design. In short term, Group Creativity is negatively impacted by COVID-19 as workers have lost the opportunity to effectively interact, collaborate and to get influenced by the physical environment due to distancing from the workplace and team members. This impact could vary depending on the organizational sizes and types of their tasks. Even though workers are gradually adapting to web-based collaboration platforms, the effectiveness of these virtual strategies in facilitating group creativity is yet to be explored. In long term, hybrid and distributed working styles are increasing its popularity as these strategies facilitate group creativity even under unpredictable external circumstances such as COVID-19 pandemic. In addition, Activity Based Workplace (ABW) concept is expected to attract the workplace strategists more due to its ability to facilitate group creativity with a positive approach into hybrid working and workplace hygiene. The knowledge created in this study contributes to the commercial workplace design sector, in planning for improved group creativity in workplaces beyond the COVID-19 pandemic.

Keywords

Physical distancing, Group creativity, Distributed working, Activity Based Workplace (ABW).

1 INTRODUCTION

The methods of working in workplaces transformed from process-based task working towards knowledge-based working in the 20th century. In the knowledge-based workplace, workers were given the autonomy to interact informally with the colleagues to exchange ideas face to face and increase their levels of creativity in performing their heterogeneous duties, that is believed to ultimately benefit the organizational productivity (cf. Hascher et al., 2002, Worthington, 1997, Greene and Myerson, 2011). Problem solving through the production of novel and potentially useful ideas was considered as the core of creative performance (Amabile, 1988; Madjar, Oldham & Pratt 2002; Shalley, Zhou & Oldham 2004; Zhou & George, 2001). According to the Interactionist Perspective of Organizational Creativity by Woodman et al. (1993) Group creativity is interpreted as a function of (1) Individual creativity, (2) Group composition (e.g.- the interaction of individuals), (3) Group characteristics (e.g.-

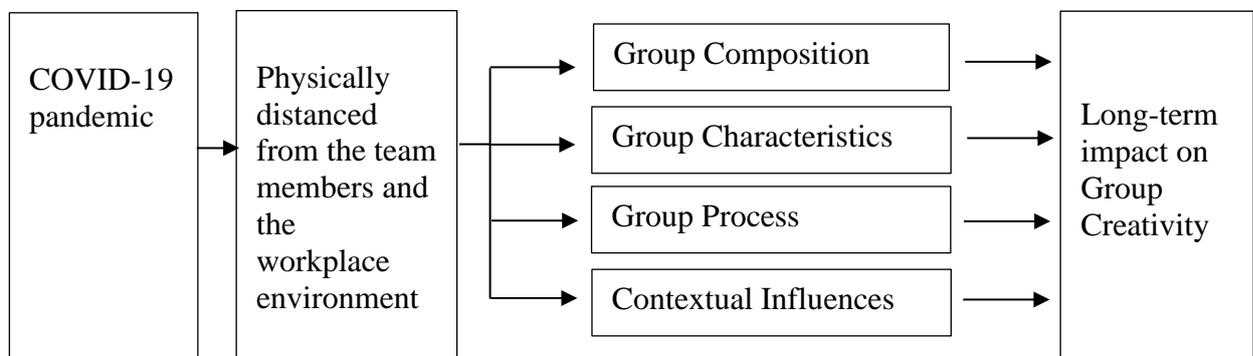
norms, size, degree of cohesiveness), (4) Group process (e.g.- approaches to problem solving) and (5) Contextual influences (e.g.- physical environment, facilities).

The COVID-19 pandemic offered strong challenges to the knowledge based working process in the organizations due to the physical distancing measures and travel restrictions (de Lucas Ancillo et al. 2020). Non-essential organizations were forced to change the traditional methods the employees operated previously, to comply with the guidelines imposed by the health authorities while ensuring business continuity (McKinsey, 2020b; World Economic Forum, 2020b). This led towards de-attaching from the physical workplaces and Working from Home (WFH) has become the recommended practice during this period for these non-essential businesses regardless of any prior acceptance or rejection (Hu, 2020). Based on the Interactionist Perspective this de-attachment from the physical workplace and the teams could have a major impact on the Group Creativity of an organization. (Dul et al. 2011).

Due to the rapid fluctuations in the COVID -19 cases, organizations are currently facing many difficulties in establishing consistent workplace strategies that could support the group creativity. Some organizations have developed Return to Workplace strategies to bring their employees back to the workplaces. However, currently certain countries and some specific states of countries are forced to re-impose further lockdowns and travel restrictions due to the rise of new COVID-19 strains, which again severely challenge the organizations to adjust to a continues strategy in operating the workplaces (Cirrincione L et al., 2020). Many virtual working and collaboration platforms have been introduced in the commercial sector but their effectiveness in enhancing group creativity is yet to be researched. Hence, workplaces are challenged to facilitate group creativity. However, the long-term impact and the challenges caused by the COVID-19 pandemic on the group creativity of organizations are not yet explored in the current literature.

Addressing this knowledge gap the main aim of this study is to analyze the impact of the COVID-19 pandemic on Group Creativity and its future direction (Figure 1). As individual creativity is a function of various factors such as antecedent conditions, creative behavior, cognitive style and personality, this conference paper is not aiming at including individual creativity as a part of the conceptual framework in analyzing the impact of the COVID-19 pandemic on group creativity. The knowledge produced in this study will assist the organizations in assessing their own workplace circumstances on group creativity and strategizing methods to enhance group creativity beyond the COVID-19 pandemic.

Figure 1. Conceptual Framework



2 RESEARCH DESIGN

To achieve the aim of the study the researcher has used two main data collection methods, recruiting participants with different roles, responsibilities, and preferences in the context of

commercial workplace design.

2.1 Research Activity 1 – Semi Structured Interviews

Through the first research activity, the study analyzed the impact of COVID-19 on group creativity in organizations and its future direction from the perspective of two major stakeholder (sample) groups in workplace design.

2.1.1 Sample 1

Architects and Designers in the workplace designing sector were selected as the first sample group under the research activity 1. The sample comprised of the winning Architectural/Design practices under the Workplace Design category in the Australian Interior Design Awards (AIDA) during the five years from 2016-2020. One of these winning practices had won the award in two years hence, only four (4) companies were interviewed. A workplace designer who had worked in the award-winning projects, nominated by each company participated in the interview.

2.1.2 Sample 2

Academic and professional research personalities in the commercial workplace design sector were selected as the second sample group under the research activity 1. The participants were selected through snowball sampling method, from the scholars and professional bodies that actively took part in conducting workplace related education, change management, academic and commercial research during the COVID-19 pandemic. Four (4) of the most prominent personalities representing different global institutions were invited to participate in these interviews.

The interviews were video recorded using Zoom and Microsoft Teams online platforms with the consent of the participants. The duration of the semi-structured interviews was between 30-45 minutes.

2.2 Research Activity 2 – Online Questionnaire Survey

Through the second research activity, the study analyzed the impact of COVID-19 on group creativity in organizations and its future direction from the perspective of the users of modern workplaces via a short online questionnaire survey. Employees of a government organization were invited to participate in this online survey and 62 participants (out of 95 total staff members) had completed it.

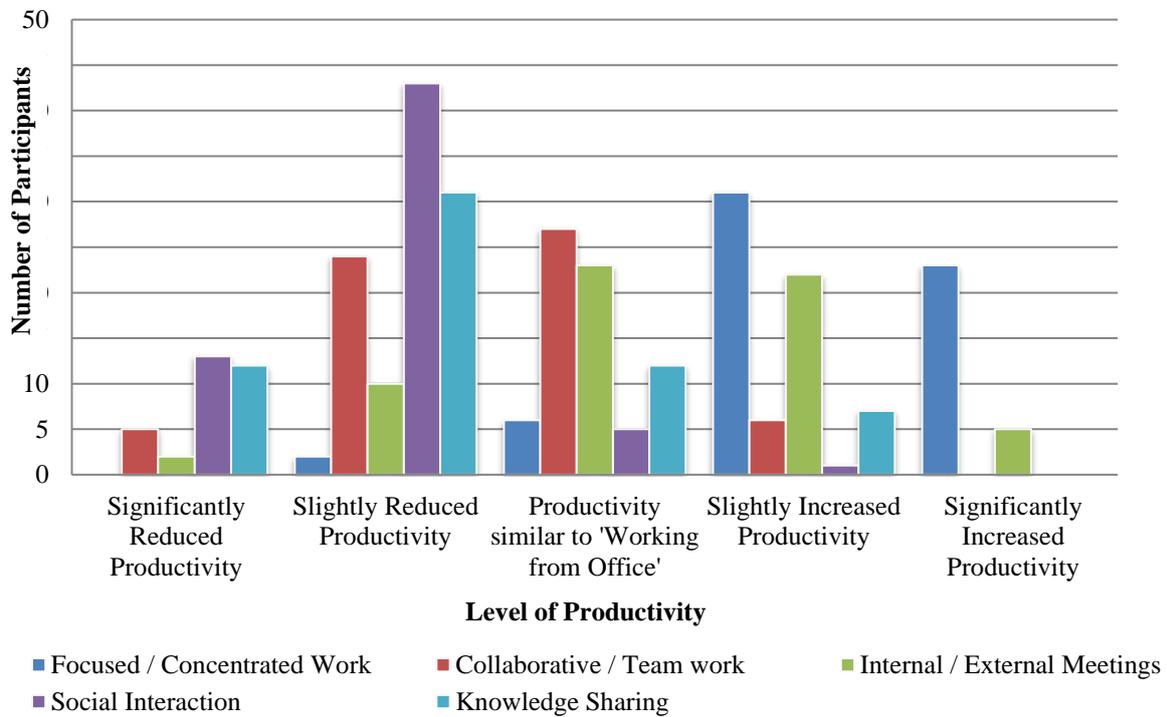
3 FINDINGS & ANALYSIS

The data collected through these main research activities were categorized under the 4 functions of Group Creativity according to the conceptual framework (Figure 1)

3.1 Impact of COVID-19 on Group Composition

Groups are usually composed of members with different job roles and tasks. The contribution of all the job roles in a group could be considered as a primary measure in achieving common creative goals. According to the interviews, some group members who mainly conducted focused work perceived high productivity during the WFH period while certain staff members who mainly conducted collaborative work have been unable to achieve their weekly plans. Individual circumstances such as household condition, lack of a suitable technology and difficulty in coordination were the main reasons identified behind the negative feedback. Due to these underperforming staff during this period group leaders have not been able to achieve their group targets and creative goals in certain occasions.

Figure 2. Perceived level of 'Productivity' in Working from Home (WFH), compared to Working from Office (WFO), during the COVID-19 pandemic period



According to the online questionnaire survey (Figure 2), 87.1% participants have experienced slightly and significantly increased productivity in Focused / Concentrated Work during the WFH period. 35.4% participants have experienced slightly increased productivity in Internal / External Meetings in WFH. Opposed to that, 90.3% participants have experienced slightly and significantly reduced productivity in Social Interaction, 69.3% participants have experienced slightly and significantly reduced productivity in Knowledge Sharing work and 46.7% participants experienced slightly and significantly reduced productivity in Collaborative / Teamwork in WFH during the COVID-19 pandemic.

These findings reflect that WFH was not found as a productive strategy in performing all types of workplace roles / tasks. Hence, unfavorable influence of the WFH on certain workplace activities, strongly impact the success in performing different job roles, eventually group composition is negatively impacted.

3.2 Impact of COVID-19 on Group Characteristics

Group characteristics are highly dependent on factors such as norms, sizes of groups, and demographics hence cohesiveness of the group members irrespective of the individual differences are important in achieving common creativity goals. (Dul et al. 2011)

According to an interviewee "It is very difficult to bring all the team members to one group session due to the problems in timing, virtual networks and the unavailability of video conferencing facilities. Some senior staff members refuse to join through Zoom due to the resistance to technology". Hence, it was clear that norms on the technological intervention on the traditional types of working has impacted certain workers negatively. Also, it was mentioned by an interviewee that "Younger staff members found it very interesting to organize virtual group catchups", which highlights the impact of demographic differences in using technology, "But the effectiveness of these sessions was found to be unsatisfactory". This had forced to drag the deadlines regularly due to the time waste in setting up virtual meetings rather

than quick face to face catchups in solving problems.

According to the online questionnaire survey (Figure 2) knowledge sharing, social interaction and collaboration have captured significant negative feedback during the WFH period. This explains the unfavorable environment exposed by physical distancing on the connectivity and professional relationship between the group members. Lack of face-to-face interaction is a key factor which becomes a barrier in achieving workplace creativity (O'Rourke, 2021). Hence, leaders of larger groups have found it complicated to maintain the cohesiveness as connecting the team members with above individual differences have negatively impacted the group creativity goals. This was explained by "Larger the team, harder to manage the goals" by one group leader.

On a positive note, from the perspective of the employers, the accelerated trend towards remote working has provided the opportunity for them to recruit creative talents beyond their local boundaries from different countries or cities where the living cost is low. This was explained through statements such as, "The competitiveness for a creative job position might not just be among the local people, as you could potentially employ someone from a different country, or a state". Hence, in future hybrid groups could include people from different geographical locations.

Further, interviewees suggested that co-working hubs in main cities would become useful to improve the social connection, access to technology and knowledge sharing that worker previously lacked during WFH. This distributed workplace concept could help to avoid the time waste in transportation, and technology related problems while the members get the opportunity to experience purposely designed workplace environments. The group members in close proximity could come to these co-working hubs and work as a group cohesively in achieving their group goals hence, these will become favorable environments for group creativity in the future.

3.3 Impact of COVID-19 on Group Process

This section discusses the impact of the COVID -19 pandemic on the processes and operations of teams which eventually impact the group creativity in the workplace

According to the interviews, extrovert personalities who are encouraged and inspired by the interaction with the colleagues have experienced negative conditions in initiating discussions, actively involving in problem solving and collective decision making due to social isolation. "The extroverts are dying currently. Organizations are going to lose a lot of brainstorming and other innovative group processes if they choose for too much home working in the future" was a statement made by one of the interviewees on the adverse impact of extensive remote working on group creativity. They explained that losing the benefits of serendipitous conversations with the colleagues has impacted the group creativity and collective decision-making ability.

These negative impacts on Group Process could occur due to certain inequalities caused by remote working. All the workers in an organization may not be able to experience the same autonomy and flexibility in WFH due to lack of education, experience in the particular industry and accessibility to the right resources. Hence, their ability to involve in the decision making and problem-solving activities could vary vastly during WFH. This was highlighted by the interviewee statements such as, "But for anybody that is new and particularly someone who maybe a recent graduate, remote working would be a very challenging way to be integrated into the creative process in a workplace".

During the remote working period the importance of virtual collaboration took over the physical collaboration in workplaces. Virtual and physical collaboration are interrelated and mutually enabling (Hu, 2020). One participant mentioned that "I think almost every meeting in the future is going to be with people from outside calling in". However, some participants complained that the virtual collaboration technology is not effective in problem solving exercises, decision

making, brainstorming and group tasks as it lacks the human touch and cohesiveness. Also, they believe that employees would require more time to adapt to these technology-based systems effectively. Hence, virtual collaboration is not expected to replace the regular collaboration in the physical workplace but to enhance the flexibility and borderless realm under new ways of working (Hu, 2020). Interviewees mentioned that the right balance of collaborative and focused spaces should be maintained in the physical workplace following detailed analysis on the activity profiles of the staff. Enabling both the physical and virtual collaboration is a major requirement in enhancing group creativity beyond the COVID-19 pandemic.

3.4 Impact of COVID-19 on Contextual Influences

The impact of the COVID-19 pandemic on the workers' relationship with the physical environment and the facilities is discussed in this section.

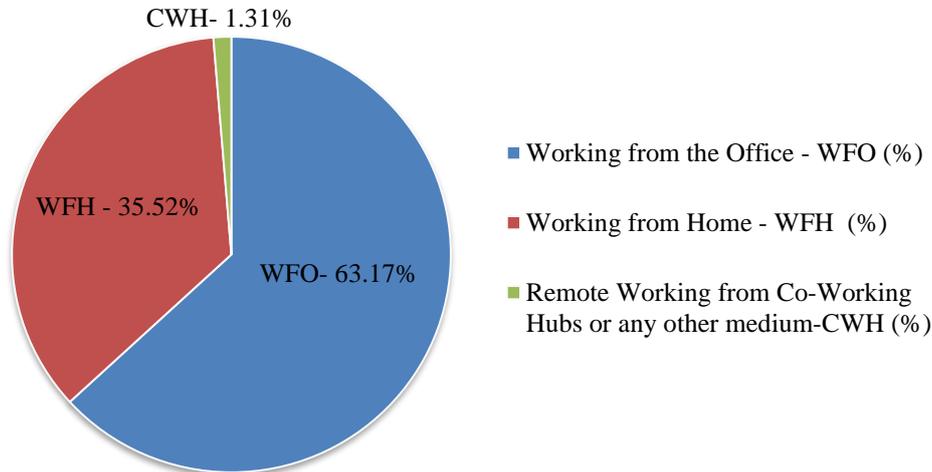
According to Reuschke and Felstead, (2020) Spatial and Social Inequalities are significant in the remote working practices. Under the social inequalities, it is argued that every industry is not suitable for WFH as many low-skilled, high service, and labor-intensive organizations need their workers to be in the workplace to perform successfully. According to the spatial inequalities some places may be better able to adapt to WFH depending on availability of real estate, household circumstances and ergonomic work settings required for this strategy (Reuschke and Felstead, 2020). Proving this argument an interviewee stated that "I did not have enough space at home and worked on the kitchen bench during COVID-19. I missed the influence of a working environment and the group of colleagues which impacted my motivation to think and to be creative". Therefore, WFH may not offer the same benefits to every employee in an organization to become a part of the group creativity. "It can certainly work for partially; it can't work the whole time. Some people, their domestic circumstances and jobs are more suited to work from home and join the creative process than others" is a statement that supports these findings. Hence, the influence of the physical environment was missing in WFH for the workers during COVID-19 pandemic which has impacted both individual and group creativity

Due to this importance of the physical workplace, organizations started to experiment different workplace trends in search of COVID safe environments such as de-densification. De-densification became a popular concept during the periods of eased lockdown and travel restrictions. Under this concept, organizations started to increase the gaps between the work settings to reduce the workplace density and to comply with the physical distancing measures but was not proven to be a 100% successful strategy in preventing the spread of the virus. One interviewee explained that de-densification could be a successful strategy if the viruses, including COVID-19, transmit only via droplets and infected surfaces, but it transmits through aerosols as well. They argue that de-densification and sneeze guards are temporary band-aids hence, long term solutions to the workplace strategy are required with a broader vision in facilitating group creativity.

According to the findings of the questionnaire survey (Figure 3) participants prefer to maintain a balance of 63.17% of WFO and 36.83% of remote working from home, co-working hubs or any other medium in a typical week to enhance group creativity. Firstly, this reflects that, workers prefer a hybrid work pattern in the future to enhance the group creativity process while improving resilience in their workplace strategies. Secondly, this reflects that even a hybrid style is predicted, the workers still believe that working majority of the time in a week from the office would help to improve the group creativity process. Hence, as one interviewee stated, "the value of the physical space in enhancing the collaboration, interaction and cohesiveness could not be underestimated". Thus, some participants suggested that more space in a workplace should be invested on creating collaborative spaces with the video conferencing

facilities since workers will more often come to the office for highly collaborative and problem-solving activities in the future.

Figure 3. Preferred balance of working styles in enhancing group creativity as a percentage on a typical working week



4 DISCUSSION & ANALYSIS

The WFH strategy accelerated by the COVID-19 pandemic has challenged the organizations to facilitate group creativity due to distancing from team members and the physical workplace environment.

4.1 Implications and Recommendations

The change was already happening gradually in the workplaces previously but, the COVID-19 pandemic has accelerated it. One interviewee mentioned that “this pandemic isn't just a temporary phenomenon; this is a remarkable and a major transition on how we think about the workplace in long term”. One interviewee mentioned, “The leadership should cultivate the participative culture while the transformation will need to be gradual and begin from the leadership of an organization following a top-down approach”. This needs to be facilitated through establishing ‘Sense of Coherence’ in the workplace which is driven by meaningful, comprehensible and manageable cultural transformation programs (Roskams and Haynes, 2019).

The trend towards hybrid working is expected to be a prominent feature in workplace strategy in the post COVID-19 era in enhancing group creativity. Designing the hybrid workplace could become an organization specific challenge to answer. One interviewee heading a commercial research agency mentioned that “According to our data we're seeing that there are certainly benefits in working from home such as focused work and there are certainly things that are better supported in the office such as collaboration and creativity”. Hence, self-assessments are required by each organization in deciding the future direction of their workplace strategy to support the group creativity. Further, many virtual platforms have already been used in the commercial world, but detailed research is required to investigate the effectiveness of these virtual solutions in productive collaboration, coordination, and interaction. Even though virtual workplace will have a greater impact on the perception of hybrid working, that will not reduce the importance of the physical workplace which provides favorable conditions for group creativity. Further, the trend of de-attaching from the main office will lead towards Distributed

Workplace models including co-working hubs which will provide the solutions for the main drawbacks identified in the WFH concept against group creativity. The increased flexibility and autonomy in the distributed workplace model could lead towards improved group creativity (O'Rourke, 2021).

Considering these challenges on group creativity due to the COVID-19 pandemic, workplace strategy consultants suggest that the concept of Activity Based Workplace (ABW) will have increased popularity in the future. ABW enables the organizations to practice multiple ways of working (such as hybrid and distributed working), enhance interaction, spontaneous meetings, collaboration and it facilitates cohesive group environments. This will enhance the creative processes of groups with increased inter-team and intra-team collaboration (Divett,2020).In addition, the strategies such as clean desk policy and etiquettes in the ABW environments will strengthen the workplace hygiene and organizational resilience (Mark et al., 2005). Thus, the characteristics of the ABW concept are expected to gain more importance in the future.

However, it was explained that this change on workplace strategies may mainly impact only the larger organizations with higher densities and larger group sizes, as they have to ensure these diverse staff members in groups are connected and effectively collaborating in producing creative business solutions. This was explained by statements such as, "I'm not sure if the smaller and medium-sized companies will see this as a trigger to change a lot".

4.2 Limitations of the Study and Recommendations for Future Research

Difficulty in accessing workplaces for case studies due to physical distancing measures was the major limitation experienced in this research. More empirical research based on larger sample groups is required with strong case studies in the future to identify clearer impacts on group creativity and better ways of facilitating it. Further, due to the word limit in this conference paper researcher had to condense the overall research process / findings in presenting here hence, planning to develop a journal paper with more comprehensive details. Still, we are living in the pandemic and in the early stage of this transformation. Consequently, most of these changes could be seen as observations that need to be further managed and analyzed. Thus, more longitudinal studies are required in the future to analyze any changes in these observations and further developments that impact the group creativity to arrive at more solid conclusions

5 CONCLUSIONS

COVID-19 has led towards unfavorable conditions for (1) Group compositions, (2) Group characteristics, (3) Group process and (4) Contextual influences. Hence, based on the conceptual framework it could be summarized that Group Creativity in workplace was negatively impacted by COVID-19. Hybrid, Distributed and Activity Based Working strategies are expected to rise in ensuring organizational resilience and generating favorable conditions for group creativity. These impacts of COVID-19 and future workplace strategies could vary depending on organizational sizes, densities, and their types of operations.

RESEARCH FUNDING

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ACKNOWLEDGMENTS

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REFERENCES

- Amabile, T.M. (1988), "A model of creativity and innovation in organizations". In: B.M. Staw & L.L. Cummings (Eds.), *Research in Organizational Behavior*, Greenwich: CT: JAI Press, 1988, vol.10, 123- 167.
- Appel-Meulenbroek, R., d. Voordt Theo van, Aussems, R., Arentze, T., Le Blanc, P. (2020), "Impact of activity-based workplaces on burnout and engagement dimensions", *Journal of Corporate Real Estate*, vol. 22 No. 4, 2020, 279-296.
- de Lucas Ancillo, A., del Val Núñez, M. T., Gavrilá, S. G. (2020), "Workplace change within the COVID- 19 context: a grounded theory approach", *Economic Research*, vol.34, 2297-2316.
- Cirriuncione L., Plescia F., Ledda C., Rapisarda V., Martorana D., Moldovan R. E., Theodoridou K., Cannizzaro E. (2020), "COVID-19 Pandemic: Prevention and Protection Measures to Be Adopted at the Workplace", *Sustainability 2020*; vol. 12(9):3603.
- Divett, M (2020), "Team dynamics within activity-based working", *Journal of Facilities Management*, vol.18, 181-194.
- Duffy, F., Laing, A., Crisp, V. (1992), "The Responsible Workplace", *Facilities*, Vol. 10 No. 11, 9-15.
- Dul, J., C. Ceylan, F. Jaspers (2011), "Knowledge workers' creativity and the role of the physical work environment", *Human Resource Management*, vol.50, 715-734.
- Greene, C., Myerson, J. (2011), "Space for thought: Designing for knowledge workers", *Facilities*, vol. 29, no. ½ 2011, 19-30
- McKinsey (2020), "Reimagining the Office and Work Life after COVID-19", McKinsey & Company, June,1–5.
- Hascher, R., Jeska, S., Klauck, B. (2002), *A design manual: Office buildings*, Basel, Berlin, Boston: Birkhauser.
- Hu, R. (2020), "COVID-19, smart work, and collaborative space: A crisis opportunity perspective", *Journal of Urban Management*, vol. 9, 276-280.
- Madjar, N., Oldham, G.R., Pratt, M.G. (2002), "There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance", *The Academy of Management Journal*, vol. 45, 757-767.
- Mark, G., Gonzales, V., Harris, J. (2005), "No task left behind? Examining the nature of fragmented work", *Proceedings of CHI 2005*, Portland, 321-330.
- Petruaitiene, V., P. Korba, S. Nenonen, T. Jylhä, S. Junnila (2018), "From walls to experience – servitization of workplaces", *Facilities*, Vol. 36 No. 9/10, 2018, 525-544
- Reuschke, D., A. Felstead (2020), "Changing workplace geographies in the COVID-19 crisis", *Dialogues in human geography*, vol.10, 208-212.
- Roskams, M., Haynes, B. (2019), "Salutogenic workplace design: A conceptual framework for supporting sense of coherence through environmental resources", *Journal of Corporate Real Estate*, Vol.22 No.2, 139-153.
- Shalley, C.E., Gilson, L.L. (2004), "What leaders need to know: A review of social and contextual factors that can foster or hinder creativity", *The Leadership Quarterly*, vol. 15, 33-53.
- Worthington, J. (1997), *Reinventing the workplace*, London Oxford: Architectural Press
- World Economic Forum (2020), How the post-COVID workplace will change business for the better", World Economic Forum.
- Yin, R. K. (2014), *Case study research: design and methods*, Los Angeles: SAGE
- Zhou, J. & George, J.M. (2001), "When job dissatisfaction leads to creativity: Encouraging the expression of voice", *Academy of Management Journal*, vol. 44, 682-696.

SESSION 5B: OFFICES, HEALTH AND WELLBEING

Office noise - Effects and control

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ABSTRACT

This paper is an overview, what office noise is, how it affects us, how it is measured, and how it can be controlled. Noise and lack of speech privacy are among the most dissatisfactory environmental factors in open-plan offices. Scientific research has shown that office noise increases stress, reduces cognitive work performance, causes noise annoyance, elevates workload, and increases fatigue. Noise can be controlled by various methods: room acoustic design, architectural design, organisational methods, and individual behaviour. A case workplace is described where all these methods were applied. Although the noise problem is better identified and better controlled than 20 years ago, further research is still needed and some important topics are listed.

Keywords

Office noise, Noise effects, Room acoustics, Open-plan offices, Activity-based offices.

1 OFFICE NOISE

Sounds in the office origin from many sources, such as:

- Colleagues' intelligible speech and laughter;
- Remote non-intelligible babble sounds;
- Building service sounds (e.g., ventilation, coolers);
- Loudspeakers producing artificial masking sound;
- Environmental noise transmitting through façade components;
- Electronic apparatus sounds (e.g., keyboard tapping, phones, printers);
- Walking sounds;
- Temporary maintenance noises.

Audible sound most frequently originates from the space where the listener is, e.g., in the open-plan office. However, it is not rare that audible sound originates from the neighbouring room via door, wall, ventilation duct, or holes in the separating constructions. Individual differences in the perception of sounds are large. The same sound can also cause opposite reactions being annoying to one and useful to another. Sound in an office is usually rated as noise when

- It is not useful for the occupant;
- It distracts the current task (e.g., private work, conversation, thinking); or
- The occupant's attitude towards the sound source is negative.

Colleagues' intelligible speech is useful sound, when the occupant is involved with the conversation, or the spoken information happens to be useful. At the same time, the same speech can be useless for another nearby occupant who is not benefiting from the spoken information or is not involved in the conversation.

2 EFFECTS OF OFFICE NOISE

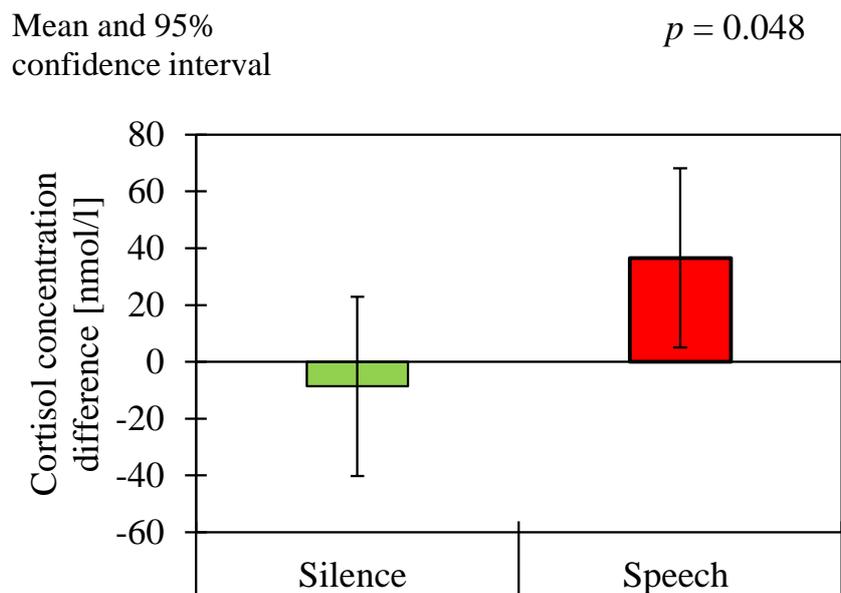
Office noise (i.e., unnecessary speech) has various effects on the occupant, such as:

- Perception of noise annoyance, disturbance, or distraction;
- Increment of physiological stress;
- Reduction of cognitive work performance;

- Reduction of environmental satisfaction;
- Various behavioural effects related to the control or avoidance of noise;
- Potential for elevated risk of sickness absence and disability retirement.

Noise annoyance is probably the first and the most usual adverse effect of office noise. Intelligible speech has been rated as the most distracting noise type in open-plan offices (Haapakangas et al., 2008). Prolonged annoyance will reduce environmental satisfaction which is linked with the most important work-related subjective metrics, i.e., job satisfaction. Haapakangas et al. (2017) showed that noise disturbance was larger in open-plan offices, where the distraction distance was larger. Distraction distance is a property of the office space, when occupants are absent. It is the distance from a single speaker, where the Speech Transmission Index (STI) falls below 0.50 (see Sec. 3). STI is an objective metric of speech intelligibility ranging from 0.00 to 1.00. The conclusion suggests that room acoustic conditions should be designed to reach short distraction distance, i.e., where the speech from a speaker remains intelligible only within a very limited area around the speaker. Environmental satisfaction is a subjective measure that measures the occupants' satisfaction with physical properties of the space. One of the strongest reasons for environmental dissatisfaction in open-plan offices is the lack of acoustic privacy and distraction due to noise (Bodin Danielsson & Bodin, 2009; Frontczak et al. 2012, Pejtersen et al., 2006). Since these factors increase stress, and elevated stress is expected to be associated with lower work performance (Vischer, 2007), it is important to invest in acoustic remedies which reduce the risk of environmental dissatisfaction. Radun et al. (2021) conducted a medical laboratory experiment where one group was exposed to speech (65 dB L_{Aeq}) and another group was exposed to silence (35 dB) where speech was absent. The exposure time was 45 minutes. During that time, the participants conducted psychological tests, responded to questionnaires, and wore cannula to enable the extraction of blood samples. Speech caused an elevated level of stress hormones in blood plasma compared to silence (Fig. 1). Because task irrelevant speech causes acute stress already after 45-min exposure, it is justified to assume that stress hormone level is continuously elevated in an office with such a sound level.

Figure 1. Radun et al. (2021) found that the cortisol concentration was elevated during speech (65 dB) compared to silence (35 dB). Cortisol is a stress hormone

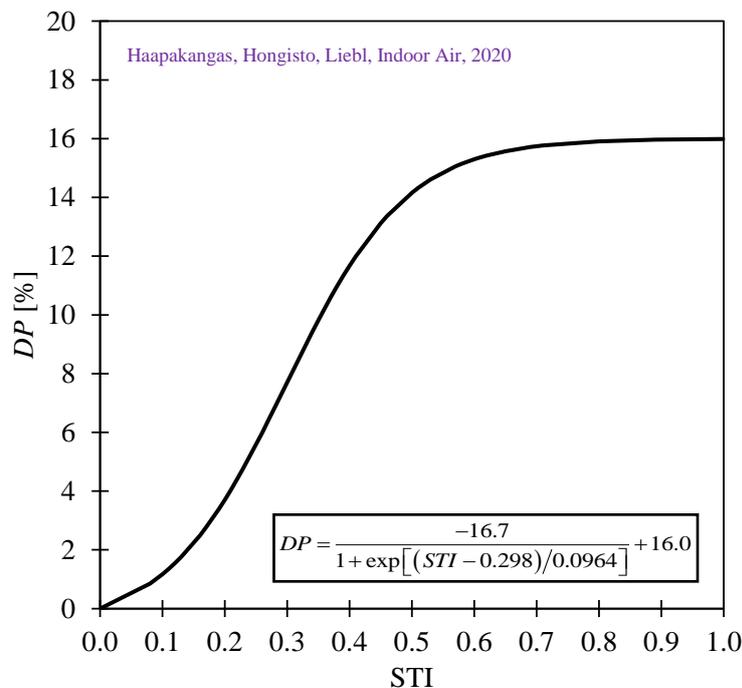


Colle and Welsh (1977) found that native speech has a strong adverse effect on short-term memory performance. Later, Colle (1980) and Ellermeier & Hellbrück (1998) showed that speech must be intelligible to produce this effect. Based on that and a couple of suggestive evidence, Hongisto (2005) developed a hypothetical model, which predicted that performance decrement increased with increasing STI. Using STI as the primary descriptor of speech intelligibility was justified since STI can be quantitatively measured.

The study of Hongisto (2005) encouraged many psychological groups to study this hypothesis. Haapakangas et al. (2020) reviewed these and found 11 experiments where performance in short-term memory tasks had been tested at different STI values. Strong experimental evidence was found that the performance reduced with increasing STI. They could confirm and revise the hypothetical model of Hongisto (2005). The revised model is shown in Fig. 2. The revised model enables the assessment of payback time of room acoustic investments because reduction of STI leads to increment of work performance (Hongisto, 2021).

Pejtersen et al. (2011) and Bodin Danielsson et al. (2014) found that the sickness absences were higher in open-plan offices than in private rooms or shared rooms. Clausen et al. (2013) found that frequent exposure to disturbing office noise was associated with increased risk of long-term sickness absence. Further, Nielsen et al. (2020) found that working in shared and open-plan offices had significantly higher risk of subsequent disability retirement compared to employees in private office rooms. These studies could not directly address that office noise leads to these risks (sickness absence, disability retirement). Because noise and lack of acoustic privacy are so important sources of dissatisfaction, and intelligible speech (office noise) has been found to elevate stress (Radun et al., 2021) and reduce cognitive performance (Haapakangas et al., 2020), it is justified to expect that adverse acoustic conditions in the open-plan office somehow contribute to these elevated risks.

Figure 2. Decrement of cognitive performance, DP , increases (i.e., work performance decreases) as a function of Speech Transmission Index, STI



3 MEASURING OFFICE NOISE

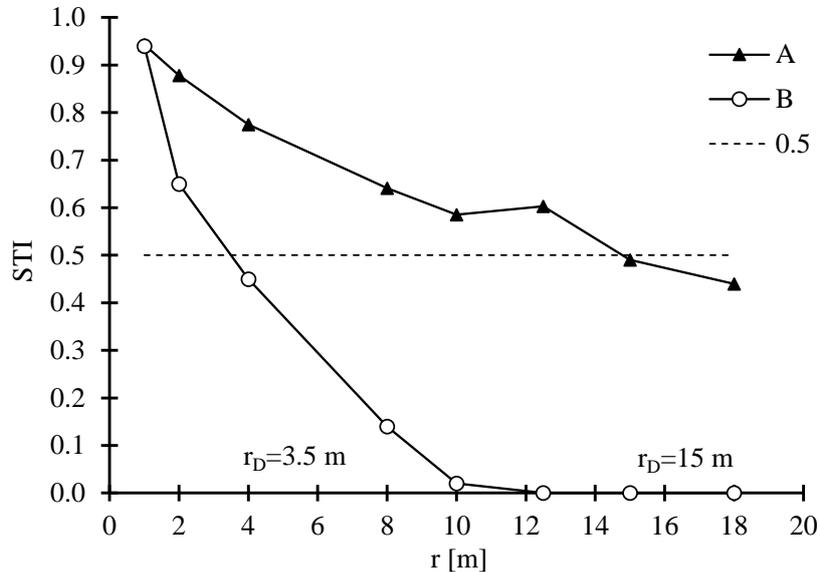
The most usual objective descriptor of noise is the sound level. It can be measured for different frequencies and durations. Typical descriptor is the mean level during an 8-hour working day: A-weighted 8-hour equivalent sound level, L_{Aeq8h} . “A” denotes a frequency filter which corresponds to the hearing sensitivity of human at frequencies from 20 to 20 000 Hz. It is a globally adopted way to report sound levels using a single number.

The lowest sound levels are usually found in offices with low rates of communication and occupancy. The opposite situation is usually found in offices with high occupancy and communication (e.g., client services and marketing).

Recently, Yadav et al. (2021) published the most extensive data regarding sound levels and room acoustics in open-plan offices. The survey included 43 open-plan offices. Sound levels varied between 48 and 58 dB L_{Aeq8h} . However, momentary sound levels (L_{Aeq1s}) can range from 30 dB (no-one talks) and 80 dB (a loud group shouting and laughing).

The sound level of normal effort speech is about 60 dB at 1 m distance from the speaker’s mouth in a reflection-free environment (outdoors). Compared to that, the sound levels reported by Yadav et al. (2021) are reasonably small. Therefore, the sound level itself cannot explain the high noise annoyance reported in open-plan offices. It must be the information that the sound carries. It has been found that high fluctuation strength of office noise (describing specific variability of sound) is associated with lower cognitive performance (Schlittmeier et al., 2012). A simpler alternative to fluctuation strength is statistical variability of noise, such as noise climate, which is the difference between the 10th and the 90th percentile of sound level (L_{A10} - L_{A90}). Variability is the largest for intelligible speech and the lowest for constant noise, such as ventilation noise or babble, where several speakers are mixed so that single speech cannot be distinguished. Kaarlela-Tuomaala et al. (2009) found that variability was higher in private office rooms than in open-plan offices. On the other hand, they also found that noise distraction was drastically larger in open-plan offices than in private rooms. This suggests that higher variability predicts lower distraction being in contradiction with Schlittmeier et al., (2012). This is, however, not a real contradiction: speech (high variability) in a private room originates from conversation carried out in that specific room. Such speech carries important information for the occupant of that room, being not at all annoying. Therefore, high variability of sound level in a private room just indicates that the room owner is speaking on the phone or with a visitor. In an open-plan office, speech is often useless to most occupants since all occupants cannot usually be part of the same conversation. Therefore, it is not possible to predict the momentary effect of office noise on an occupant either by measuring sound level (L_{Aeq}) nor variability of noise (L_{A10} - L_{A90}). In the long term, however, it is quite safe to expect that higher variability and higher sound level in the open-plan office is associated with higher distraction. Because higher STI predicts weaker cognitive performance, it is possible to design offices which have small STI, i.e., offices where speech can only be distinguished at short conversational distances (under 3 m) but not at larger distances (Sec. 5). STI is measured in rooms according to the IEC 60268-16 standard (IEC, 2003). Therefore, STI was adopted to an international standard ISO 3382-3 (ISO, 2012), which describes a method to measure the room acoustic conditions in open-plan offices. Figure 3 clarifies the measurement results in two open-plan offices having extremely different room acoustic performances. In the measurement setup, a loudspeaker is installed to one workstation. STI is measured at different distances from this loudspeaker. Usually, the measurement is conducted along a direct path that passes through workstations. Distraction distance, r_D , is the distance, where STI falls below 0.50. In case A, the distraction distance is 15 metres, while in case B it is only 3.5 metres. This means that in case A, a single speaker disturbs other occupants until 15 m distance, while in case B, the disturbance is limited to 3.5 m distance.

Figure 3. Speech Transmission Index, STI, as a function of the distance to the speaker, r , in an office in two conditions. A: room has very little sound-absorbing materials and background noise level is low ($30 \text{ dB } L_{Aeq}$, from ventilation). B: room has very much sound-absorbing materials and background noise level is elevated ($44 \text{ dB } L_{Aeq}$, from artificial sound masking system)



4 IMPORTANCE OF MANDATORY ACOUSTIC TARGET VALUES

The previous Finnish building regulations published in 1998 did not contain specific room acoustic requirements for open-plan offices, which would affect the STI in a positive way. Instead, the situation was the opposite since the tight regulation for ventilation noise ($<33 \text{ dB } L_{Aeq}$) led to very large STI values and large noise distraction. Workplace designers and acousticians became convinced about the importance of room acoustic design only after 2005 when first Finnish studies about office noise effects were available. The first voluntary Finnish target values were published in 2008 (RIL 243-3, 2008; BIF, 2008). They were slowly adopted by workplace designers, acoustic consultants and material manufacturers, and the room acoustic quality of Finnish offices began to improve. Voluntary target values were adopted only in such office design projects, where the user was convinced about their importance and acoustic consultant was used. Since many office projects chose not to use acoustic consultants, the room acoustic qualities became very divergent. However, successful designs according to the 2008 guidelines increased the interest of users towards the better acoustic design. Business of absorbing screens, soft carpets, wall and ceiling absorbers, and sound masking appliances increased and the pressure to design good room acoustic conditions increased also from that direction. When the previous building regulation was under revision stage, the scientific evidence and pressure from the building and user sector led to the setup of governmental target values both for room acoustic design and sound insulation between working rooms. The Finnish regulated target values of MoE (2017; 2018; 2019) are summarised in Figure 4 and they were closer explained by Hongisto (2018). Building regulation means that the target values must be achieved in all building projects which require a building permission from the municipality (new buildings, significant renovations, change of use). Finland is the only country who has governmental target values for the room acoustic conditions of open-plan offices based on the objective quantities of ISO 3382-3 standard (ISO, 2012). Because the experiences have been positive, and the payback time of the extra cost due to room acoustic solutions is short (Hongisto, 2021), it is important to share this experience also to other countries.

Figure 4. Finnish governmental target values for the acoustic conditions of office buildings (MoE, 2017; 2018; 2019)

<p>Airborne sound insulation</p> <ul style="list-style-type: none"> • Office → office : $D_{nT,w} \geq 40$ dB • Meeting → other: $D_{nT,w} \geq 48$ dB • Office → aisle: $D_{nT,w} \geq 30$ dB • Meeting → aisle: $D_{nT,w} \geq 34$ dB • Between organizations: $D_{nT,w} \geq 52$ dB 	<p>Room acoustics open-plan office spaces*</p> <ul style="list-style-type: none"> • Reverberation time: $T < 0.60$ s • Distraction distance:** $r_D \leq 8$ m <p>* Values concern all spaces independent on use and furniture. ** STI must be < 0.50, when distance to speaker exceeds 8 m</p>
<p>Noise level</p> <ul style="list-style-type: none"> • Building services: $L_{A,eq} < 33$ dB • Outdoor noise: $L_{A,eq} < 35$ dB 	<p>Impact sound insulation</p> <ul style="list-style-type: none"> • Between floors: $L'_{nT,w} + C_{L,50-2500} \leq 63$ dB

5 NOISE CONTROL

Challenges caused by noise in open-plan offices were identified already in the 1950s (Hardy, 1957). Most of the noise control methods invented at that time are still valid. Noise and acoustic privacy can be controlled in the office by several means. Fig. 5 gives an approach where the control is divided into four parts, depending on the responsible party:

- Architectural design: what the architect and the acoustic designer can do together.
- Room acoustic design: what the interior designer and acoustic designer can do together.
- Organisational measures: what the user can do after the office is finished.
- Individual (behavioural) measures: what the individual can do to control noise or privacy.

Figure 5. Schematic list of methods to reduce office noise and to improve speech privacy

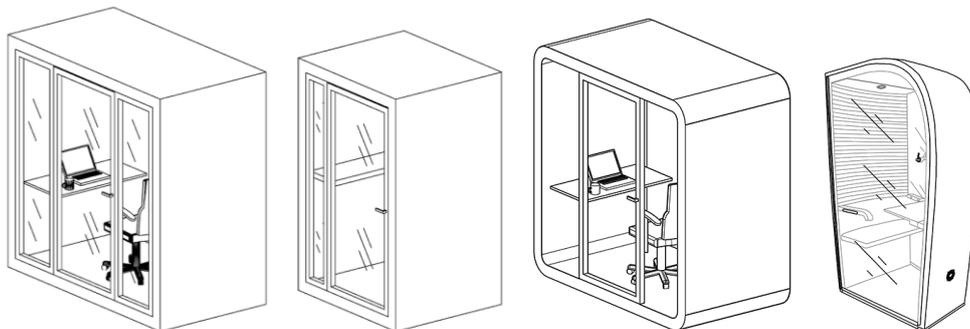
<p>Architectural design</p> <ul style="list-style-type: none"> • Diverse room layout allowing activity-based work • Soundproofing of noisy and sensitive spaces: office rooms, meeting rooms, aisles, and break rooms • Sufficient workstation distances 	<p>Organizational measures</p> <ul style="list-style-type: none"> • Office etiquette • Mobile pods or booths • Silent vs. communication zones • Offering qualified headsets • Displays indicating occupancy • Remote work contracts • Continuous development of the office
<p>Room acoustics design</p> <ul style="list-style-type: none"> • Ceiling absorbers (>75% coverage, class A) • Wall absorbers (>25% coverage, class A) • Sound-absorbing foldable curtains • Screens and storage units (height > 1.4 m) • Sound-absorbing screens (at least class C) • Soft floor covering • Artificial sound masking system (42-45 dBA) 	<p>Individual behavioral measures</p> <ul style="list-style-type: none"> • Choosing soundproof workstation • Notifying colleagues • Remote working • Hearing protectors • Headphone sound masking

Architectural design includes, among other things, that the spaces are designed so that noise appears only in rooms where it does not disturb the others. Therefore, the division of spaces with essentially different activities by sound insulating walls, doors, mobile walls, and glass walls is extremely important. If the workplace supports activity-based working etiquette, the amount of disturbing noise can be further controlled by individual task-based workstation choices. Room acoustic design has a significant effect on noise disturbance (Haapakangas et al., 2014; 2017). Room acoustic design aims at the situation where intelligible speech can only be heard beyond a couple of metres and it cannot be distinguished at longer distances than 8 metres from the speaker (distraction distance). Room acoustic research has shown that the distraction distance varies between 2.5 and 20 metres (Hongisto and Keränen, 2021). Such a large range proves that there is a huge capacity in room acoustic design. Reduction of STI requires that three essential factors are simultaneously considered: high absorption, sound masking, and high screens between workstations. Room acoustic design factors are more specifically detailed in Fig. 5. Detailed room acoustic design guidelines are given, e.g., by Keränen and Hongisto (2013) and Keränen et al. (2020). Organisational measures involve that the users (occupants) together create an adequate etiquette of how to use the spaces to reduce noise distraction and improve speech privacy. Mobile pods and booths can be bought to provide spaces for local privacy unless they do not belong to the architectural design. Separate open-plan offices or rooms can be nominated for silent (concentration demanding tasks) and non-silent (communication demanding tasks) purposes. Occupants speaking in phone or web meetings can be given high quality headsets (headphones with near-field microphones) so that there is no need to raise voice during the communications and the risk of overhearing confidential office conversations is minimised. Many organisations have smart displays in the entrance hall or mobile app that indicates the real-time workstation occupancy of the office. This helps the choice of workstation according to task needs. In overall, the user should continuously develop the office spaces according to the changing needs.

6 OFFICE BOOTHS

Office booths are relatively new means to control noise. Examples of office booths are mobile phone booths for a single occupant, mobile working booths for 1 to 2 occupants and mobile meeting booths for up to 6 occupants. Enclosures are usually equipped with a door, electric outlets, lighting, glazing, ventilation fan, and furniture so that it is possible to work there for several hours without perceiving high temperature, bad air quality, or improper working posture. Figure 6 shows some schematic examples of booths.

Figure 6. Example of office booths for one person



First booths arrived in the market in the beginning of this century. They provided very limited sound insulation and they were not believed to provide a serious solution for noise mitigation nor speech privacy elevation. In 2010, booths with better sound insulation appeared in the market. However, there was no test method to describe their acoustic performance. Hongisto et al. (2016) developed a test method in 2013 (which became an international standard ISO 23351-1 (ISO, 2020)). The outcome of the test method is the speech level reduction, $D_{S,A}$, that describes how many decibels the speech level is reduced by the booth compared to a situation when the booth is absent. The same number also applies for outdoor-indoor noise reduction. Booths are now very easy to compare with each other from an acoustic perspective since all commercial booths should be specified with $D_{S,A}$.

Hongisto et al. (2016) showed that workstations and sofa groups of various configurations can only reach 4 dB $D_{S,A}$. Instead, commercial mobile phone booths reduced speech level much more. Even the worst booth reduced speech level by 15 dB $D_{S,A}$, while the best booths reduced noise even by 30 dB $D_{S,A}$ (Hongisto et al., 2020). The best booths reduce speech level so efficiently that speech produced indoors cannot be distinguished right behind the door of the booth. Thus, the best booths can be placed very close to the workstations. The booths offer an easily attainable place, where one can go to speak whenever needed, taking the speech away from the open-plan office. Room acoustic measures cannot provide such a drastic noise reduction.

Facility owners prefer open-plan offices having only a minimum number of walls since the need of privacy and noise control is user-dependent and open-space looks the most flexible for the potential tenant. The building cost of a fixed room is much higher to the building owner than the cost of a mobile booth. Booths are usually owned by the tenant, the installation is dust-free and fast, and the booths can be easily moved inside the premises and relocated to other buildings with small costs. This way, mobile booths provide flexibility both in workplace design and building economy. Therefore, the market of sound-insulating mobile booths has grown since 2015.

7 CASE STUDY

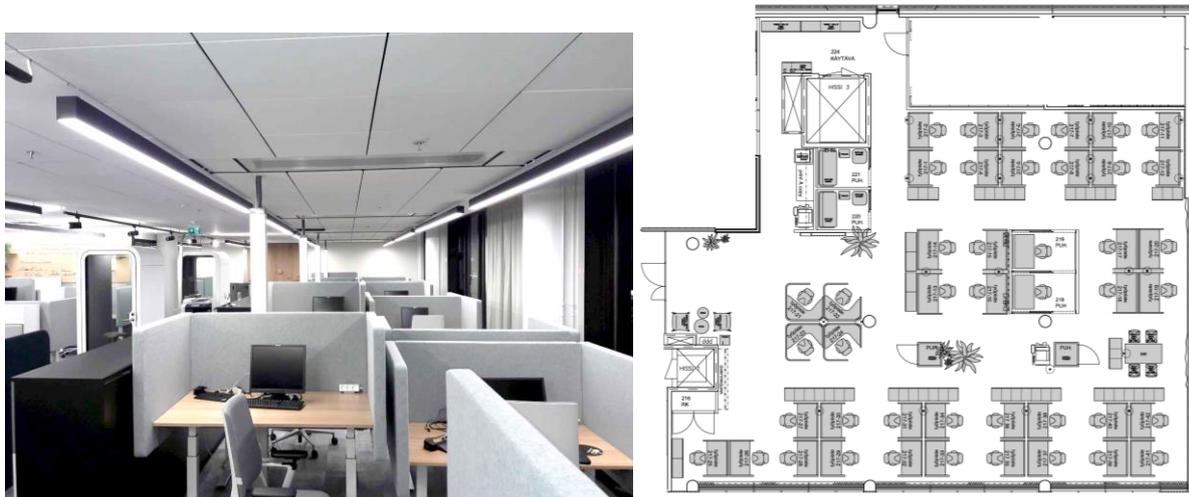
A Finnish company bought an old office building and renovated it to fit their needs. The new office contained several floors including both rooms and open-plan offices. Fig. 7 shows a photograph and the layout of the open-plan office on one floor. Both the company and the architect agreed that an open-plan office is a risk due to noise and lack of speech privacy. For example, conversations in client services units contained sensitive information and it was not allowed that ambient office speech was overheard by clients. Therefore, the architecture and room acoustics of the open-plan office were planned in a very disciplined way by following the principles of Fig. 5 as much as possible. The following solutions were used:

- 80% of suspended ceiling area was sound-absorbing (20 mm mineral wool, class A).
- 25% of wall area was sound-absorbing (40 mm mineral wool glued to the wall, class A).
- Textile floor covering (thickness 8 mm, unclassified).
- Sound-absorbing table screens (700 mm above the table height, class B).
- Sound masking system providing 44 dB L_{Aeq} (one small loudspeaker in the ceiling per 10 m² floor area).
- Folded textile curtains on the façade.
- The office was isolated from the adjoining coffee room, main aisle, and work rooms by soundproof walls ($R_w=40$ dB) and doors ($R_w=35$ dB).
- Two mobile phone booths with $D_{S,A}=30$ dB in the middle of the office so that it is fast available from all workstations.

- Occupants were given high-quality headsets which improve the confidential privacy (colleagues' voices do not reach the client) and reduce voice effort (i.e., office noise) during web and phone conversations.
- Occupants were informed in advance about the acoustic remedies: why they are needed, what they are, and how they work.

Sound absorption classes of ISO11654 standards range from A-E and unclassified (worst). The acoustic measurements were conducted according to ISO 3382-3. Unparalleled results were obtained. The distraction distance was only 3.5 metres. That is, STI fell below 0.50 already at 3.5 m distance from the speaker while the Finnish regulation allows this distance to be up to 8 metres. The outcome was, thus, much better than regulations required. Unfortunately, we did not have a chance to conduct a questionnaire study before and after the office relocation to investigate how the occupants perceived the change. Based on prior similar interventions including strong acoustic changes (Hongisto et al., 2012; Hongisto et al., 2016), the change in acoustic satisfaction was probably positive.

Figure 7. A photograph of the open-plan office of 44 workstations and the floor layout. The photograph was taken in the leftmost bottom corner



8 FUTURE RESEARCH NEEDS

Although the control of office noise has significantly increased during the last 20 years, office noise is still a challenge (Radun & Hongisto, 2022). One important reason for this is that the space efficiency has increased (paperless office, flat displays, flexible and anonymous workstations) and the cognitive demands of the office work has increased. Therefore, the disturbing potential of task-irrelevant speech (office noise) can be even higher than 20 years ago when all workers had fixed workstations and they worked daily in the office. Because remote working has increased, occupants can also set higher requirements for the workplace than before since home workstations may provide a much better place for concentration-demanding work than the office. The following noise and privacy related research needs have been identified:

- There is a need to develop a noise metric that describes the noise annoyance potential of any moment in any office environment. Such a tool would benefit the work of, e.g., occupational health professionals and noise consultants, who should be able to quantitatively assess the perceived noisiness of the office environment but they cannot do it at the moment. Smart office applications based on sensors distributed to the office are nowadays used to inform

the occupants about, e.g., desk occupancy and temperature. Distributed microphones could provide information about the annoyance of the local sound environment so that the occupant could choose a desk according to current job demands.

- Activity-based offices have been proposed as a means to improve environmental satisfaction and to reduce office noise compared to conventional open-plan offices. However, the evidence about the superiority of activity-based offices is limited.
- Mobile booths and other supporting spaces are expected to reduce office noise and increase confidential privacy and workplace satisfaction. However, independent research is lacking.
- It is possible to design offices which have significantly better room acoustic quality than required by the Finnish regulations ($r_D=8$ m). For example, Sec. 7 reported about an office with $r_D=3.5$ m. There is a need to investigate what benefits such a design would provide.
- Active noise control means that noise signal 1 is cancelled out in the listener's position by producing there another noise signal 2 which is identical to noise signal 1 but it has an opposite phase. This technology is applied in headphones having active noise control features. It is generally believed that wearing such headphones could reduce office noise in the ear channel. However, there is very limited research evidence about that.

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REFERENCES

- BIF (2008), LVI 05-14004 en Classification of indoor environment 2008. Target Values, Design Guidance, and Product Requirements. Rakennustietosäätiö - Building Information Foundation, Helsinki, Finland.
- Bodin Danielsson, C., Bodin, L. (2009), Difference in satisfaction with office environment among employees in different office types, *J. Arch. Plan. Res.* 26:3, 241-257.
- Bodin Danielsson, C., Chungkham, H. S., Wulff, C., Westerlund, H. (2011), Office design's impact on sick leave rates. *Ergonomics* 57(2), 139-147.
- Bradley, J.S. (2003), The Acoustical Design of Conventional Open Plan Offices. *Can. Acoust.*, 27(3), 23-30.
- Clausen, T., Kristiansen, J., Hansen, J. V., Pejtersen, J. H., Burr, H. (2013), Exposure to disturbing noise and risk of long-term sickness absence among office workers: a prospective analysis of register-based outcomes. *Int. Arch. Occup. Environ. Health* 86, 729-734.
- Colle, H. A. (1980), Auditory encoding in visual short-term recall: effects of noise intensity and spatial location, *J. Verbal Learn, Verbal Behav.* 19, 722-735.
- Colle, H. A., Welsh, A. (1976), Acoustic masking in primary memory. *J. Verbal Learn. Verbal. Behav.*, 15, 17-31.
- Ellermeier W., Hellbrück J. (1998), Is level irrelevant in irrelevant speech? Effects of loudness, signal-to-noise ratio, and binaural unmasking. *J. Exp. Psychol.: Human Percept. Perform.* 24(5), 1406-1414.
- Frontczak, M., Schiavon, S., Goins, J., Arens, E., Zhang, H., & Wargocki, P. (2012), Quantitative relationships between occupant satisfaction aspects of indoor environmental quality and building design, *Indoor Air* 22, 119-131.
- Haapakangas, A., Hongisto, V., Hyönä, J., Kokko, J., Keränen, J. (2014), Effects of irrelevant speech on performance and subjective distraction: The role of acoustic design in open-plan offices, *Applied Acoustics* 86 1–16.
- Haapakangas, A., Helenius, R., Keskinen, E., Hongisto, V. (2008), Perceived acoustic environment, work performance and well-being - survey results from Finnish offices, 9th

- Int. Congr. of Noise as a Public Health Problem (ICBEN), July 21-25, 434-441, Mashantucket, Connecticut, USA.
- Haapakangas, A., Hongisto, V., Eerola, M., Kuusisto, T. (2017), Distraction distance and disturbance by noise – An analysis of 21 open-plan offices, *The Journal of the Acoustical Society of America*, 141(1) 127–136.
- Haapakangas, A., Hongisto, V., Liebl, A. (2020), The relation between the intelligibility of irrelevant speech and cognitive performance—A revised model based on laboratory studies. *Indoor Air* 30 1130–1146.
- Hardy, H.C.; A guide to office acoustics. *Architectural Record*, February, 1957, 235-240.
- Hongisto, V. (2005), A model predicting the effect of speech of varying intelligibility on work performance. *Indoor Air* 15 458–468.
- Hongisto, V., Haapakangas, A., Helenius, R., Keränen, J., Oliva, D. (2012), Acoustic satisfaction in an open-plan office before and after the renovation, *Euronoise 2012*, June 10-13, 654-659, Prague, Czech Republic.
- Hongisto, V., Keränen, J., Virjonen, P., Hakala, J. (2016), New method for determining sound reduction of furniture ensembles in laboratory, *Acta Acustica united with Acustica* 102 67–79.
- Hongisto, V., Haapakangas, A., Varjo, J., Helenius, R., Koskela, H. (2016), Refurbishment of an open-plan office –environmental and job satisfaction, *Journal of Environmental Psychology* 45 176–191.
- Hongisto, V., Keränen, J. (2018), Open-plan offices - New Finnish room acoustic regulations, *Conf. Proc. Euronoise 2018*, 1147-1152, 27-31 May 2018, Hersonissos, Crete, Greece.
- Hongisto, V., Keränen, J. (2020), Acoustic performance of eleven commercial phone booths according to ISO 23351-1. *Research Reports from Turku University of Applied Sciences* 51, 20 pp., Turku University of Applied Sciences, Turku, Finland. At: <http://julkaisut.turkuamk.fi/isbn9789522167743.pdf>
- Hongisto, V. (2021), Office noise reduces work performance - A tool to assess the payback time of room acoustic investments, *Proc. Euronoise 2021*, 1262-1269, 25-27 October, Madeira, Portugal.
- Hongisto, V., Keränen, J. (2021), Comfort Distance – A Single-Number Quantity Describing Spatial Attenuation in Open-Plan Offices. *Applied Sciences* 11(10) 4596, 10
- IEC (2003), IEC60268-16 Sound system equipment - Part 16: Objective rating of speech intelligibility by speech transmission index, Ed. 3, International Electrotechnical Commission, Geneva, Switzerland.
- ISO (2012), ISO3382-3:2012 Acoustics - Measurement of room acoustic parameters. Part 3: Open plan offices, Geneva, Switzerland.
- ISO (2020), ISO 23351-1 Acoustics - Measurement of speech level reduction of furniture ensembles and enclosures - Part 1: Laboratory method.
- Kaarlela-Tuomaala, A., Helenius, R., Keskinen, E., Hongisto, V. (2009), Effects of acoustic environment on work in private office rooms and open-plan offices - longitudinal study during relocation, *Ergonomics* 52 (11) 1423–1444.
- Keränen, J., Hongisto, V. (2013), Prediction of the spatial decay of speech in open-plan offices, *Applied Acoustics* 74 1315–1325.
- Keränen, J., Hongisto, V., Hakala, J. (2020), The effect of sound absorption and screen height on spatial decay of speech in open-plan offices, *Applied Acoustics* 166 107340 11+3
- MoE (2017), Decree 796-2017 of the Ministry of the Environment on the acoustic environment of buildings, 24 November 2017, Helsinki, Finland, available at: <https://www.finlex.fi/fi/laki/alkup/2017/20170796>

- MoE (2018), Acoustic environment, Guideline of the Ministry of the Environment on the acoustic environment of buildings, 28 June 2018, Ministry of the Environment, Helsinki, Finland, available at: <https://www.ym.fi/download/noname/%7B2852D34E-DA43-4DCA-9CEE-47DBB9EFCB08%7D/138568>
- MoE (2019), Planning and implementation of the acoustic conditions of buildings, Publications of the Ministry of Environment, 2019, Helsinki, Finland, available at: <https://julkaisut.valtioneuvosto.fi/handle/10024/161953>
- Nielsen, M.B., Emberland, J.S., Knardahl, S.; Office design as a risk factor for disability retirement: A prospective registry study of Norwegian employees. *Scand. J. Work Environ. Health* 47(1), 2021, 22-32.
- Pejtersen, J., Allermann, L., Kristensen, T.S., Poulsen, O.M. (2006), Indoor climate, psychosocial work environment and symptoms in open-plan offices, *Indoor Air* 16, 392-401.
- Pejtersen, J.H., Feveile, H., Christensen, K.B., Burr, H. (2011), Sickness absence associated with shared and open-plan offices – a national cross sectional questionnaire survey, *Scand. J. Work Environ. Health* 37(5) 376-382.
- Radun, J., Maula, H., Rajala, V., Scheinin, M., Hongisto, V. (2021), Speech is Special. The Stress Effects of Speech, Noise, and Silence during Tasks Requiring Concentration. *Indoor Air* 31(1) 264–274.
- Radun, J., Hongisto, V. (2022), Indoor environmental quality satisfaction in offices – office types and cultural differences. Manuscript submitted. *Proc. of Transdisciplinary Workplace Research*, 7-10 October, Milan, Italy.
- RIL 243-3 (2008), Acoustic Design of Buildings. Offices, Finnish association of Civil Engineers, Helsinki, Finland.
- Schlittmeier, S.J., Weißgerber, T., Kerber, S., Fastl, H., Hellbrück, J. (2012), Algorithmic modelling of the irrelevant sound effect (ISE) by the hearing sensation fluctuation strength. *Attention, Perception, & Psychophysics*, Vol. 74 No. 1, pp. 194-203.
- Vischer, J. C. (2007), The effects of the physical environment on job performance: towards a theoretical model of workspace stress, *Stress Health* 23, 175-184.
- Yadav, M., Cabrera, D., Kim, J., Fels, J., de Dear, R. (2021), Sound in occupied open-plan offices: Objective metrics with a review of historical perspectives. *Appl. Acoust.* 177 107943.

Conceptualising healthy flexible office design

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ABSTRACT

This paper contributes to the conceptualisation of healthy flexible office design by providing new insights into the interrelations between flexible office design, users' perceptions of them, and user SOC. The paper summarises the work done as part of a doctoral thesis including a literature review as well as three mixed-method case studies on flexible offices. The literature reviews reveal that both 'health' and 'healthy office' conceptualisations were limited to risk factors (pathogenic forces). The case studies showed that users' perceptions of the design features either hindered or promoted comprehensibility, manageability, and meaningfulness in the flexible office. The case studies also highlighted the temporal changes in users' perceptions and thus their sense of coherence indicating that the novelties of the new office wore off and the initial problems observed in the office environment got worsened. The studies also exposed that the flexible office designs were not always perceived as intended and the reasons related to suboptimal design solutions, users' lack of involvement in the design process, as well as previous office type, users' preferences, and activity profiles. In summary, the findings emphasise that relocations to flexible offices consist of several interacting components which may determine the success and failure of flexible office designs. The paper concludes that a healthy flexible office, that includes the SOC framework, focuses on characteristics that enable active coping. A salutogenic office environment is thus one in which office users are given resources and opportunities to co-design an environment that enables them (i) build meaningful social relationships, (ii) manage visual and acoustic distractions, (iii) read and understand workspaces, and (iv) receive support from management in their daily work.

Keywords

Flexible office, Healthy workplace, Salutogenic, Health, Office.

1 INTRODUCTION

Flexible offices are designed to support flexible working by providing workspaces for a variety of activities, such as spaces for individual concentrated work, creative work, or collaborative work with others (De Been and Beijer, 2014; Hoendervanger et al., 2016). The two main types of flexible offices are the 'Activity-based Flexible Office' (AFO) and 'combi office', with the distinction that users in combi offices have assigned desks, while users in AFOs share desks (Bodin Danielsson and Bodin, 2008). Studies show that flexible offices are not always perceived or used as intended (Appel-Meulenbroek et al., 2011; Brunia et al., 2016; Hoendervanger et al., 2016), and the evidence about the influence of flexible offices on users is mixed (Engelen et al., 2019; Marzban et al., 2022). A growing body of evidence shows that the office environment has an impact on users' health (c.f. Clements-Croome, 2018; Jensen and van der Voordt, 2019). Building on this knowledge, architectural design concepts have been developed to address environmental and health challenges (Chamberlain et al., 2015). However, it is not clear how such design concepts conceptualise and address health and healthy offices. Another gap is that most research has focused mainly on risk factors (pathogenic) while there are limited insights about the health-promoting (salutogenic) potential of flexible offices (Colenberg et al., 2020; Jensen and van der Voordt, 2019).

Salutogenesis is a health model that focuses on factors that promote health instead of factors that cause disease (Antonovsky, 1987). The salutogenic concept ‘sense of coherence (SOC)’ explains why some people manage to stay healthy in stressful situations and reflects the ability to cope with challenges by (i) understanding the nature of the problems (comprehensibility), (ii) identifying and using relevant resources (manageability), and (iii) viewing the perceived problems as meaningful and worthy of engagement (meaningfulness) (Antonovsky, 1987). The salutogenic model can help to explore the design characteristics of flexible offices that enable users to cope with environmental stressors more successfully and thus promote health. This paper aims to contribute to the conceptualisation of healthy flexible office design by providing new insights into interrelations between flexible office design, users' perceptions of them, and user SOC.

2 METHODS

This paper is based on four studies summarising a doctoral thesis (Figure 1).

2.1 Scoping review

The scoping review aimed at exploring ways in which various office design concepts and approaches addressed health and healthy offices. The collected literature was sorted according to the inclusion criteria and the content of articles was coded according to the type of design concept or approach, addressing health, healthy office, and design features. This first study corresponds to publication 1 (Forooraghi et al., 2020).

2.2 The case studies

The case studies were based on post-occupancy evaluations in two organisations. The first organisation involved a university department and resulted in publications 1a and 2b (Forooraghi et al., 2021, 2022). The second organisation involved a public service organisation in Sweden that resulted in a forthcoming publication (publication 4). In both cases, employees had access to a variety of workspaces, such as quiet rooms, telephone booths, and meeting rooms. However, the main difference between the cases was that the AFO users shared desks while combi office users had assigned desks. Data collection included the study of (i) office users' perspectives through questionnaires and semi-structured interviews, (ii) office use through observations, and (iii) office design through layout analysis. Questions in both the interviews and questionnaires addressed perceptions of a variety of aspects of the office environment, e.g., overall satisfaction, privacy, and social. Data from these sources were triangulated to identify the main themes with regard to office design, users' perceptions of them and user SOC.

Figure 1. An overview of the included publications in this paper

<p>Literature review</p>	<p>Publication 1: Scoping review</p> <p>Systematic search in electronic databases Manual search within scientific journals n=18</p>
<p>University department</p> <p>Relocation from cell offices to combi office</p>	<p>Publication 2a: Two-wave longitudinal case study</p> <p>Wave 1: Six months post-relocation; Wave 2: two years post-relocation Semi structured interviews with users (W1=17, W2=18) Structured observations (W1=18 and W2=19 rounds) Secondary data from building documents</p>
<p>Public service organization</p> <p>Relocation from cell and open plan offices to AFOS</p>	<p>Publication 2b: Single-case mixed-methods study</p> <p>Two years post-relocation Semi structured interviews with users (n=41) Structured observations (18 rounds) Layout analysis Secondary data from building documents</p>
<p>Public service organization</p> <p>Relocation from cell and open plan offices to AFOS</p>	<p>Publication C: Comparative case study</p> <p>Six months post-relocation Questionnaires (CS=71%, CL=72%) Open-ended comments Interviews with interior architects (n=2) Layout analysis</p>

3 COMBINED FINDINGS

The combined results are presented in two sections: (1) office design approaches and concepts, and (2) interrelations between flexible office design, users' perceptions of them, and user SOC.

3.1 Design concepts and approaches in relation to health and healthy office design

The scoping review came across various design concepts and approaches with diverse emphases, based on different theories. The approaches were categorised as: i) health-focused (e.g., active design, environmental design, salutogenic design), (ii) user-focused (e.g., evidence-based design, participatory design, user-centred design), (iii) office concepts (e.g., open-plan offices and activity-based flexible offices). In general, there was a lack of conceptualizations of health and healthy offices, with a few exceptions. For instance, Smith and Pitt (2011) conceptualised a healthy work environment as “*free from negative health contaminants and where safety hazards are reduced to the minimum*”. Heerwagen et al. (1995) argued that a healthy work environment with a salutogenic perspective requires both the absence of environmental stressors and the presence of certain features (nature, sunlight, and daylight, windows, aesthetic pleasantness) for positive and health-promoting outcomes. The design approaches are mainly related to design features and health outcomes. Most design features related to Indoor Environmental Quality (IEQ), such as noise and acoustics, light, temperature, humidity, etc. Other aspects related to spatial design (e.g., openness, material,

colour), socio-spatial aspects (e.g., privacy, a sense of control, sense of ownership), and social interactions. Other aspects such as users' activity profiles or preferences were mentioned to a lesser extent.

3.2 Interrelations between flexible office design, users' perceptions of them, and sense of coherence

Perceptions of flexible office and user perceptions. The interviews indicated that users' perceptions of the flexible offices related to their SOC. Factors such as behavioural rules, facility management strategies/processes, and readability of zones and workspaces either hindered or promoted structure and predictability and thus comprehensibility in the office. Thanks to spatial openness, an abundance of daylight and the aesthetic design were regarded as pleasant and inspirational, and thus meaningful. The transparency also led to a better overview of colleagues and more meaningful social interactions. That said, feelings of social isolation were a recurring theme in all the flexible offices studied, where office users had difficulties finding their colleagues and lacked meaningful social encounters. Also, discouragement to personalise workspaces contributed to feelings of anonymity and thus to a less meaningful office environment. The openness and transparency of the space led to a perceived lack of visual and acoustic and thus made the office less manageable. Also, the users perceived a lack of involvement in the design and implementation process which led to feelings that their opinions were not valued. The longitudinal study showed that in the second study wave (two years post relocation) some of the positive perceptions of the office environment such as aesthetics and the social aspects, as well as aspects that were not reoccurring in the first study wave (six months post relocation) like control and behavioural rules became more negative.

Perceptions of flexible offices and design intentions. The study revealed divergences between design intentions and perceptions. That is, not all the potential of the flexible offices was perceived by the users. For example, office users were not aware of the facilities provided, such as bicycle storage, locker rooms, and showers. On the other hand, office users found potential in the environment that was not initially planned by the designers. For instance, quiet rooms were used for informal discussions, phone booths for concentrated work, and meeting rooms for brainstorming and individual work. This was likely due to the material affordances of the respective workspaces. The quiet rooms had soft furniture reminiscent of meeting rooms. The phone booths were compact and offered minimal distractions thereby signalling unavailability. A divergency related to speech rules for different zones. The respondents reported incompliance with speech rules due to deficient design of zones and workspaces which led to increased acoustic distractions. Design deficiencies included poor soundproofing, the proximity of skype rooms with quiet rooms, unadjustable furniture, unfit distribution of workspaces on different floors and a shortage of phone booths.

Contextual circumstances were critical to illuminate the finding of the case studies. Office users appreciated the trust-based working model and that they could choose to work remotely or avoid rush hours to cope with office distractions or manage personal life. Workspace choices were influenced in part by users' activity patterns, e.g., in the combi office, those with low task variety preferred to work primarily at their workstations. Also, several AFO users reported a high task variety that required a quiet environment with adjustable furniture and screens. However, this was not supported by the AFOs. Preferences varied between those who were more adaptable and/or less sensitive to stimuli, or those who had experienced better or worse conditions in their former offices. Also, the findings showed despite having higher ratios of enclosed workspaces, the AFO users that were relocated from cell offices were on average less satisfied with privacy than those who were relocated from open plan offices and other AFOs.

4 DISCUSSION

The paper aimed to contribute to the conceptualisation of healthy office design by providing insights into interrelations between flexible office design intentions, users' perceptions of them, and user SOC.

Conflicting components of SOC. The findings showed components of a sense of coherence can be conflicting at times. This also relates to the age-old question in office design: the balance between concentration (managing acoustic and visual stimuli) and interaction (creating spaces for meaningful social relations) that has been a topic of interest in studies (Kim and de Dear, 2013). Understanding the office users' preferences and activity profiles, as well as the organisation's goals, helps prioritise the component of SOC in the office design. Hence, a needs analysis should be conducted in organisations, considering the temporality, and evolving nature of users' needs. Future research can investigate methods to measure the effectiveness of a particular design feature for each component of SOC in the office environment.

Temporal aspects. The findings showed that the novelty of the new office wore off over time, and the negative influences of acoustic and visual distractions spilled over into positive influences on the social aspects. Thus, more communication did not improve users' SOC in the long term, and the negative influences caused by poor design choices not only did not resolve themselves over time but worsened. Regular evaluations are needed to observe changes over time and address them with office space modifications.

Misuse vs. alternative use. Office users coped with the suboptimal design by disregarding behavioural rules, (mis)using workspaces, or modifying the workspaces to meet their needs. Such coping mechanisms have also been highlighted by others (Appel-Meulenbroek et al., 2011; Babapour Chafi and Rolfö, 2019; Søjland, 2021) and using workspaces for different purposes than intended has been considered as misuse of architecture (Appel-Meulenbroek et al., 2011). From an architectural design perspective, such acts can be viewed as 'alternative use' which reflects users' agency as well as building's adaptability- the capacity of a building for different social use (Arge, 2005; Groak, 2002). Nevertheless, such informal participation in design does not substitute thorough participatory design processes in which needs are identified in the early stages. The importance of user involvement has been widely highlighted for successful implementations of flexible offices (Ekstrand and Hansen, 2016; de Paoli et al., 2013). The disconnect between how designers think and design, and how users read and use spaces (comprehensibility and manageability) signifies an area for more in-depth studies to align design solutions with users' needs and preferences.

Challenges to creating a meaningful flexible office. The results showed that flexible office design can lead to feelings of social isolation and loneliness, which is in line with recent studies (Babapour Chafi et al., 2020; Haapakangas et al., 2019; Wohlers and Hertel, 2018). Furthermore, large-scale flexible offices that accommodate multiple organisations under one roof may create a lack of sense of belonging to the community. This is a major drawback of flexible offices given that humans derive meaning from their social relations, which are critical to their health and well-being (Diener and Seligman, 2004; Ryff and Keyes, 1995).

Conceptualizations of health and healthy offices. The lack of clarification of the meaning of health is problematic for the development of design solutions for healthy offices. A pathogenic orientation in health definitions can lead to design strategies that are focused on risk removal, while positive health approaches would also support active and positive coping with stressors, i.e., sense of coherence (Miedema, 2020; Miedema et al., 2017). Additionally, the lack of healthy office conceptualizations becomes problematic when considering the present need for evidence-based approaches to understanding the interrelations between the built environment and users' health. The need to better understand how environmental factors contribute to health promotion and how they relate to other health aspects is of special interest to the built

environment community (Miedema, 2020), also highlighted by Hanc et al. (2019) calling for a clear and unambiguous definition of well-being to provide insights to design and manage healthy buildings.

Design characteristics. In addition to the level of openness, ratios of workspaces per employee, and location workspaces, other design characteristics such as adjustability of furniture and technical solutions play a role in users' perceptions of flexible offices. Hence, reducing the design of flexible offices to office type will hinder the acquisition of insight on health-promoting design solutions.

Methodological considerations. A variety of qualitative and quantitative methods were used for the office user studies, including interviews, observations, questionnaires, card sorting, and layout analysis. By adopting mixed-method approaches, researchers can obtain more comprehensive and informed results, complement the shortcomings of one method, and explore information that is not accessible through a single approach alone (Creswell and Plano Clark, 2017). The triangulation of the multiple data sources enables the work to address the complexity of the phenomenon and the scope of the real-world context (Yin, 2011). That is, in this paper, the interrelations between flexible office design and user perceptions of them and SOC. The results of this paper provide a foundation for future studies by exploring, categorising, and evaluating the salutogenic resources of flexible office design.

4.1 Remarks for future research

From the findings, there are at least four broad aspects that can be incorporated in studies of healthy offices:

- Methods are needed to collect objective data on the number and design characteristics of workspaces and layouts. Workspace quantities can be measured with respect to e.g., the number of workstations/seats/rooms per employee as well as the ratio of concentration and collaboration spaces. As for design characteristics, it is more challenging to design a standard method to investigate e.g., wayfinding, spatial seclusion, and control possibilities over the environment.
- Survey instruments should be developed to measure SOC (Mazzi, 2021) with qualitative and quantitative data on user perceptions in the context of the physical office environment.
- Data on use and behaviour are needed to understand the reasons behind discrepancies between the intended and actual use of offices. Self-measurement instruments such as wearables and apps can be used to collect data in real-time on the use of workspaces as well as health.
- Information should be collected on the contextual circumstances to understand and explain conflicting results from different studies. Additionally, for future adaptations, there is a need for information about motivations for working in the office.

4.2 Practical implications

The findings of this paper provide insights for architects, teams and facilities management. Although architects and designers cannot control the level of stress people bring to the office, they can design work environments where office users are supported with resources to successfully manage stressors, build relationships, and collaborate creatively. In this context, the SOC framework appears to be important in understanding how users want to work and use their workspaces in the post-pandemic era. *Comprehensibility* refers to how well the work environment is structured, predictable, and explicable.

Architects. Interior architects are recommended to create a user-friendly design language that communicates the intended use of workspaces, zone divisions and subdivisions, and expected behaviour. Design elements such as colours, furniture, information boards and spatial seclusion can help the spatial readability and thus comprehensibility in the office environment.

Facilities/team management. The facility and team management play an important role in creating an unambiguous and trusting environment in flexible offices (Davies, 2010). Transparent information sharing and the establishment of new work model policies can help create structure and predictability for employees. Correspondingly, new spatial adaptations should be introduced based on information on new work routines and expectations. *Manageability* refers to how well the environment provides office users with access to resources to cope with stressors. A manageable work environment provides its users with a range of resources to craft an environment that suits their needs.

Architects. To ensure a manageable work environment, designers should co-design a range of solutions with users, e.g., noise cancelling headphones, noise absorbing artefacts, and quiet rooms to promote a sense of control over the environment (e.g., visual and acoustic stimuli). Moreover, it is important to distribute workspaces on different floors with the assumption that users often stay on the same floor where their stores are located.

Facilities/team management. The hybrid work model should be supported by team managers as it may improve a work-life balance and thus manageability. Nevertheless, many employees will need to continue working in the office due to the lack of space and inability to concentrate at home. Other constraints, such as specific technical requirements can also limit the possibility of remote work. The organisations should allocate resources to need analyses and participatory design processes to capture the specific needs of employees and incorporate them into design solutions. During the pandemic, many employees have succeeded in creating a well-functioning workspace at home, hence, they may have a better understanding of what aspects work for them in the office. *Meaningfulness* is perhaps the most crucial and yet challenging component of flexible office design, especially in the new era of hybrid working. The need for organisations to promote meaning through social cohesion and a sense of belonging to the community is greater than ever.

Architects. Designing nodes such as coffee machine corners and dedicated breakout areas in the layout design can help locate/run into colleagues in the office. It is important to note that spatial openness and transparency do not always lead to positive outcomes and that factors such as proximity to colleagues and personalization of workspaces can promote meaningfulness. That said, personalisation at the individual level may become less important as the acceptance of desk sharing may increase due to hybrid work practices and less time spent in offices. However, collective personalisation of dedicated social space with pictures, indoor plants and art may help mitigate the negative effects on the social interactions and thus meaningfulness in the office.

Facilities/team management. In addition to dedicating social spaces to groups, a digital platform may be helpful in which employees voluntarily can notify their colleagues where they are in the building. Also, team managers can schedule collective activities such as coffee breaks in a fixed location in the office.

5 CONCLUSIONS

The findings show that designing for sense of coherence in flexible offices includes many interacting components: (a) design characteristics e.g., level of openness, building scale, ratios of workspaces per employee, zone division, distribution of workspaces on different floors as well as adjustability of furniture and technical solutions (b) users activity profiles and preferences, (c) implementation process, and (d) experiences of previous offices. The ‘health in the river of life’ analogy by Antonovsky (1987) indicated that people not only need to build bridges to avoid falling into the river but also need to learn how to swim (Antonovsky, 1996). With this in mind, a healthy flexible office, that includes the SOC framework, focuses on characteristics that enable ‘swimming in the river’. A salutogenic office environment is thus

one in which office users are given resources and opportunities to co-design an environment which enables them (i) build meaningful social relationships, (ii) manage visual and acoustic distractions, (iii) read and understand workspaces, and (iv) receive support from management in their daily work.

REFERENCES

- Antonovsky, A. (1987), *Unravelling the Mystery of Health*, Jossey-Bass Publishers, San Francisco, California.
- Antonovsky, A. (1996), “The salutogenic model as a theory to guide health promotion”, *Health Promotion International*, Vol. 11 No. 1, 11–18.
- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), “An end-users perspective on activity-based office concepts”, *Journal of Corporate Real Estate*, Vol. 13 No. 2, 122–135.
- Arge, K. (2005), “Adaptable office buildings: Theory and practice”, *Facilities*, Vol. 23 No. 3–4, 119–127.
- Babapour Chafi, M., Harder, M., Bodin Danielsson, C. (2020), “Workspace preferences and non-preferences in Activity-based Flexible Offices: Two case studies”, *Applied Ergonomics*, Elsevier Ltd, Vol. 83 No. October 2019, 102971.
- Babapour Chafi, M., Rolfö, L. (2019), “Policies in Activity-based Flexible Offices -‘I am sloppy with clean-desking. We don’t really know the rules.’”, *Ergonomics*, Taylor & Francis, Vol. 62 No. 1, 1–20.
- De Been, I., Beijer, M. (2014), “The influence of office type on satisfaction and perceived productivity support”, *Journal of Facilities Management*, Vol. 12 No. 2, 142–157.
- Bodin Danielsson, C., Bodin, L. (2008), “Office type in relation to health, well-being, and job satisfaction among employees”, *Environment and Behaviour*, Vol. 40 No. 5, 636–668.
- Brunia, S., De Been, I., van der Voordt, T.J.M. (2016), “Accommodating new ways of working: lessons from best practices and worst cases”, *Journal of Corporate Real Estate*, Vol. 18 No. 1, 30–47.
- Chamberlain, P., Wolstenholme, D., Dexter, M., Seals, E. (2015), “The State of the Art of Design in Health An expert-led review of the extent of the art of design theory and practice in health and social care”, No. January 2015, available at: <http://www.healthdesignnetwork.net/>
- Clements-Croome, D. (2018), “Effects of the built environment on health and well-being”, in Clements-Croome, D. (Ed.), *Creating Productive Workplace*, 3rd ed., Routledge, London and New York, NY., 3–40.
- Colenberg, S., Jylhä, T., Arkesteijn, M. (2021), “The relationship between interior office space and employee health and well-being—a literature review”, *Building Research and Information*, Taylor & Francis, Vol. 49:3, 352–366.
- Creswell, J., Plano Clark, V. (2017), *Designing and Conducting Mixed Methods Research*, Third., SAGE Publications, Inc.
- Davies, H. (2010), “The psychological and physical needs of workers impacting office design”, *Proceedings of the RICS Foundation Construction and Building Research Conference*, COBRA, London, 1–15.
- Diener, E., Seligman, M.E.P. (2004), “Beyond Money: Toward an Economy of Well-Being”, *Psychological Science in the Public Interest*, Vol. 5 No. 1, 1–31.
- Ekstrand, M., Hansen, G. (2016), “Make it work! Creating an integrated workplace concept”, *Journal of Corporate Real Estate*, Vol. 18 No. 1, 17–29.
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, A. (2019), “Is activity-based working impacting health, work performance and perceptions? A systematic review”, *Building Research and Information*, Taylor & Francis, Vol. 47 No. 4, 468–479.

- Forooraghi, M., Cobaleda-cordero, A., Babapour Chafi, M. (2022), "A healthy office and healthy employees: a longitudinal case study with a salutogenic perspective in the context of the physical office environment salutogenic perspective in the context of the physical office environment", *Building Research & Information*, Taylor & Francis, Vol. 50 No. 1–2, 134–151.
- Forooraghi, M., Miedema, E., Ryd, N., Wallbaum, H. (2020), "Scoping review of health in office design approaches", *Journal of Corporate Real Estate*, Emerald Group Publishing Ltd., 18 March.
- Forooraghi, M., Miedema, E., Ryd, N., Wallbaum, H. (2021), "How Does Office Design Support Employees' Health? A Case Study on the Relationships among Employees' Perceptions of the Office Environment, Their Sense of Coherence and Office Design", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 23, 12779.
- Groak, S. (2002), *The Idea of Building, The Idea of Building*.
- Groen, B. H., Jylha, T., Van Sprang, H. (2018), "Healthy Offices : An Evidence-Based Trend in Facility Management ?", *Transdisciplinary Workspace Research Conference*, Tampere, 19–21.
- Hanc, M., McAndrew, C., Ucci, M. (2019), "Conceptual approaches to wellbeing in buildings: a scoping review", *Building Research and Information*, Taylor & Francis, Vol. 47 No. 6, 767–783.
- Heerwagen, J.H., Heubach, J.G., Montgomery, J., Weimer, W.C. (1995), "Environmental Design, Work, and Well Being", *AAOHN Journal*, Vol. 43 No. 9, 458–468.
- Hoendervanger, J.G., De Been, I., Van Yperen, N.W., Mobach, M.P., Albers, C.J. (2016), "Flexibility in use: Switching behaviour and satisfaction in activity-based work environments", *Journal of Corporate Real Estate*, Vol. 18 No. 1, 48–62.
- Jensen, P.A.A., van der Voordt, T.J.M. (2019), "Healthy workplaces: what we know and what else we need to know", *Journal of Corporate Real Estate*, Vol. 22 No. 2, 95–112.
- Kim, J., de Dear, R. (2013), "Workspace satisfaction: The privacy-communication trade-off in open-plan offices", *Journal of Environmental Psychology*, Vol. 36, 18–26.
- Marzban, S., Candido, C., Mackey, M., Engelen, L., Zhang, F., Tjondronegoro, D. (2022), "A review of research in activity-based working over the last ten years: lessons for the post-COVID workplace", *Journal of Facilities Management*.
- Mazzi, A. (2021), "Toward a Unified Language (and Application) of Salutogenic Design: An Opinion Paper", *Health Environments Research and Design Journal*, Vol. 14 No. 2, 337–349.
- Miedema, E. (2020), *Health-Promotive Building Design*, Chalmers University of Technology.
- Miedema, E., Lindahl, G., Elf, M. (2017), "Health promotive ambitions related to building design- the case of Angered Nearby Hospital", *ARCHI7 Conference*, Copenhagen.
- de Paoli, D., Arge, K., Blakstad, S.H. (2013), "Creating business value with open space flexible offices", *Journal of Corporate Real Estate*, Vol. 15 No. 3, 181–193.
- Ryff, C.D., Keyes, C.L.M. (1995), "The Structure of Psychological Well-Being Revisited", *Journal of Personality and Social Psychology*, Vol. 69 No. 4, 719–727.
- Smith, A., Pitt, M. (2011), "Sustainable workplaces and building user comfort and satisfaction", *Journal of Corporate Real Estate*, Vol. 13 No. 3, 144–156.
- Søiland, E. (2021), "De-scripting office design: exploring design intentions in use", *Journal of Corporate Real Estate*, Vol. 23 No. 4, 263–277.
- Wohlens, C., Hertel, G. (2018), "Longitudinal effects of activity-based flexible office design on teamwork", *Frontiers in Psychology*, Vol. 9 No. OCT, 1–16.
- Yin, R.K. (2011), "Applications of Case Study Research", *Applications of Case Study Research*, SAGE Publications, Inc., 3–20.

Indoor environmental quality satisfaction in offices – office types and differences between continents

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ABSTRACT

Satisfaction with indoor environmental quality (IEQ) factors is one measure of office environments' functioning. This study examined satisfaction with IEQ factors with a large global dataset. The aim was to examine which IEQ factors caused the most dissatisfaction in general and in different office types. In addition, differences between continents in satisfaction with IEQ factors were examined. The respondents (N=85 194) were from all over the world from 68 different countries. The key IEQ factors which satisfaction was examined were thermal conditions, noise, air quality, natural light, and office lighting. The examined office types were private office, assigned workstation in open office, and flex office. Responses from three continents (Asia, Europe, and North America) were examined for differences. The proportion of dissatisfied respondents was the highest with thermal conditions (30.6 %) and noise (27.8%). The most important IEQ factor causing dissatisfaction in all office types was thermal conditions. However, office type had the clearest influence on dissatisfaction with noise, where flex offices had the highest proportion of dissatisfied respondents (35%) and private offices the lowest (15%). The differences between the continents were clear: respondents from Asia were less dissatisfied with all IEQ factors compared to respondents from Europe and North America. This study examined IEQ satisfaction with a large global dataset. Especially, the differences between the continents in IEQ satisfaction are under examined and the reasons behind these differences need more research. Thermal conditions and noise require special attention in offices. In flex and open offices, special care should be paid to noise control.

Keywords

Office type, Indoor environmental quality factors, Noise, Environmental satisfaction.

1 INTRODUCTION

Satisfaction with indoor environmental quality (IEQ) factors is one subjective measure of office environments' quality (Graham et al., 2021; Kim & de Dear, 2013). Ambient key IEQ factors that can be used to characterise user comfort in any building are air quality, thermal comfort, lighting, and acoustics (Frontczak & Wargocki, 2011; Vischer, 2008).

Different office types have different challenges, which can be reflected in IEQ satisfaction (Bodin Danielsson & Bodin, 2009; Kim & de Dear, 2013). Enclosed office types differ from open ones for example in perceived acoustic conditions and privacy (Kim & de Dear, 2013). Another factor possibly influencing IEQ satisfaction that has not gained much attention is cultural differences. Are the IEQ factors estimated in a similar way in different cultures or surroundings? This question has not been examined much.

Our purpose was to study the IEQ satisfaction in a large global dataset with 85 194 respondents. The first question was which IEQ factor caused the most dissatisfaction in the office

environment. The second question was how office types influenced dissatisfaction with IEQ factors. Third less frequently posed question was whether there were differences in dissatisfaction with IEQ factors that were visible between continents. The focus was office workers that worked more than half of their work time in offices.

2 METHOD

2.1 Respondents

Data comprises responses to Leesman Standard surveys (Leesman Ltd, UK) between December 2018 and January 2020 from office workers, who worked at least half of their working time in their workplaces. Leesman Ltd is a global company providing survey services where the questionnaire has a fixed form to enable comparative analysis. The data was collected before the COVID pandemic began to increase remote working. The proportion of women was 40 and men 51. Most of the respondents were 25–34 (35%) or 35–44 (32%) years old. The respondents were from 68 different countries. Countries that had more than 5% of respondents were India (20.3%), United States (17.2%), United Kingdom (11.4%), Australia (8.0%), and the Netherlands (7.9%). Table 1 describes the number of respondents from different continents. When examining differences between the continents, the respondents from three continents with the highest number of respondents were selected. These were Asia, Europe, and North America.

Table 1. The number of respondents from different continents. The continents marked with grey were included in the examination of differences between continents

Continent	Respondents
Asia	34 269
Europe	25 340
North America	15 044
Australia	6 850
Africa	2 969
Middle and South America	722
Total	85194

2.2 Office types

Three office types were selected for further examination of differences between office types. The office types and the number of respondents per office type in general (global) and in different continents are described in Table 2. Notice that flex office was defined with use (non-allocated workstation), whereas allocated workstations were further distinguished with the space they were in: open or private office.

Table 2. Description of office types and the numbers of respondents (N) in the whole dataset (global) and in the three continents selected for further analysis

Office type	Description of work setting	Global [N]	Asia [N]	Europe [N]	North America [N]
Flex office	A flexible/non-allocated workstation (often in open office)	20 552	4 561	7 423	3 498
Open office	A workstation or a cubicle, assigned solely to you	41 319	17 800	12 109	7 928

Private office	A private office assigned solely to you	4 560	1 444	1 173	1 757
Altogether		66 431	23 805	20 705	13 183

2.3 IEQ factors

The satisfaction of IEQ factors was inquired only for physical features that the respondent considered important for an efficient workplace. The question was: “Thinking about the work that you do, which of the following physical features are important in creating an effective workplace for you. From the list below, select only the features that are important. Then when the scale appears, rate your satisfaction with those important features in your main workplace, or select the “not provided” box.” The rating scale was: -2 Very unsatisfied, -1 Unsatisfied, 0 Neutral, +1 Satisfied, +2 Very satisfied. In addition, a value “not provided” was included. These ratings were examined for the following factors: noise level, air quality, temperature control, natural light, and office lighting. Due to a two-stage question, the variables were further divided into two dichotomous variables: a respondent was classified as dissatisfied when the response to the second question was -2 or -1 and satisfied when the response was 1 or 2. These resulting variables were named: (dis)satisfaction with noise, (dis)satisfaction with air quality, (dis)satisfaction with thermal conditions, (dis)satisfaction with natural light, and (dis)satisfaction with office lighting.

2.4 Statistical analysis

The statistical analyses were performed with SPSS for Windows version 28 (IBM Corp., Armonk, NY, USA). Significance level was defined as $p < 0.001$. In an analysis covering all office types and continents, the whole dataset was examined, whereas when comparing office types and continents, respondents belonging only to these categories were included (see Tables 1 and 2). The proportion of respondents dissatisfied with IEQ factors was examined in different office types and continents with Pearson’s χ^2 -test.

3 RESULTS

Figure 1 presents the proportion of satisfied and dissatisfied respondents per IEQ factor. The respondents were the most satisfied with office lighting (40.3%) and natural light (39.7%) and the most dissatisfied with thermal conditions (30.6%) and noise (27.8%). The proportion of dissatisfied respondents was further examined in different office types and continents.

Differences between continents were obvious (Figure 2). Continent influenced satisfaction with all IEQ factors (Thermal conditions: $\chi^2(2)=5976.9$, $p < 0.001$; Noise: $\chi^2(2)=4543.0$, $p < 0.001$; Air quality: $\chi^2(2)=2369.0$, $p < 0.001$; Natural light: $\chi^2(2)=1427.1$, $p < 0.001$; Office lighting: $\chi^2(2)=1597.8$, $p < 0.001$). Respondents from Asia were clearly less dissatisfied with all IEQ factors than respondents from North America or Europe.

Figure 1. The proportion of respondents dissatisfied or satisfied with IEQ factors. N is the number of respondents

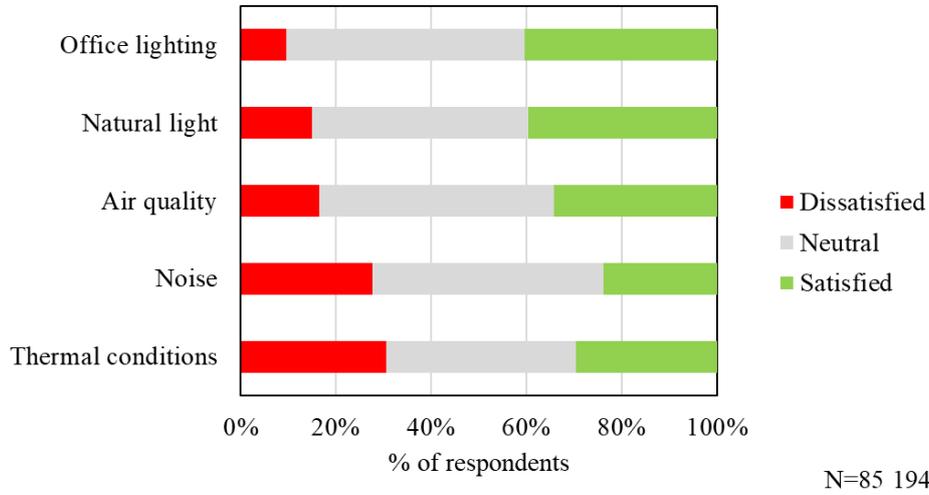
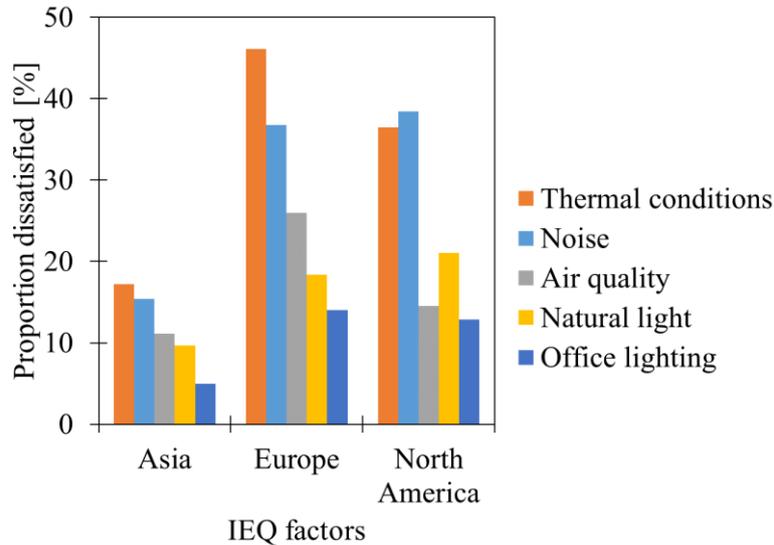


Figure 2. The proportion of respondents dissatisfied with IEQ factors in three continents



The proportion of respondents dissatisfied with IEQ factors depended on the office type (Thermal conditions: $\chi^2(2)=17.7$, $p<0.001$; Noise: $\chi^2(2)=835.7$, $p<0.001$; Air quality : $\chi^2(2)=75.9$, $p<0.001$; Natural light: $\chi^2(2)=103.4$, $p<0.001$; Office lighting: $\chi^2(2)=44.6$, $p<0.001$) (Figure 3). Dissatisfaction with noise has the clearest relation to office type.

Figure 3. The proportion of respondents dissatisfied with IEQ factors in different office types

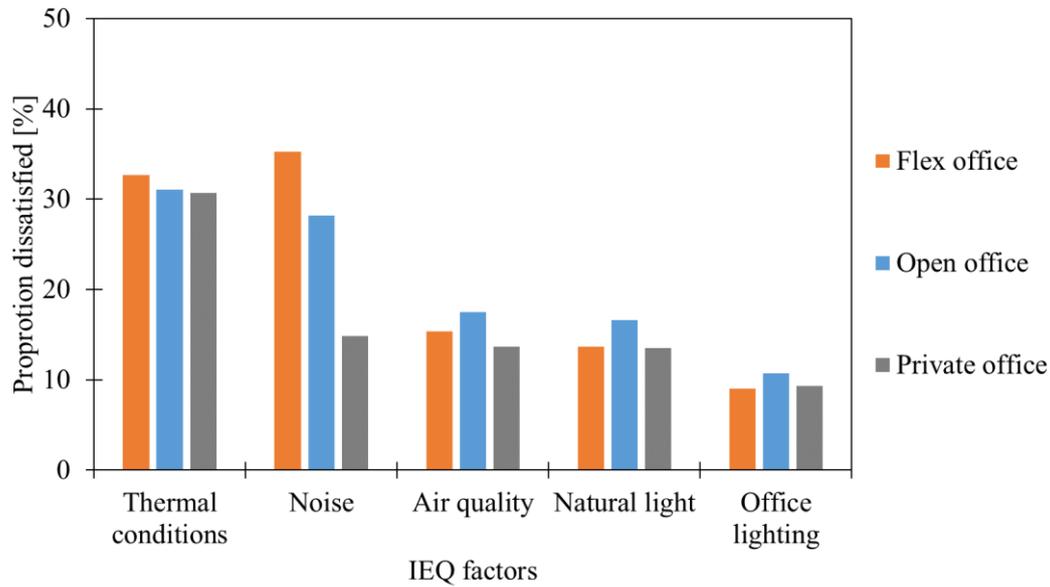


Figure 4 presents the proportion of respondents dissatisfied with IEQ factors in different continents per office type. The respondents from Asia were in general less dissatisfied with all IEQ factors than the respondents from other two continents were. In private offices, the respondents from North America and Europe were the most dissatisfied with thermal conditions, whereas other IEQ factors were not causing dissatisfaction as often. The largest proportion of respondents from Europe were dissatisfied with thermal conditions in all office types, whereas the respondents from North America were more often dissatisfied with noise in other office types than private offices.

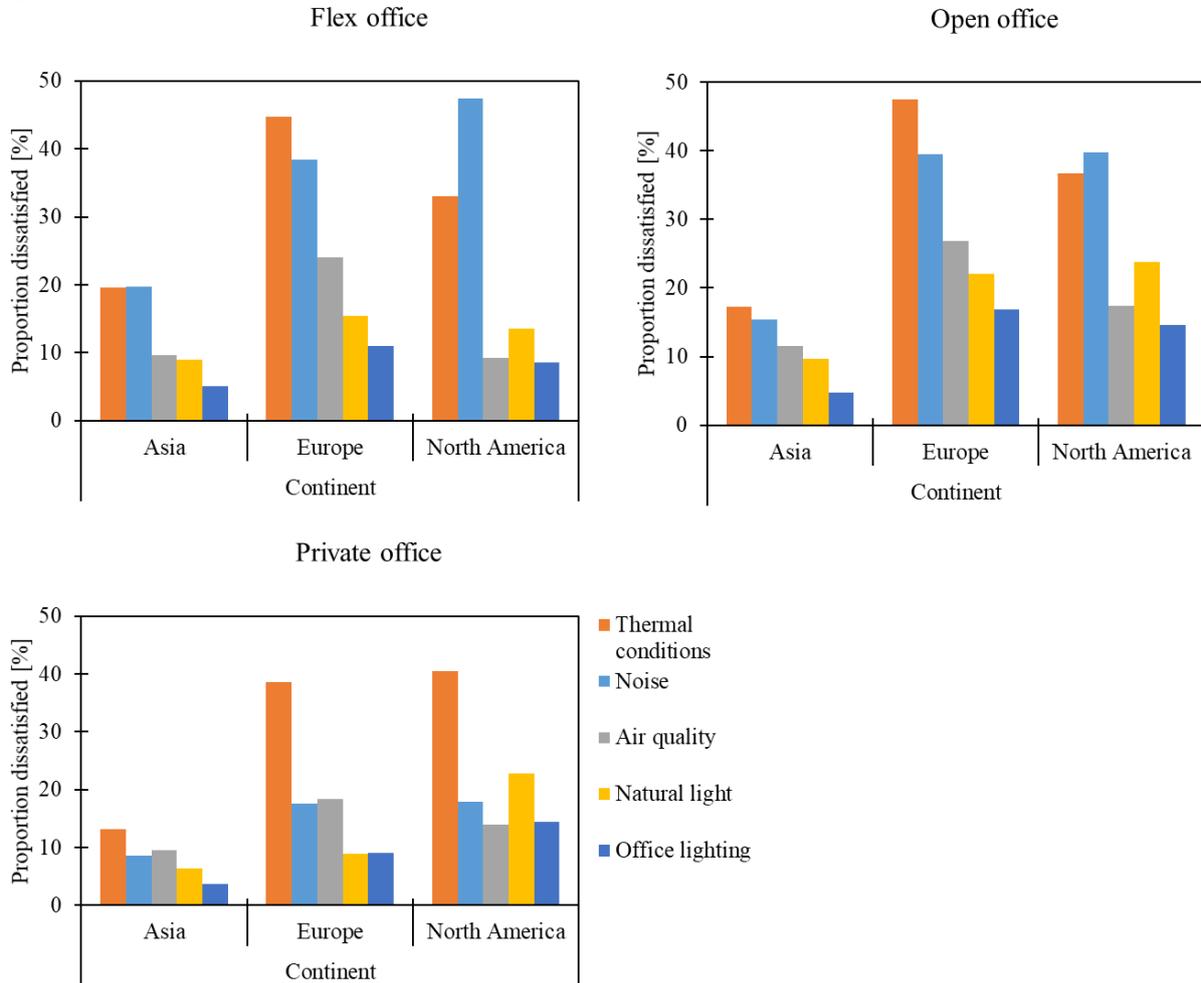
4 DISCUSSION

The study shows that the IEQ factors causing dissatisfaction in offices the most often are thermal conditions and noise. About 31% and 28% of respondents were dissatisfied with them, respectively. This is almost in line with previous results on large datasets indicating dissatisfaction to be 39% with temperature and 34% with noise level (Graham et al., 2021). Dissatisfaction with noise depended on the openness of the office. Open and flex offices caused more dissatisfaction with noise, which was according to the expectations as the satisfaction with acoustics and privacy separate enclosed offices from open offices (Kim & de Dear, 2013). The largest proportion of respondents were dissatisfied with noise in the flex office. This was against expectations, since more dissatisfaction with noise was reported in open offices, especially in large open offices, than in flex offices (Bodin Danielsson & Bodin, 2009). However, flex offices were differently defined in these studies. In our study, the flex office was characterised only by not having an assigned workstation and in their study flex office characterization included other information about the physical layout and functioning of the office. It is possible that our data could show different results, if the activity-based flex offices would be examined separately.

The differences between the continents are less examined, but they were clear in our data. The respondents from Europe and North America were more often dissatisfied with IEQ factors than the respondents from Asia were. For example, almost half of the respondents from North America were dissatisfied with noise in the flex office (47.4%) and similarly almost half or the respondents from Europe were dissatisfied with thermal conditions in open office (47.5%). The reason for the difference between the continents cannot be solved in this examination. The

difference can be for example due to cultural differences in the concept of satisfaction or differences in offices and surroundings in general. This question clearly needs further research.

Figure 4. The proportion of respondents dissatisfied with IEQ factors per continent in different office types



The data has many limitations as the limited information on the respondents' workplace characteristics. However, the large number of respondents overcomes these and the results present an overview of workplaces in different continents in offices, where employers are interested in workplace development, as they took part in the Leesman Standard survey.

5 CONCLUSION

This global data showed that thermal conditions and noise are the main causes of dissatisfaction in offices. Differences between the continents suggest that there is a need for further examination of cultural or environmental differences in office context.

ACKNOWLEDGMENTS

We thank Leesman Ltd. for sharing their data and especially Dr Peggie Rothe and Dr Madalina Hanc. The analysis and writing of this paper was funded by the Academy of Finland [ActiveWorkSpace – project decision 314597].

REFERENCES

- Bodin Danielsson, C., Bodin, L. (2009), Difference in satisfaction with office environment among employees in different office types. *Journal of Architectural and Planning Research*, 26(3), 241–256.
- Frontczak, M., Wargocki, P. (2011), Literature survey on how different factors influence human comfort in indoor environments. *Building and Environment*, 46(4), 922–937. <https://doi.org/10.1016/j.buildenv.2010.10.021>
- Graham, L. t., Parkinson, T., Schiavon, S. (2021), Lessons learned from 20 years of CBE's occupant surveys. *Buildings and Cities*, 2(1), 166–184. <https://doi.org/10.5334/bc.76>
- Kim, J., de Dear, R. (2013), Workspace satisfaction: The privacy-communication trade-off in open-plan offices. *Journal of Environmental Psychology*, 36, 18–26. <https://doi.org/10.1016/j.jenvp.2013.06.007>
- Vischer, J. C. (2008), Towards an environmental psychology of workspace: How people are affected by environments for work. *Architectural Science Review*, 51(2), 97–108. <https://www.tandfonline.com/doi/abs/10.3763/asre.2008.5114>

SESSION 5C: BOOK PRESENTATIONS

Transdisciplinary Workplace Research and Management

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ABSTRACT

Although workplace design and management are gaining more and more attention from modern organisations, workplace research is still very fragmented and spread across multiple disciplines in academia. There are several books on the market related to workplaces, facility management (FM), and corporate real estate management (CREM) disciplines, but few open up a theoretical and practical discussion across multiple theories from different fields of studies. Therefore, workplace researchers are not aware of all the angles from which workplace management and effects of workplace design on employees has been or could be studied. A lot of knowledge is lost between disciplines, and sadly, many insights do not reach workplace managers in practice. This new book series is titled ‘Transdisciplinary Workplace Research and Management’ because it bundles important research insights from different disciplinary fields and shows its relevance for both academic workplace research and workplace management in practice. The books will address the complexity of the transdisciplinary angle necessary to solve ongoing workplace-related issues in practice, such as knowledge worker productivity, office use, and more strategic workplace management. In addition, the editors work towards further collaboration and integration of the necessary disciplines for further development of the workplace field in research and in practice. This book series is relevant for workplace experts both in academia and industry. The first two books of the series will be introduced “A Handbook of Management Theories and Models for Office Environments and Services” and “A Handbook of Theories on Designing Alignment Between People and the Office Environment”.

Keywords

Workplace, Theories, Book.

Researching Physical and Virtual Workplaces: Methodological Approaches for Workplace Research

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ABSTRACT

Management of the physical workplace is gaining attention in both the industry and academia. Nevertheless, the bulk of knowledge on this topic is scattered and needs systematisation, which is challenging given the multiplicity of disciplines involved in workplace-related matters. On the one hand, many decisions about the workplace are taken without appropriate information basis, and workplace managers require guidelines to apply workplace theories in practice. On the other hand, workplace researchers struggle to combine all the angles from which workplaces are studied and would benefit from a reference collection of methodologies favourably applicable in the workplace context from different disciplinary areas. The multiplication of available data further complicates the scenario. Novel opportunities to triangulate information from various sources and produce innovative insights are open but need guidance to be exploited through traditional and innovative methods. This handbook explores a wide range of methods to examine various forms of physical workplace environments. It focuses on the most pressing questions regarding the relationship between the spatial component of the workplace, including its progressive hybridisation with other physical and virtual places, and its users (e.g. public organisations, companies, start-ups, and solopreneurs). These questions do not only impact the research realm but translate into very concrete practical matters and deserve to be tackled through careful analyses. The book includes foundational knowledge of different methodological approaches; innovative evolutions of these methodologies; and their application in various workplace contexts. The proposed hands-on approach will guide the reader throughout the research process until the expected outcomes.

Keywords

Workplace, Methodology, Research.

Smart working starts from the office

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ABSTRACT

The Coronavirus emergency has forced companies to ask their employees to work remotely from one day to the next, accelerating an already existing digitalization process. As a result, new scenarios have opened up on work spaces which, from containers for chairs and desks, are transformed into attractive meeting places suited to the needs of the new ways of working. Do we still need the office in the era of smart working? Starting from an analysis of the factors that have contributed to a real change of direction in the founding pillars of work organisation (places, times, technology and system of rules), this book tries to answer this question by reflecting on the new role played by the office in the hybrid model of work. In fact, in the first part of the volume we start from the history of office design and the intertwining with current and past organisational models, we pass through the new workplaces such as the home and co-working and finally we analyse, with the contribution by CNR researcher Luisa Errichiello, the impact of the physical work space on productivity and well-being. The second part is dedicated to practical applications with business cases, interviews with HR managers and a rich in-depth analysis on the methodology with which Workitect deals with workplace change projects. Organisations currently have a huge opportunity in their hands: they will be able to reduce the size of their offices to rethink them and make them an essential asset of the hybrid work model.

Keywords

Smart working, New ways of working, Office design.

Beyond the Workplace Zoo

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ABSTRACT

Dr Nigel Oseland will present a brief overview of his latest book: *Beyond the Workplace Zoo*. The book draws on over 30 years' of his experience of exploring workplace comfort, performance and wellbeing, with a mix of research and practice. Nigel draws on his environmental psychology background to offer an evidence-based and human-centric approach to create workplaces that enable the occupants to thrive rather than simply survive. The book begins by outlining the common design mistakes with the modern office and the industry focus on reducing cost and increasing density that has resulted in the ill-fated workplace zoo. Nigel also points out that the office is non-binary and, as such, the ongoing and raging debate on open plan versus private offices is moot. Criticism of open plan usually refers to larger high-density workspaces with little screening or breaking up of the serried rows of desks. The requirements of office-based workers according to the fields of psychology, anthropology, sociology and zoology are fully explained. Research in environmental psychology highlights how personality and other personal factors affect our requirements. This in turn informs individual requirements for the workplace as well as group needs. The impact of studies in evolutionary psychology and biophilia relevant to office design are also considered. The latter part of the book turns to pragmatic guidance and workplace solutions, it focuses on how to plan, design and manage offices to accommodate human needs now and in the future. The importance of designing for inclusivity is also recognised, including designing spaces for neurodiversity. Dr Oseland's proposed workplace solution *The Landscaped Office* is a revived and revised version of *Bürolandschaft* and *Action Office* with a contemporary twist. The impact of workplace trends, such as agile and hybrid working, complement the workplace solution, resulting in the *Agile Landscaped Office*.

Keywords

Psychology, Performance, Wellbeing, Design, Office, Productivity, Biophilia, Landscaped, *Bürolandschaft*.

SESSION POSTER

New Office Culture: A case of real-life user preferences

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ABSTRACT

The XXXXX will in 2023 relocate to a new building at XXXX. This includes a new strategy for flexible attendance and new models for office- and desk sharing based on a strong vision statement from 2012 with a focus on analogue vs. digital working, relations and collaboration, flexibility, and mobility at the workplace. From a local practitioner's point of view, we have an intrinsic case of real-life user preferences disclosed by the question: Which solutions and models do the different department heads and employees prefer in this open framework? How can we use the new insights of work culture at XXXXX in our pursuit for a better workplace relative to the vision statement? The poster describes the models chosen by the departments together with key learning points archived.

Keywords

New office culture, Flexible working, Flexible attendance, Real-life user preferences, Individual workplace vs. spaces for collaboration and relations, Hot desk vs. personal desk.

New Office Culture: A case of real-life user preferences

A.K. Overgaard, K. Gauthier & T.D. Johansen

ABSTRACT

The Faculty of Health Sciences at University of Southern Denmark will in 2023 relocate to a new building at Campus Odense. This includes a new strategy for flexible attendance and new models for office- and desk sharing based on a strong vision statement from 2012 with a focus on analogue vs. digital working, relations and collaboration, flexibility, and mobility at the workplace.

From a local practitioner’s point of view, we have an intrinsic case of real-life user preferences disclosed by the question: Which solutions and models does the different departments heads and employees prefer in this open framework? How can we use the new insights of work culture at Faculty of Health Sciences in our pursuit for a better workplace relative to the vision statement?

The poster describes the models chosen by the departments together with key learning points archived.

INTRODUCTION & METHOD

At the faculty level a central framework for flexible attendance was decided and at the same time four office culture models were described for inspiration: 1/ Flexible working and activity-based working, 2/ Flexible working and hot desking, 3/ Shift team model, and 4/ Flexible working with fixed personal desks.

The aim for the change is to 1/ enhance the capacity of available desks, 2/ accommodate the global trend of hybrid working and 3/ enhanced collaboration between employee, groups, and departments.

Within the framework of flexible attendance, the departments choose, re-model, and test models that might suit their needs. A shared pilot was established as an initial change strategy to describe learning points and best practices before implementation in the new building. Models of choice were identified through contact to head of the departments and report from pilot managers followed by categorization based on the models.

Four models for inspiration:

- 1/ Flexible working and activity-based working
- 2/ Flexible working and hot desking
- 3/ Shift team model
- 4/ Flexible working with fixed and shared personal desks

The models chosen by the departments:

- Business-as-usual (not described as a possibility)
- Flexible attendance with fixed personal desk in shared office (model 4),
- Flexible attendance with hot desking in pre-allocated areas (a combination of the inspiration models 1 and 2)

Fig: Development of models for a new office culture.

The starting point was four models for inspiration. From these the departments modulated two models for flexible office culture with either fixed personal desk or hot desking. One department chose not experiment with flexible office culture instead continuing with ‘business as usual’.

Overalls tendency in the organisation:

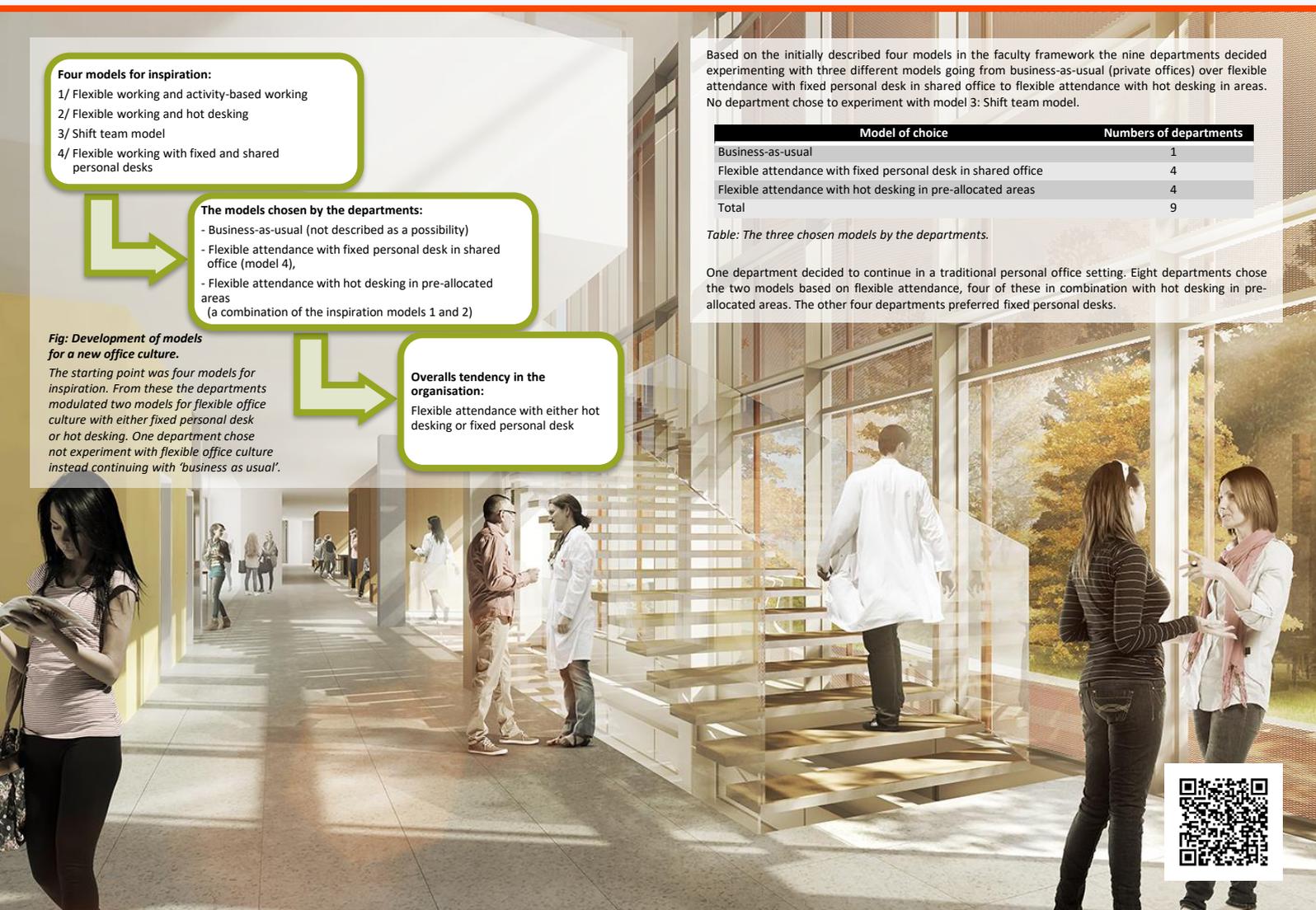
Flexible attendance with either hot desking or fixed personal desk

Based on the initially described four models in the faculty framework the nine departments decided experimenting with three different models going from business-as-usual (private offices) over flexible attendance with fixed personal desk in shared office to flexible attendance with hot desking in areas. No department chose to experiment with model 3: Shift team model.

Model of choice	Numbers of departments
Business-as-usual	1
Flexible attendance with fixed personal desk in shared office	4
Flexible attendance with hot desking in pre-allocated areas	4
Total	9

Table: The three chosen models by the departments.

One department decided to continue in a traditional personal office setting. Eight departments chose the two models based on flexible attendance, four of these in combination with hot desking in pre-allocated areas. The other four departments preferred fixed personal desks.



RESULTS

Our real-life case discloses an organizational preference for flexible attendance as a future model for work at the faculty. In addition, either hotdesking or fixed personal desks are wanted by the users of office-space.

The department choosing to continue with business-as-usual differs from the other departments having to receive clients and be following specific protocols in government services.

No department chose or used the ‘shift team model’ even though this model is well-known and used in e.g., healthcare, and could benefit the aim of enhancing the capacity of available desks.

We will use these new insights in our process of change aiming at a better workplace-culture:

- The vision statement from 2012 for a better workplace is durable and relevant to the users.
- There is a broad organizational interest for flexible working in the organization.
- A co-created model for work has crystalized: Flexible attendance with either hot desk or personal desk.
- Rethinking known practices as meetings (hybrid meetings) and management (leading from the distance) as well as infrastructure for relations and collaboration will be necessary to meet the challenges of flexible attendance.
- Change of culture takes time and organizational learning must be supported by evaluation and relevant courses.

DISCUSSION & CONCLUSIONS

The aim of the Office Culture project was to bring action to our vision statement from 2012. With the experiences from the Covid-19 lockdowns the vision became even more relevant as the lockdowns changed the perception toward flexible and hybrid working extending the office at the physical workplace to the private home typically twice a week. The project showed an overall preference for flexible working in the organization where 8 out of 9 departments chose to experiment with flexible attendance in a ‘personalized’ model fitted to the department.

Flexible attendance and working from home are now seen as a positive possibility for immersion and concentration without disturbance. But at the same time the employees missed out and asked for ways of dialogue for informal professional sparring as well as social relations with colleges.

We see flexible attendance as a development toward a culture where the focus on the individually workspace might be balanced with a new awareness on spaces for collaboration and relations moving the organization forward toward a more relations-based culture. This change of culture needs to be repeatedly addressed through dialogues and actions from the management to secure organizational learning.

Enhancing capacity and individual preference might not correspond with other organizational goals. Going forward, we see a need to explore how a new culture affect wellbeing, motivation, relations and results to identify pros and cons regarding a new Office Culture in the long term.

The right people, spaces and content for an inclusive hybrid community

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ABSTRACT

The COVID-19 accelerated shift towards hybrid workspaces places major pressure on workplace communities and culture. This study explores the emergence of a collaborative academic workspace, which is still in the real estate development phase. The aim is to establish preconditions for community building, and the relationship between the community and the physical space. The study employs a qualitative case study approach, where the case is the development process of a co-working space for sustainability researchers in Helsinki, Finland. The site is planned to also host regular office space, as well as an event space, and a café open to the public. We utilise 9 interviews as primary data, and a range of written documents and photographs as secondary data. All data is analysed using template analysis. The study finds that while the output of the project is the renovated physical building, the desired outcome is a community of academics, and other like-minded people. The outcome is to be achieved through dedicated human resources, structured communication efforts, and an outspoken concept. The concept highlights science-based evidence related to the sustainability crisis, but also inclusiveness and dialogue with the public. The virtual community has emerged already before the physical space exists, and will likely transform into a hybrid community once the space opens. However, the target group for the virtual community is more towards the general public, while the physical community will be more aimed at sustainability researchers with the potential for major societal impact. A complete merging of the virtual and physical communities is not planned, and might not even be possible. The findings are useful to owners and service providers of collaborative spaces in determining their strategy and needed resources for community building. Real estate developers should consider initiating community building efforts already in the development phase.

Keywords

Collaborative workspaces, Co-working, Hybrid community, Shared spaces, Virtual community.

The right people, spaces and content for an inclusive hybrid community

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BACKGROUND AND AIM

Delivering functionality over ownership is considered as one of the sustainable business model archetypes (Bocken et al. 2014). In the spatial context, access-over-ownership models (Brinkø et al. 2017), such as, collaborative workspaces allow for flexibility and resource-efficiency. Collaborative spaces increasingly also include virtual spaces (Lundgren et al. 2022). Interestingly, Hacker et al. (2021) found that virtual workspaces were experienced as more inclusive than physical space during the COVID-19 pandemic. This study therefore asks:

DATA AND METHODS

The study employs a qualitative case study approach. The case is a refurbished heritage building in Helsinki, Finland. The buildings hosts collaborative workspaces for organizations and researchers in ecological sustainability, as well as an event space and restaurant open to the public. Our data comprises 9 semi-structured interviews, written documents, social media posts, photographs, and observations from a site visit and online webinars. The data was analysed using pre-defined themes from business model theory (e.g., **resources, value delivery**), complemented with sub-themes emerging from the data (e.g., **inclusiveness, hybrid community**).

What are the building blocks of an inclusive hybrid community?

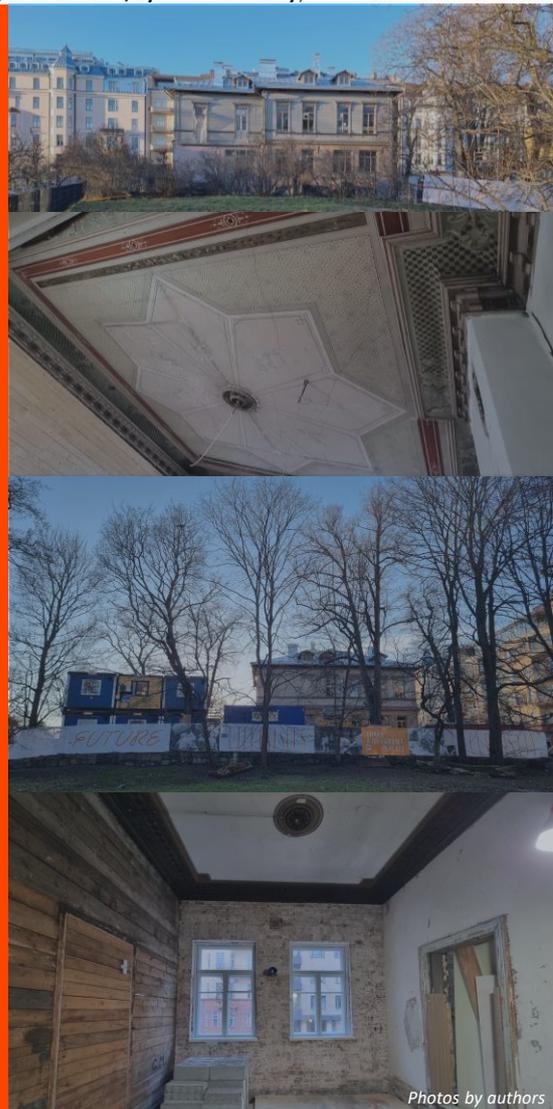
"A person to run the activities in-house, and also strengthen our theme when it comes to managing and growing the community—virtual or physical" (N6)

"A basic coworking place which already has fascinating things, community building and values — but when it's the content value and the coworking value, then it's upgraded value" (N5)



"Since we can't invite people into this space yet, because it's not ready, and because of the pandemic, we've been having these friendly demonstrations online, which are kind of really good discussions, featuring people from different contacts, different backgrounds" (N8)

"Space for people to have the interactions and conversations that they might not have elsewhere. We'd love to have even people with quite opposing views sit at the same table and hear about each other's realities" (N8).



Photos by authors

FINDINGS

Category	Product or service	Target group	Value creation, delivery & capture
Human	Concept Owners	Open hybrid	concept development, networking and PR, selection of end-users
	House Manager	Open physical	memberships, bookings
	Communications Specialist	Open virtual	social media input (Twitter, Instagram), newsletters, blogs
Resources	Chief Experience Officer	Open hybrid	activities, events
	"Science Attic"	Closed physical	Desk space for researchers of ecological sustainability through a selection process. Meeting rooms 15-30€/h. Complementary coffee.
Spaces	Co-working space	Closed physical	Desk space for organizations with an ecological sustainability focus. Membership 100-300€/month, meeting rooms 15-60€/h. Complementary coffee.
	Event space	Open physical	Bookable space for sustainability themed events. Anyone can book, 100-200€/hour.
	Restaurant	Open physical	External service provider. Serving coffee, lunch and dinner. Open for anyone.
	"Friendly demonstrations"	Open virtual	Panel discussion and debate series with the themes of societal polarization and sustainability. Public figures and researchers as panelists, general public as audience.
Content	"14 rooms"	Open physical	Immersive arts exhibition with a sustainability theme. Artists, researchers, and activists as organizers, general public as visitors.
	Multidisciplinary and multisectoral encounters	Closed physical	Organic encounters of like-minded people. Members of the two co-working spaces

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Find out more about our research here

The Reluctant Returner

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ABSTRACT

Unispace embarked on a robust study combining the results of an in-depth survey and deep dive interviews to understand the true motivations behind why employees (and many employers) are reluctant to return to the office. Key countries of polling included the UK, Ireland, the Netherlands, Belgium, Germany, France, Italy, Spain, and Switzerland. Click [here](#) to access the research.

Keywords

Unispace, Reluctant, Returner.

The Reluctant Returner

An office worker who has indicated negative sentiments about returning to the workplace post-Covid including anxiety, unhappiness, annoyance, demotivation, uneasiness, dread, or worry.



ABSTRACT

Unispace embarked on a robust study combining the results of an in-depth survey and deep dive interviews to understand the true motivations behind why employees (and many employers) are reluctant to return to the office. Key countries of polling included the UK, Ireland, the Netherlands, Belgium, Germany, France, Italy, Spain, and Switzerland.

METHOD

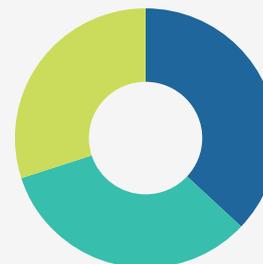
3,000 office workers who worked from the office full-time pre-pandemic, and worked from home during the pandemic

10+ deep dive interviews with senior Real Estate, People, and Operations decision makers from major employers

2,750 employers Director-level or above, in companies with at least 50 employees

9 European Countries UK, Ireland, Italy, Germany, Switzerland, Spain, France, the Netherlands, and Belgium

AGES



37% (aged 18 – 34)
33% (aged 35 – 44)
30% (aged 45+)

GENDER SPLIT

52%
Female

48%
Male

RESULTS

64% of workers in Europe are reluctant to return to the workplace this number drops to **62%** for Italy.

56% of employers in Italy felt some reluctance to return to the office, the lowest rate in Europe.

52% of employers in Italy are mandating employees back to the office.

For Italians who are having second thoughts about making a return to the office, the main reasons behind the reluctance are:

Preferring to have extra-time to work around child or caring arrangements

Feeling more productive at home

Not seeing a real need to return to the office



of Italian office workers believe their journey into work is invaluable alone time.



indicating that travel takes up a significant part of their day.



of Italian office workers find it easier to focus in the workplace.

When we asked office workers in Italy what would encourage them back into the office, the top incentives listed were:

HAVING TRAVEL PAID FOR

83% Italians

79% Europeans

AN OFFICE WITHIN 5-10 MINUTES OF YOUR HOME *

81% Italians

79% Europeans

YOUR EMPLOYER PROVIDING FREE LUNCH, COFFEE AND SNACK OPTIONS

81% Italians

79% Europeans

*Italy polled as having the shortest commute in Europe at 30.7 minutes.

10 tips to encourage Reluctant Returners back to the office

- 1 Know your audience
- 2 Consider how your workforce is evolving
- 3 Offer true flexibility - no strings attached
- 4 Create a workspace that caters for all types of work
- 5 Use technology to enable collaborative spaces
- 6 There is such a thing as a free lunch
- 7 Increased physical spaces
- 8 Feeding the masses
- 9 Fresh air
- 10 Future travel benefits

Authors: Ilana Como (Unispace) & Vickie Collinge (BlueSky)

Acknowledgments: Research conducted alongside Opinium

Summer School on Workplace Management 2022 - Best project "The nest of the entrepreneurs"

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ABSTRACT

The nature of work has been evolving, even faster after the COVID-19 outbreak. Along this change, new working spaces have been accommodating emerging needs. This dynamic has major implications for working space design, management and location that need to respond to new challenges. Workplaces are not anymore intended only as physical places but as a combination of Buildings, Bytes and Behaviours. Companies express an increasing interest in incorporating the perspective of the users, moving the focus from space efficiency to the creation of a mood that reflects values and identities of employer and employees. We put into practice these principles in our proposal for the potential readaptation and reorganisation of Assolombarda Headquarter in Milan.

Keywords

Summer school on workplace management, Best project, Coworking space.

Assolombarda Headquarter, Milan | Strategic Brief for a reorganisation

Yousra Yagoub Ahmed, Maria Raphael Kottoor, Carla Iurilli, Shifu Zhang, Vika Zhurbas

Summer School on Workplace Management - SSWM 2022 | COST Action CA18214 – ‘New Working Spaces and the impact on the periphery’

ABSTRACT

The nature of work has been evolving, even faster after the Covid-19 outbreak. Along this change, **new working spaces** have been accommodating emerging needs raising from the perspective of the users. This “Workplace Experience” dynamic has major implications for **working space design, management and location** that need to respond to new challenges.

We started from these premises to define a proposal for the reorganisation of Assolombarda Headquarter, an association of companies operating in the Metropolitan City of Milan and in the provinces of Lodi, Monza and Brianza, and Pavia, whose mission is representing the enterprises’ interests in dealing with the political world, social and political organizations, local authorities and trade unions.

INTRODUCTION & METHODS

Assolombarda is headquartered in Palazzo Gio Ponti, built in the 1960s as “House of the entrepreneurs” within Milano District 1-Duomo. The building hosts 205 employees as well representatives of member companies, training seminars and public conferences.

The definition of our proposal comes from the integration of multiple methods:

- Literature review
- Guided tours to case studies of headquarters and co-working spaces
- Data analysis of the questionnaire provided by the company and the Real Estate Center of Politecnico di Milano
- Site visit in Assolombarda Headquarter
- Interviews with company representatives
- SWOT analysis of the context
- Definition of the typical User profiles “Personas”

Company Goals



Assolombarda asked to focus on three main goals:

- Increase efficiency and flexibility of spaces;
- Identify new spaces and services for multi-task performance as well as taking in account teams specific requirements;
- Include collaborative and hospitality spaces where employees, stakeholders and member companies may easily meet and work together.

SWOT of urban context: District 1-Duomo

Strengths

- Business agglomeration
- Historical points
- High pedestrian traffic
- Closeness to Cinque Vie District
- Location in the hearth of the city

Weaknesses

- Niche-like HQs in the neighborhoods
- Lack of open spaces for local people

Opportunities

- Education Juxtaposition
- Aging issues
- High touristification density

Threats

- A certain kind of uncertainty

User Profiles “Personas”

Main Users: Employees of Assolombarda



Position : Officer
Workstyle: In-office work
Preference: *Open space, Private Space, Individual Space*



Position : Manager
Workstyle: On-the-go
Preference: *Hybrid Meeting Space, Private Spaces*

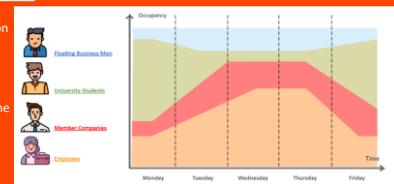
Potential Users

- University Students
- Floating Business Men
- Assolombarda’s Employees based in other business units

Strategy: User Integration

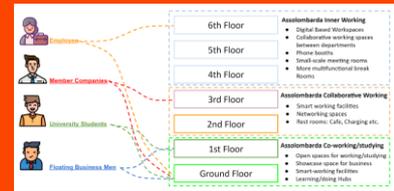
Temporal Integration

Aims at temporal complementary utilization of the working space of Assolombarda building. According to statistics, employees and member companies tend to use the building in the middle of the week, thus leaving vacancy for potential users.

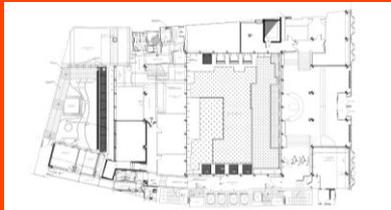


Spatial Integration

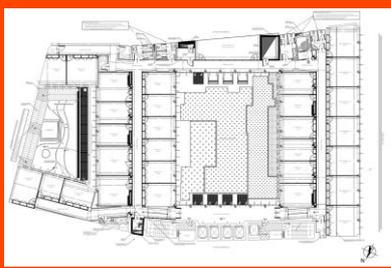
Aims at matching the characteristics of the working spaces with the preference of different users groups.



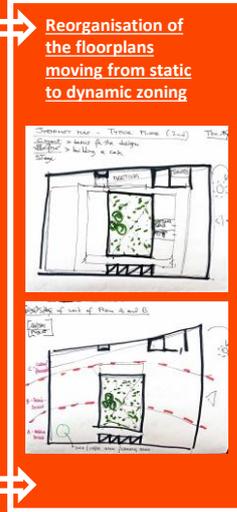
Current Spatial Utilization



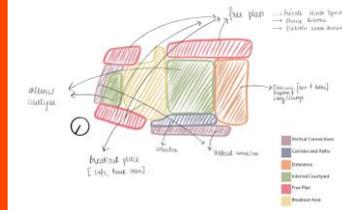
Ground Floor



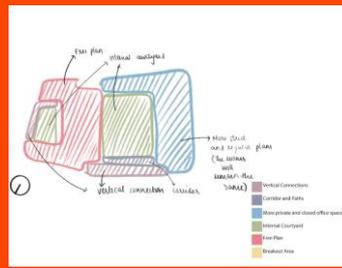
First Floor



Conceptual Design

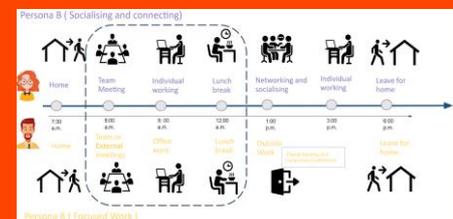


Ground Floor

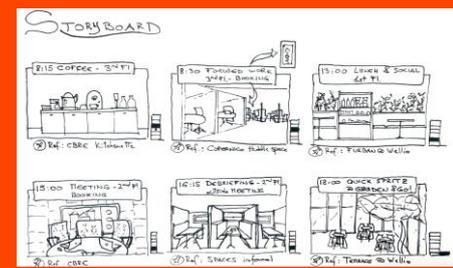


First Floor

Scenarios



Activities Timeline



A typical working day @Assolombarda

RESULTS

The proposal offers answer to both the explicit goals listed from Assolombarda and the identified additional “hidden” needs thanks to an overall perspective to the physical building and its location within the prestigious District 1-Duomo:

Goals listed from Assolombarda:	Space Efficiency	●
	Space Flexibility	●
	Spaces for the Workforce	●
	Services for the Workforce	●
	Collaborative Spaces for Employees, Stakeholders and Members	●
	Hospitality Spaces for Employees, Stakeholders and Members	●
“Hidden” goals raised during the analysis of the Set of Conditions:	Enhance the Building- Palazzo Gio Ponti	●
	Enhance the relationship with the Neighborhood.	●

CONCLUSIONS

The case study offers a clear example about how much *bricks, bytes and behaviours* are nowadays interconnected and require an holistic approach.

Some Lesson Learnt:

- Integrating coworking spaces within a headquarter may be a win-win, adding-value option;
- A workplace change process needs planning, programming and executing phases;
- A space reorganization must be based on a Strategic brief listing the Space and Time policies tailored on the specific values and needs of the Company;
- The future evolution of workplaces has an impact not only at the building and local scale but my positively effect a whole District.

CONTACTS

Interested to know more or to get in touch with the authors? →



Summer School on Workplace Management 2022 - Best Project "CCC - Community Coworking Centre"

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ABSTRACT

Assolombarda is the largest territorial association within the Confindustria system which represents over 6,800 firms located in Monza, Milano, Lodi and Pavia. The goal was to create a place to Connect, Collaborate and Grow. This could be achieved through solutions such as Establishing a community, Enhancing work life, and Improving existing services. Establishing a community and creating sufficient spaces will enhance sharing of knowledge, workflow & productivity and quality rest. Connect and network with one another with the help of integrative and stimulating spaces aiming to link people based on needs, interests and knowledge. Finally, with the improvement of existing services and working conditions that are going to be implemented CCC strives to boost employee and company satisfaction.

Keywords

Summer school on workplace management, Best project, Coworking space.

CCC – Community Coworking Centre - *sl, sl, sl*

SUMMER SCHOOL ON WORKPLACE MANAGEMENT

Ada Yildirim, Apoorva Sukathirtha, Blanca Monni, Tamara Chamsi Bacha



ASSOLOMBARDA

Assolombarda is the largest territorial association within the Confindustria system which represents over 6,800 firms located in: Monza - Milano - Lodi - Pavia.

The goal was to create a place to Connect Collaborate and Grow.

This could be achieved through solutions such as :

- Establishing a community
- Enhancing work life
- Improving existing services



GOALS AND METHODS

Goals :

- INCREASE** efficiency and flexibility of spaces,
- IDENTIFY** New space and services
- INCLUDE** Collaborative and hospitality spaces

By recognizing the focal points :

- Identity - Representation - Services

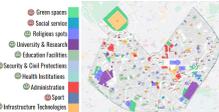


ANALYSIS

Zone 1 Milan



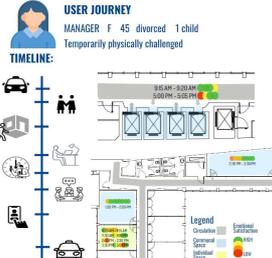
Central Zone 1 of Milan is anchored by the Gothic-style Duomo di Milano and 18th-century Teatro alla Scala opera house. Da Vinci's "The Last Supper" is on show at Renaissance-era Santa Maria delle Grazie church, and Sforzesco Castle has art and archaeology museums. High-end boutiques line the streets of the Quadrilatero della Moda. Brera has funky design stores, and fine-dining restaurants sit among cozy osterias.



Potential Users of Zone 1: what kind of spaces do they need?

Office Workers	Entrepreneurs	Freelancers	Students	Floating Crowd
Age: 25-50 yrs Working Hours: 9AM-5PM	Age: 25-45 yrs Working Hours: 24hrs	Age: 25-45 yrs Working Hours: 24hrs	Age: 14-30 yrs Working Hours: 24hrs	Age: 14-60 yrs Working Hours: 24hrs
Mix of Public and Private Spaces Recreational Spaces Spaces for Focused Work Adaptable Spaces Security Storage Spaces	Mix of Public and Private Spaces Recreational Spaces Interactive Spaces Adaptable Spaces Security Any Time Access	Recreational Spaces Recreational Spaces Adaptable Spaces Any Time Access	Recreational Spaces Spaces for Focused Work Inspirational Spaces Storage Spaces Any Time Access	Recreational Spaces Inspirational Spaces Adaptable Spaces Storage Spaces Any Time Access

Assolombarda User Analysis and Journey



RESHAPING ASSOLOMBARDA - CCC

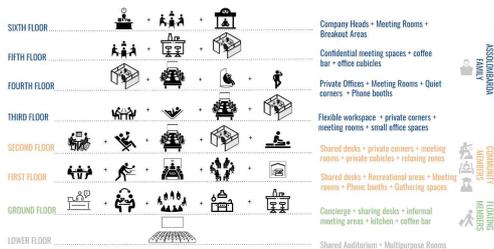
Proposed Solutions

- ESTABLISH A COMMUNITY**
Create Multipurpose Spaces for Community Events
Create Collaborative Spaces: Meeting Rooms of Varying Sizes, Adaptable Open Spaces
- ENHANCE WORK LIFE**
Designate Family Friendly Zones
Create Platforms to Share Information and Research Between Members
Designate Quiet Zones for Focused Work
Private Phone Booths
Create Spaces for De-Stressing and Relaxing
Create Inspirational Zones with Enhanced Aesthetics
- IMPROVE EXISTING SERVICES**
Improvement of Lobby to Accommodate More Waiting Areas
Enhance Green Spaces
WiFi Access for all Visitors

Digital Solutions

- ESTABLISH A COMMUNITY**
Information Pod
Digital Presentation Wall
Helpline
Sensing Machines at Recreational Areas
- ENHANCE WORK LIFE**
Advance Intercommunication Applications
Soundproof Corners
Multisensory Zones
- IMPROVE EXISTING SERVICES**
Digital Booking for Workspaces and Storage
Digital Inter Communication
Self-watering Plants
WiFi Access for all Visitors

Spatial Distribution



Proposed Conceptual Plans



NEW BUSINESS MODEL

Key Partners <ul style="list-style-type: none"> Member companies of Assolombarda 	Key Activities <ul style="list-style-type: none"> Technical support Networking opportunities Digital connections Spatial products Services & Amenities 	Value Propositions Build a place to: <ul style="list-style-type: none"> Connect Collaborate Grow 	Customer Relationships <ul style="list-style-type: none"> One to one Events Phone Emails 	Customer Segments <ul style="list-style-type: none"> Employees External Visitors: <ul style="list-style-type: none"> Office users Entrepreneurs Students Freelancers Floating Crowd
Key Resources <ul style="list-style-type: none"> Office spaces Common areas Community kitchen Garden chill areas Event spaces 		Channels <ul style="list-style-type: none"> Community building Networking SEM & SEO Public speaking Affiliates 		
Cost Structure <ul style="list-style-type: none"> Construction Redesign Talent Acquisition 		Revenue Streams <ul style="list-style-type: none"> Memberships Temporary Passes Renting out meeting rooms/event space 		

CONCLUSION

- COLLABORATE**
Establishing a community and creating sufficient spaces will enhance sharing of knowledge, workflow & productivity and quality rest
- CONNECT**
Connect and network with one another with the help of integrative and stimulating spaces aiming to link people based on needs, interests, knowledge...
- GROW**
With the improvement of existing services and working conditions that are going to be implemented CCC strives to boost employee and company satisfaction.

ACKNOWLEDGMENTS

Thank you to Assolombarda for allowing us to study their office space and giving us access to all the necessary information.
Thank you to Politecnico di Milano for giving us the possibility to participate in the SSWM 2022 and all the opportunities that came along with it.

SESSION 6A: PRACTICES OF HYBRID WORKING

Multifaceted employees' feedback on hybrid work environment: findings from a news media company

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ABSTRACT

As we continue to move through the pandemic, the hybrid work environment has been given attention more extensively and is considered as the approach for the post-covid world of work. This study aims to assess feedback of employees on hybrid work environments and to explore the link between physical environment aspects and factors influencing employees' work performance. A review of the literature showed various impacts of hybrid working on employees and their work. A case study of an online news media company in Thailand was conducted to explore if and how these literature findings are met in practice. Research methods include an interview with a general manager and a questionnaire survey (i.e. employee satisfaction, perceived productivity support and perception regarding the link between physical environment aspects and factors influencing work performance). The study shows items that employees appreciate most are ICT and online meeting platforms, working atmosphere and accessibility to working space and common facilities. They perceived that the size and functionality of the space relate to creativity, sharing ideas, face to face communication, collaboration, and positive feedback between colleagues. On the other hand, ICT and ICT support facilities were linked to positive feedback between colleagues, confidence of team members, friendly relationships, ability to work with others, and amount of work done. It is clear that employees are satisfied with the support given to individual and team productivity. The paper shows that an organisation's context (i.e. business type, organisation structure, staff characteristics) has an impact on the physical work environment, which influences employee satisfaction and perceived productivity support. The findings show a link between physical environment aspects (i.e. workplace, ICT and ICT support facilities, office space layout, and acoustics) and factors influencing employees' work performance from employees' perspective.

Keywords

Collaboration, Employee satisfaction, Perceived productivity support, Remote working, Usability.

1 INTRODUCTION

The changing environmental context such as the economic situation, technological development, social and environment has an impact on work and employment. Information and communication technologies (ICT) enable employees to work remotely. Data from a survey from the U.S. The Bureau of Labor Statistics showed a 115% increase of workers who telecommute engaged (Abrams, 2019; BLS, 2020). The changing in organisation's work pattern and flatter structure contribute to the changing in work process and influence the implementation of workplace transformation. According to the 2021 Work Trend Index findings, a mix of remote and office work, known as hybrid work, is likely to become a fixture

with over 70% of workers surveyed in favour of flexible remote work options (Microsoft, 2021). Hybrid work models are being adopted by organisations amid COVID-19 to maximise productivity and ensure employee well-being (Bangkok Post, 2022). Hybrid work environments have been increasingly important to online news media companies that aim to provide the support for employees who work in the office as well as for those who work remotely. It is important to collect feedback from employees on their work environment to identify areas to be improved with regard to the workplace implementing hybrid working. This study aims to assess employees' feedback (i.e. employee satisfaction, perceived productivity support) on hybrid work environments and to explore the link between physical environment aspects and factors influencing employees' work performance.

2 LITERATURE REVIEW

2.1 Transformation of news media

The printing operations of newspapers have remained highly stable for decades (Graham and Greenhill, 2013). However, the advent of the internet and the recent Web 2.0 has made the survival of regional newspapers questionable (Grewal et al., 2010). The development of internet technology and its global diffusion boosted the success of digital contents (Mangani and Tarrini, 2017). As a result, newspapers and other news media providers have increasingly changed the media formats in which they provide news. The appearance and flourish of online newspapers and magazines, e-books and similar products have convinced the experts that a new era of information was emerging.

The shift to the digital platform has changed the way in which people consume and use information. Technological advancements have changed the way in which many people interact (Mwiya et al., 2015). Online media has an impact on print media and has changed the way the business is processed. On the other hand, a highly competitive environment, social media and altered customer expectations (interaction, crowd-sourcing, multimedia-based content) create an ever-evolving context for today's newspaper journalists (Grubenmann and Meckel, 2014). Huang et al. (2006) mentioned that huge (open) data sets, the digital environment and social media require extended skills from today's journalists. Grubenmann and Meckel (2014) emphasised the established habitual routines that sustain profession-related identities in journalists' traditional work settings may no longer be applicable to the changing work environment as new tasks, requirements and relationships evolve. Journalists must consciously redesign habits, routines and their attitude to the changeable context.

2.2 Hybrid work environment and its' impact on employees

Halford (2005) mentioned that new technology, work and employment has been the way that information and communication technologies enable the spatial reconfiguration of work, management and organisation. Employees in hybrid working patterns work both from home and from an organisational workplace, using virtual technologies to connect the two spaces. Hybrid work can be explained as a combination between co-located and remote work. Literature suggests that one of the first terms used to refer to the remote working arrangement was telecommuting (Nilles, 1975), as it was used to define people working from their home and using technology to communicate with their colleagues at the workplace premises (Matli, 2020). Employees' who work predominantly outside of their home office, but are associated with a traditional office and may be using a traditional office for some administrative support and to hold physical meetings was also referred to as telecommuting (Knight and Westbrook, 1999). As a part of hybrid working, remote work has diversified, and it continues to change the working environment. Matli (2020) argued that workers working remotely away from their organisation's premises is changing the traditional workplace in which workers have to be physically on the premises to undertake their tasks. In terms of the social factors, Beyer and

Marshall (1981) proposed eight factors on the interrelationship between workers including confidence and trust, mutual help, mutual support, friendliness and enjoyment, team efforts toward goal achievement, creativity, open communication, and freedom from threat. Illegems and Verbeke (2004) found that teleworkers do not experience the negative effects on job satisfaction, with the exception of a reduction in professional interaction. Kowalski and Swanson (2005) introduced a framework of the critical success factors including support, communication and trust that are instrumental in developing telework programmes. The framework outlines critical success factors at the organisational, managerial and employee level. In this study, the impact of a hybrid work environment on employees was explored.

3 RESEARCH METHODS

The research steps range from the initial literature review and case study to drawing conclusions. The research applied a field study focused on an online news media company, The Standard, as a part of the case study method. Data collection involved a questionnaire survey and an interview. The questionnaires were disseminated online to 117 employees by the coordinator of the case study organisation and were filled out by 36 employees (31% response rate). Respondents were classified into four groups of work models including working from home (3 respondents), hybrid working (19 respondents), onsite working (11 respondents), and flexible working (3 respondents). The questionnaire evaluates employee responses to the work environment in three areas: employee satisfaction, perceived productivity support and the link between physical environment aspects and factors influencing work performance. The first part of the questionnaire assessed employee satisfaction on working environment aspects (i.e. workplace, layout, furniture and office facilities, ICT and ICT support facilities, support spaces, lighting, acoustics). The employee satisfaction survey makes use of a five-point scale from 1 - very dissatisfied to 5 - very satisfied. Satisfaction percentage is calculated from the average percentages of satisfied and very satisfied respondents. The second part evaluated employees' perceived productivity support of the work environment of both individual and team productivity. The self-assessment of productivity was adopted using the survey that asked the respondents how they perceive the working environment as being supportive on a five-point scale from 1-totally unsupportive to 5 - totally supportive. The third part asked employees how they perceived the link between physical environment aspects and factors influencing work performance (i.e. creativity, sharing ideas, face-to-face communication, collaboration, positive feedbacks between colleagues, confidence of team members, friendly relationship, work without stress, ability to work with others, amount of working time, and amount of work done). The survey asked respondents how they agree/disagree about the link between variables on a five-point scale from 1 - strongly disagree to 5 - strongly agree. The results of the first two parts of the questionnaire were presented as percentages whereas the third questionnaire were presented as average scores. The semi-structured interview with the general manager focused on the organisation's policy on hybrid working, employees' work pattern and impact of hybrid working on employees and employees' work performance. Criteria for case selection included location, the physical characteristics of hybrid work environment and organisational size (i.e. 50 - 200 employees). The study selected a case in Bangkok owing to the high growth rate of news media business in the capital city. The study was conducted between February 2021 and May 2021.

4 CASE DESCRIPTION

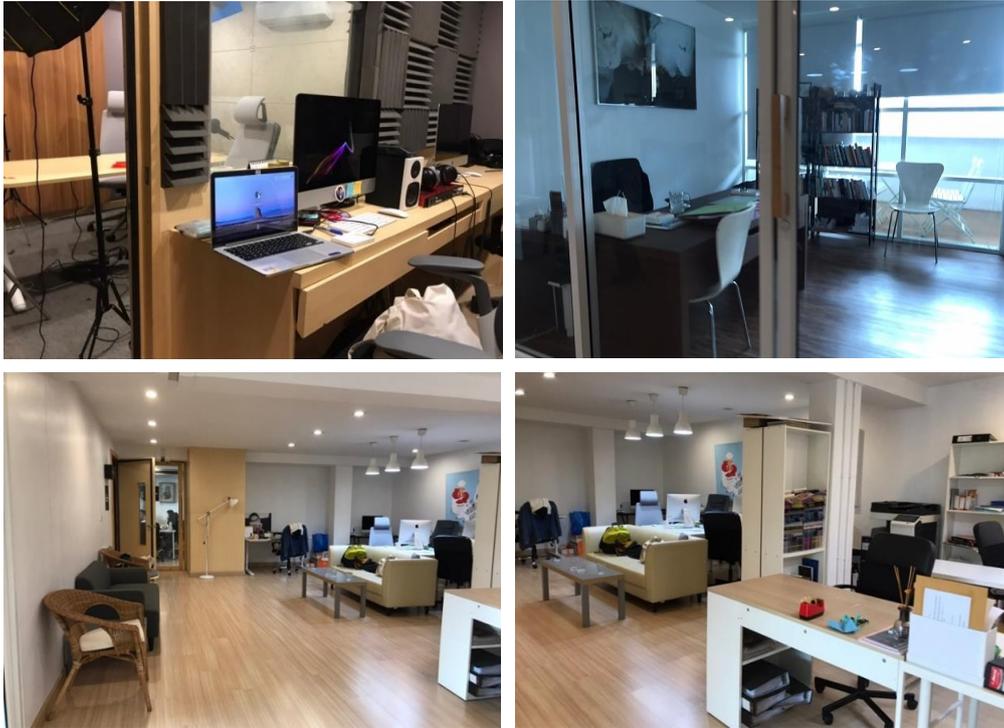
The Standard was established in 2017 as a news agency and online media production company with a wide range of platforms including online articles, videos, and podcasts covering both domestic and international coverage. The company has a total number of 117 employees

including both regular workers who have permanent employment and contracted out workers who work temporarily in the company. There are four main departments including The Standard POP, The Standard News, The Standard Wealth, and The Standard Podcast supported by video, art & proof, marketing & account, digital media, administration, and human resource department. The Standard's office was located on the Rama 9th Road in Bangkok, Thailand in a four-storey building, which has a total number of 1,000 square metres. The company adopted a flexible working policy including flexible working time and remote work. However, the management policy requires employees to work onsite at least once a week. Plate 1 and Plate 2 illustrate various settings and working atmosphere on the 3rd and 4th floor respectively.

Figure 1. Working environment on the 3rd Floor



Figure 2. Working environment on the 4th Floor



5 RESEARCH FINDINGS

The findings of questionnaires highlighted the impact of physical environment aspects on employees and employees' work performance. This section describes the results based on the three questionnaires followed by a description on the organisation's policy with regard to hybrid working approach and the impact of COVID-19 on work practice. The respondents include 11 males, 22 females and 3 not specified. The 36 respondents from the total number of 117 employees account for 31%.

5.1 Employee satisfaction on work environment

Findings from the questionnaire surveys showed different responses on the satisfaction of working environment aspects. Table 1 showed employee satisfaction percentages in seven categories of physical environment aspects: workplace, layout, furniture and office facilities, ICT and ICT support facilities, support spaces, lighting, and acoustics.

Table 1. Percentage of satisfied respondents with regard to different aspects of physical environment

Aspect	Items	Percentage
1. Workplace	Working atmosphere	83
	Size of office space	48
	Size of workspace	50
	Flexibility of the space	61
2. Layout	Zoning and allocation of working space in open plan office	56
	Privacy	28
	Accessibility to working space	81
	Working space supports face-to-face communication	78
	Accessibility to common facilities (e.g. meeting rooms, canteen)	81
	Efficient and up-to-date facilities	67

Aspect	Items	Per cent
3. Furniture and office facilities	Diversity of workstation furnishing	56
	Number of furniture	61
	Size of workstation	56
	Comfort and functionality of workspace	47
	Number of printing facilities	64
	Number of computer facilities	42
4. ICT and ICT support facilities	Wi-Fi connection and internet speed	78
	ICT platform	92
	Online meeting platform	86
5. Support spaces	Number of parking space	44
	Size/number of meeting rooms	31
	Size/number of storage spaces or lockers	28
	Size of kitchen	25
	Size of the relaxation area (e.g. living area)	36
	Number and size of dressing rooms	22
	Size of podcast room	36
	Number and size of the broadcasting room	28
	Amount of multipurpose space (e.g. as workshops)	33
	Number of private online m	31
6. Lighting	Access to natural light	69
	Amount of light in the workspace	72
7. Acoustics	Acoustics of the workspace	33

The findings indicated the high satisfaction percentages in the workplace (working atmosphere - 83%), layout (accessibility to working space - 81%, accessibility to common facilities - 81%) and ICT and ICT support facilities (ICT platform - 92%, Online meeting platform - 86%, Wi-Fi connection and internet speed - 78%).

5.2 Perceived productivity support

The findings show most employees perceive that their physical environment contributes to both individual and team productivity. Table 2 showed the extent to which the physical environment supports the individual (80%, indicated by 33% supportive and 47% very supportive) and team productivity (75%).

Table 2. Percentage of respondents that perceive their physical environment as being supportive to individual and team productivity

Perceived productivity support	Totally unsupportive	Unsupportive	Neutral	Supportive	Totally supportive
Individual	3	0	17	33	47
Team	0	6	19	39	36

5.3 Physical environment aspects and the link to factors influencing work performance

Table 3 showed how employees perceived the link between physical environment aspects and factors influencing employees' work performance. Considering all seven aspects, two aspects including workplace (i.e. working atmosphere, size of office space and workspace, flexibility of the space) and ICT and ICT support facilities (i.e. Wi-Fi connection and internet speed, ICT and online meeting platform) have greater scores regarding the link to factors influencing

employees' work performance. Employees perceived that size and functionality of the space relate to creativity, sharing ideas, face to face communication, collaboration, and positive feedback between colleagues. On the other hand, ICT and ICT support facilities were linked to positive feedback between colleagues, confidence of team members, friendly relationships, ability to work with others, and amount of work done.

Table 3. Average scores of employees that perceived their physical environment aspects relate to factors influencing work performance

Factors influencing work performance	Physical environment aspects	Average scores	Top three highest scores
1. Creativity	Workplace	4.31	1
	Layout	4.25	3
	Furniture and support facilities	4.00	-
	ICT and ICT support facilities	4.25	3
	Support spaces	3.94	-
	Lighting	4.28	2
	Acoustics	4.22	-
2. Sharing ideas	Workplace	4.36	1
	Layout	4.22	2
	Furniture and support facilities	4.06	-
	ICT and ICT support facilities	4.36	1
	Support spaces	4.03	-
	Lighting	3.86	-
	Acoustics	4.11	3
3. Face to face communication	Workplace	4.36	1
	Layout	4.19	2
	Furniture and support facilities	4.08	3
	ICT and ICT support facilities	4.06	-
	Support spaces	4.11	2
	Lighting	3.86	-
	Acoustics	4.19	1
4. Collaboration	Workplace	4.31	1
	Layout	4.25	3
	Furniture and support facilities	4.00	-
	ICT and ICT support facilities	4.28	2
	Support spaces	4.00	-
	Lighting	3.81	-
	Acoustics	4.22	-
5. Positive feedbacks between colleagues	Workplace	4.17	1
	Layout	3.94	2
	Furniture and support facilities	3.89	-
	ICT and ICT support facilities	4.17	1
	Support spaces	4.03	-
	Lighting	3.81	-
	Acoustics	3.92	3
6. Confidence of team members	Workplace	4.11	2
	Layout	3.97	-
	Furniture and support facilities	4.04	3
	ICT and ICT support facilities	4.22	1
	Support spaces	3.86	-

Factors influencing work performance	Physical environment aspects	Average scores	Top three highest scores
7. Friendly relationship	Lighting	3.78	-
	Acoustics	4.00	-
	Workplace	4.22	3
	Layout	4.25	2
	Furniture and support facilities	3.97	-
	ICT and ICT support facilities	4.31	1
	Support spaces	4.14	-
	Lighting	3.86	-
8. Work without stress	Acoustics	4.11	-
	Workplace	3.72	-
	Layout	3.89	3
	Furniture and support facilities	3.86	-
	ICT and ICT support facilities	3.83	-
	Support spaces	3.86	-
	Lighting	4.08	2
9. Ability to work with others	Acoustics	4.14	1
	Workplace	4.11	-
	Layout	4.06	3
	Furniture and support facilities	4.06	3
	ICT and ICT support facilities	4.19	1
	Support spaces	3.97	-
	Lighting	3.86	-
10. Amount of working time	Acoustics	4.14	2
	Workplace	4.00	3
	Layout	3.97	-
	Furniture and support facilities	4.06	2
	ICT and ICT support facilities	3.97	-
	Support spaces	3.81	-
	Lighting	4.00	3
11. Amount of work done	Acoustics	4.19	1
	Workplace	4.00	2
	Layout	3.94	3
	Furniture and support facilities	3.94	3
	ICT and ICT support facilities	4.06	1
	Support spaces	3.78	-
	Lighting	3.72	-
Acoustics	4.00	2	

5.4 Findings from the interview

The findings from the interview with the general manager indicate that the company had initiated remote working before COVID-19 and fully applied working from home during the pandemic. Hybrid working model has been chosen as a long term approach to cope with changes in the new normal. Organisation's policies to support employees working from home included money allowance for internet packages and application programs. In addition, employees are allowed to bring computers and office equipment with them to work from home. In terms of the hybrid work environment, there was a requirement for additional spaces and facilities including working spaces, meeting rooms and ergonomic furniture as well as ICT and ICT support facilities such as software and the speed and stability of the network.

6 DISCUSSION

The organisation's structure of The Standard can be described as a flat structure with a total number of 117 employees. Less barriers in terms of communication between functional teams as well as between the management team and employees in the operational level. The Standard's business type is associated with the current news media services such as the internet newspapers that are becoming more common. Digital journalism is developing rapidly with better designed web pages and layouts. To keep pace with the rise of blogging software and the citizen journalism phenomenon, the company needs to be more efficient in terms of its news content production. The hybrid working that allows employees to work partly at home and at the office provides a degree of flexibility while reducing travel time to and from the office.

The findings showed a high satisfaction percentage in the working atmosphere (83%). The Workplace of The Standard is designed with informal work settings and homelike office interior (see plate 2 and 3) that make employees feel comfortable in a friendly work environment. Employees are satisfied about layout arrangement including accessibility to working space (81%) and accessibility to common facilities (81%). We see that workspaces are arranged in simple layouts in an open plan office with clear functions of the working units and are easily accessible to other support spaces such as kitchen and photocopying area. The findings showed that employees satisfied about ICT and ICT support facilities (i.e. ICT platform - 92%, online meeting platform - 86%). The Standard is an online news media company that has a policy to adopt an ICT system and online meeting platform to support the work of employees involved with the production of online news and the communication and collaboration between team members. Most of the employees are between 20 - 35 years old (72.2% of total employees) classified as generation Y and generation Z office workers that fit for online work.

We see that the working environment supports both individual and team productivity that can be traced to the physical environment aspects contributing to employee satisfaction (i.e. working atmosphere, accessibility to working space and common facilities, ICT and online meeting platform). These aspects enhance communication and stimulate collaboration between team members who work remotely and those who work in the office, and enable them to work productively. Findings from the previous study showed that there is a straight relation between the employee satisfaction with their workplace and their health and productivity (Kamaruzzaman et al., 2015).

We see the link of employees' perception between physical environment aspects and factors influencing their work performance. Two aspects concerning physical conditions of the workplace and the support of ICT and ICT support facilities come to the fore with regard to the link to various factors influencing work performance. The functionality of a building depends on the extent to which its spatial and physical qualities support climatologic, cultural and economic function (Van der Voordt and Van Wegen, 2005). In the case study, employees perceived that size and functionality of the space (i.e. working atmosphere, size of office space and workspace and flexibility of the space) are linked to creativity, sharing ideas, face to face communication, collaboration, and positive feedback between colleagues. On the other hand, the functionality of ICT and ICT support facilities (i.e. Wi-Fi connection and internet speed, ICT platform, online meeting platform) is linked to positive feedback between colleagues, confidence of team members, friendly relationship, ability to work with others, and amount of work done. This reflects the pattern of work, the occupancy of space and the use of ICT concerning workplace usability of hybrid working. Usability or functionality in use is defined as the extent to which a system can be used by specified users to achieve specified goals with

effectiveness, efficiency and satisfaction in a specified context of use (Fenker, 2008). Usability in the built environment should focus on user perceptions of the ease and efficiency with which they use workplaces (Windlinger et al., 2016).

However, the findings showed that the other physical environment aspects also have their roles regarding the link to factors influencing employees' work performance such as office space layout (i.e. zoning and allocation of working space in open plan office, privacy, accessibility to working space, working space supports face-to-face communication, accessibility to common facilities) and acoustics of the workspace that were awarded among the top three highest average scores (see table 3). Hillier and Leaman (1976) mentioned the spatial organisation of activities as one of the main functions of a building that needs to provide optimum support for the activities desired by properly arranging the available space. Findings from the previous study indicated that office layout satisfaction, thermal comfort satisfaction, air quality satisfaction, lighting satisfaction, and noise satisfaction have significant positive effects on overall satisfaction; the overall satisfaction increased with an increase in these factors. Furthermore, overall satisfaction has shown a significant positive effect on productivity (Freihoefer et al., 2015).

7 CONCLUSIONS

The findings show that organisation's context of the case study organisation including business type, organisation's structure and staff characteristics has an impact on workplace concept and the arrangement of work environment, which affect employee satisfaction and perceived productivity support. The empirical findings confirm the link between employee satisfaction and perceived productivity support of the work environment. Working atmosphere, accessibility to working space and common facilities and ICT and online meeting platforms are important to improve employee satisfaction and perceived productivity support (i.e. individual and team productivity) in this case. The results of this study show that the impacts of various aspects of the physical environment on factors influencing employees' work performance are compound. Employees perceived four physical environment aspects including workplace, ICT and ICT support facilities, office space layout, and acoustics that link to the factors influencing their work performance.

The number of respondents and an interview are limited due to the ability and willingness to cooperate during the pandemic. This study is based on a single case and thus impacts the generalisability of the study. In this study, the case study approach allowed exploring relationships between employee's feedback on work environment, workplace concept, organisation's structure and staff characteristics in a qualitative way. The data from the questionnaire about employees' feedback (i.e. employee satisfaction, perceived productivity support and perception regarding the link between physical environment aspects and factors influencing work performance) make it possible to further explore relationships in a quantitative way. Additional statistical analysis of the currently available data from the questionnaire and data from other case studies could help to improve our understanding of the complex relationships between interrelated variables and to explain factors that affect employees' feedback on hybrid work environments.

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REFERENCES

- Abrams, Z. (2019), "The future of remote work", American Psychological Association, available at: www.apa.org/monitor/2019/10/cover-remote-work (accessed 3 September 2021).
- Bangkok Post (2022), "The best of both worlds", available at: www.bangkokpost.com/life/social-and-lifestyle/2229795/the-best-of-both-worlds (accessed 6 October 2021).
- Berube Kowalski, K., Swanson, J. A. (2005), Critical success factors in developing teleworking programs. *Benchmarking: An International Journal*, Vol. 12(3), 236-249.
- Beyer, J. E., Marshall. (1981), The Interpersonal Dimension of Collegiality. *Nursing Outlook*, Vol. 29(11), 662-665.
- Fenker, M. (2008), "Towards a theoretical framework for usability of buildings", in Alexander, K. (Ed.), *Usability of Workplaces: Phase 2*, International Council for Research and Innovation in Building and Construction, Rotterdam.
- Freihoefer, K., Guerin, D., Martin, C., Kim, H.Y., Brigham, J.K. (2015), "Occupants' satisfaction with, and physical readings of, thermal, acoustic, and lighting conditions of sustainable office workspaces", *Indoor and Built Environment*, Vol. 24, No. 4, 457-472.
- Graham, G., Greenhill, A. (2013), "Exploring interaction: print and online news media synergies", *Internet Research*, Vol. 23, No. 1, 89-108.
- Grewal, D., Janakiraman, R., Kalyanam, K., Kanan, P.K., Ratchford, B., Song, R., Tolerico, S. (2010), "Strategic online and offline retailing pricing: a review and research agenda", *Journal of Interactive Marketing*, Vol. 24, No. 2, 138-54.
- Grubenmann, S., Meckel, M. (2014), "*Metaphors of occupational identity: traces of a changeable workplace in journalism*", The 74th Annual Meeting of the Academy of Management, Philadelphia, PA, USA.
- Halford, S. (2005), "Hybrid workspace: re-specialisations of work, organisation and management", *New Technology, Work and Employment*, Vol. 20/1, 19-33.
- Hillier, B., Leaman, B. (1976), "Architecture as a discipline", *Journal of Architectural Research*, Vol. 5(1), 28-32.
- Huang, E., Davison, K., Shreve, S., Davis, T., Bettendorf, E., Nair, A. (2006), Bridging Newsrooms and Classrooms: Preparing the Next Generation of Journalists for Converged Media. *Journalism & Communication Monographs*, Vol. 8(3), 221-262.
- Illegems, V., Verbeke, A. (2004), Telework: What does it mean for management. *Long Range Planning*, Vol. 37(4), 319-334.
- Kamaruzzaman, S.N., Egbu, C.O., Zawawi, E.M.A., Karim, S.B.A., Woon, C.J. (2015), "Occupants' satisfaction toward building environmental quality: structural equation modelling approach", *Environmental Monitoring and Assessment*, Vol. 187 No. 5, 1-21.
- Knight, P.J., Westbrook, J.D. (1999), Comparing Employees in Traditional Job Structures vs Telecommuting Jobs Using Herzberg's Hygiene & Motivators. *Engineering Management Journal*, Vol. 11, 15-20.
- Mangani, A., Tarrini, E. (2017), "Who survives a recession? Specialisation against diversification in the digital publishing industry", *Online Information Review*, Vol. 41, No. 1, 19-34.
- Matli, W. (2020), "The changing work landscape as a result of the COVID-19 pandemic: insights from remote workers' life situations in South Africa", *International Journal of Sociology and Social Policy*, Vol. 40, No. 9/10, 1237-1256.

- Microsoft (2021), “The Work Trend Index: The next great disruption is hybrid work - are we ready?”, available at: www.microsoft.com/en-us/worklab/work-trend-index/hybrid-work (accessed 6 October 2021).
- Mwiya, M., Phiri, J., Lyoko, G. (2015), “Public Crime Reporting and Monitoring System Model Using GSM and GIS Technologies: A Case of Zambia Police Service”, *International Journal of Computer Science and Mobile Computing*, Vol. 4(11), 207-226.
- Nilles, J. (1975), “Telecommunications and organisational decentralisation”, *IEEE Transactions on Communications*, Vol. 23, No. 10, 1142-1147.
- U.S. Bureau of Labour Statistics (2020), “Employed persons working at home, workplace, and time spent working at each location” available at www.bls.gov/news.release/atus.t06.htm (accessed 15 October 2021).
- Van der Voordt, D. J. M., Van Wegen, H. B. R. (2005), *Architecture in use: an introduction to the programming, design and evaluation of buildings*. UK: Architectural Press.
- Windlinger, L., Nenonen, S., Airo, K. (2016), “Specification and empirical exploration of a usability concept in the workplace”, *Facilities*, Vol. 34, No. 11/12, 649-661.

A Hybrid Office How-To: Developing a framework to address the complexities of the post-pandemic return to the physical office

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ABSTRACT

Organisations wishing to combine working from home with some office-based activities in a so-called hybrid model seem to struggle knowing where to start and how to decide what is right for them. In this paper we address this apparent lack of strategies on how to make decisions around a hybrid office and develop a systematic framework covering five distinct aspects of the post-pandemic office: 1) Where will staff work? 2) How will the office be organised spatially? 3) How do management and practices need to adapt? 4) What to do with existing real estate? 5) What technology will support this? The COVID-19 pandemic has provided a natural experiment for many organisations to trial working from home at speed and at scale. Employees have adopted these more flexible practices, and many are now demanding a different approach to physical office space allowing them to work from home for 2-3 days a week. In setting their return to the office policies, organisations find themselves faced with tricky decisions to make to be able to balance competing objectives with newly introduced variables. A review of the latest published research, surveys and articles covering the topic of hybrid working. By defining a series of parameters and spelling out decisions, options and parameter interplay as well as potential outcomes such as collaborative cultures, learning, onboarding, knowledge exchange, coordination or well-being, this framework allows organisations to ask themselves a series of relevant questions, helping to reflect on the hybrid office, its possible shapes and variations, and how those might support desired organisational outcomes and strategies. This newly developed framework will help organisations who wish to adopt hybrid working to decide where to start from and understand hidden implications of certain decisions and their interdependencies.

Keywords

COVID-19, Hybrid office, Decision-Making, Strategy, Workplace layout.

1 INTRODUCTION

Organisations are facing critical decisions relating to their return to the workplace as many have found that hybrid working offers potential benefits to both the employer and employee. But as organisations anticipate a post-pandemic workplace strategy, analysis of the benefits of hybrid working is changing and often shows contradictory evidence. This paper reviews the changing evidence and provides possible explanations. The paper concludes by offering a more

scientific and systematic way to make decisions on hybrid working that will allow organisations to support desired organisational outcomes and strategies.

2 HYBRID WORKING - THE EVIDENCE TO DATE

In the early days of the COVID-19 pandemic, remote working looked like a win-win. One 2020 survey of American office workers found respondents reporting that employees were more productive while working from home (Birkinshaw, J. et al, 2020). As companies return to the office, hybrid working seems to offer the best deal for both employers and employees. It combines pre-COVID-19 patterns of office-based working with remote days, in a working schedule that would allow both in-person collaboration and team building, as well as greater convenience, flexibility and the opportunity for continued work at home. Some companies even offer hybrid working in employee's contracts, aware that across all generations and life circumstances, employees want more remote working and flexible work schedules (Nachiappan, 2022).

However, hybrid working doesn't seem so attractive to everyone. In December 2021, just after the prime minister announced new work from home guidance, the vacuum cleaner maker Dyson told many of its UK employees to continue working in the office (Jolly & Davies, 2021). The claim by Dyson was that large portions of its business are impossible to carry out from home. The explanation for this decision appears to be all about innovation. The UK operations, where employees have been told to work from the office, is a centre for research and development where creativity and innovation are clearly critical. The statements made by the company explaining the instruction to work from the office and not from home talk about the value of collaboration and the role that face-to-face interaction plays in making effective collaboration (*ibid*). This view is in line with academic findings that unplanned social interaction is critical to creativity (Penn & Hillier, 1992; Sailer et al. 2021).

But there is tension at Dyson. Employees have not universally responded well to these demands to work from the office as it is potentially less convenient, more costly and many have got used to the personal benefits of working from home. But these personal benefits appear to be in conflict with the strategic demands of the company and, at least in the view of Dyson, may damage key organisational outcomes. This tension is by no means restricted to Dyson.

Given that many companies have adopted more flexible policies, allowing individual teams to work from home for a number of pre-agreed days, it is important to review the evidence that continues to emerge on the value and dangers of hybrid working. What becomes apparent is that the picture has become more nuanced since the early days of the COVID-19 pandemic. A study of 10,000 skilled professionals at a large Asian tech company found that many were working longer hours, and productivity fell, partly because they were just having more meetings (Gibbs, Mengel & Siemroth, 2021). Some executives revealed "I love my staff ... But they're taking far longer to get things done at home." Studies have found that employees are busier, having more meetings and seeing more internal emails, partly because remote working requires more coordination (Cavendish, 2022). New hires struggle to learn from senior people while leaders find it difficult to know what is really going on if they're not having informal encounters with people outside their senior circle (*ibid*).

The wellbeing of employees also appears to have suffered. A recent study found 20% of UK workers reported difficulties switching off from work and feeling 'always on'; struggling to adapt to hybrid, and the permeable boundaries between home and work, was cited as a major factor (Samsung & The Future Laboratory, 2021). Workers reported the hybrid was more emotionally demanding than fully remote arrangements and even full-time office-based work (Tinypulse, 2021). It is the change of setting every day, the constant feeling of never being settled, the constant planning, the stop-start routine, the maintenance of two workplaces, that

makes people tired. With these frequent changes to daily habits, it is hard for workers to find a routine when their schedule is always in-and-out the office.

To resolve this tension, a dialogue between employees and employers needs to happen that is based on more than gutfeel and policies made on-the-fly. For this dialogue to be successful a more systematic and scientific approach needs to be adopted. The following section proposes a framework for such a dialogue to allow organisations to support desired outcomes and strategies following hybrid working policies.

3 A FRAMEWORK FOR HYBRID WORKING

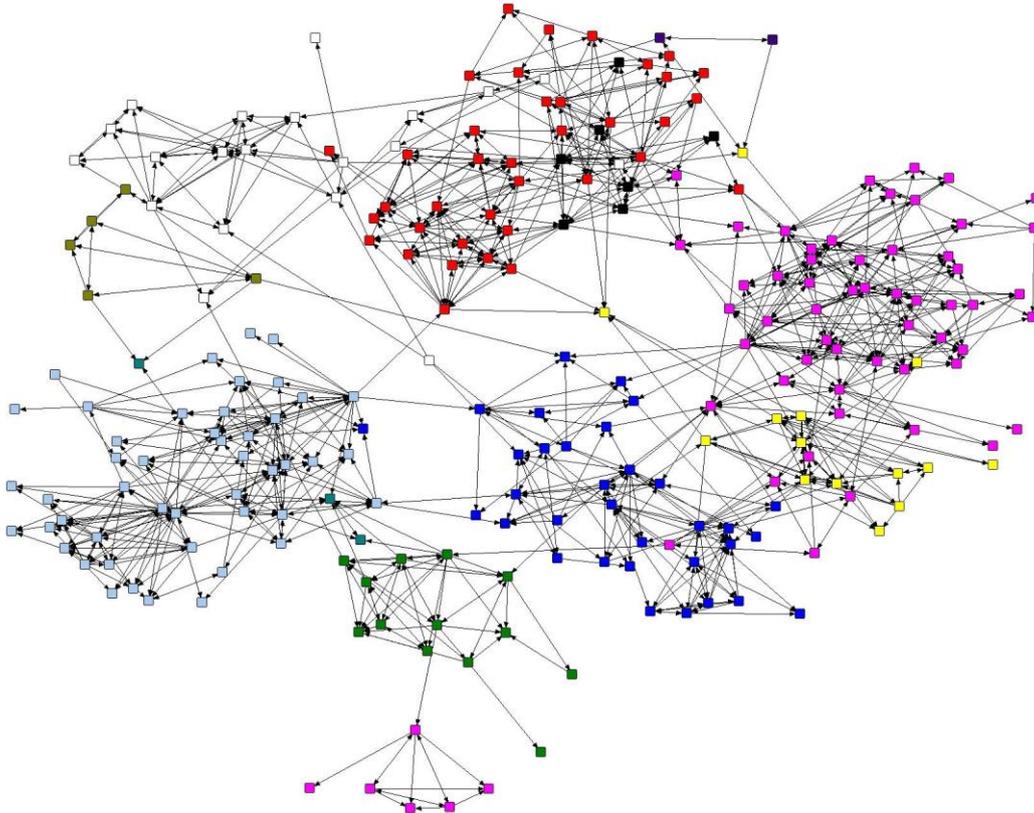
To make decisions around a hybrid office we propose a systematic framework covering five distinct decision variables: 1) Where will staff work? 2) How will the office be organised spatially? 3) How do management and practices need to adapt? 4) What to do with existing real estate? 5) What technology will support this?

3.1 Where shall staff work?

This is the question at the heart of any policy on hybrid working, assuming that organisations aim to move away from everyone at all times and are not keen to abolish the physical office completely. It therefore needs to be asked how often employees should be in, do they choose their own days, are office days stable or variable, and does this vary by function. The number of variables means that these decisions are often reduced to ‘who do we as managers want to be in the office?’ or conversely, ‘what are employees demanding in terms of flexibility?’. The problem with both is that they ignore the collaborative dynamics of the business. Another factor that is often overlooked is the kind of solidarities required, for example, is it important to the organisation’s prosperity and culture that everyone feels connected to everyone else, or does the organisation thrive on strong subgroups and identities? This idea has been termed correspondence (Hillier & Hanson, 1984) and applied to workplace strategy (Sailer & Thomas, 2019, 2020). A correspondent organisation is one where social solidarity (e.g., team affiliation) and spatial closeness match. Imagine an agency deciding its creatives would come to the office Mondays and Tuesdays, whereas business development and sales would come Wednesdays and Thursdays. This organisation would develop strong islands at the detriment of cross-functional exchange and cohesiveness of the whole.

Organisational network analysis (ONA) offers a novel approach for guiding those return-to-office decisions. ONA is a method that visualises employees’ working relationships (see figure 1) and provides an evidence-based approach that can help leaders understand which connections among employees should ideally happen in person and which ones can occur digitally. Leaders and companies relying on intuition-based approaches tend to assign too much weight to functional structures and miss the importance of cross-functional interactions. ONA helps to optimise for both within- and between-unit collaborations and can prioritise interactions that consume significant time as opposed to those that are lighter touch. Return-to-office assessments ask employees to rate the relative importance of digital versus in-person interaction modalities for each person in their network. Aggregating and analysing this data reveals clusters of employees who most need to work together in person at some point during the workweek (Cross & Gray, 2021).

Figure 1. Example case of an ONA showing frequent interactions among staff within and across departments pre-pandemic (highlighted by node colour)



In a recent study, the network data inspired some reluctant people to want to return as they found out that half of their network thought they were more effective in person rather than digitally (*ibid*). This shift in thinking - from solely about what was most efficient for the individual to a true understanding of how others relied on them - had a profound motivating effect. Many employees have become hesitant to incur the personal costs of going to the office if they think they will have exactly the same interactions that could have been done digitally. Showing employees that the more precious in-person time will be used only for interactions that really do have more value in person than digitally can make it worthwhile for employees to actually come in.

In the context of a hybrid return-to-office strategy, ONA provides unique insights into the types of in-person interactions that leaders must prioritise. We must now think about whether the office is organised spatially in a way that will encourage those interactions.

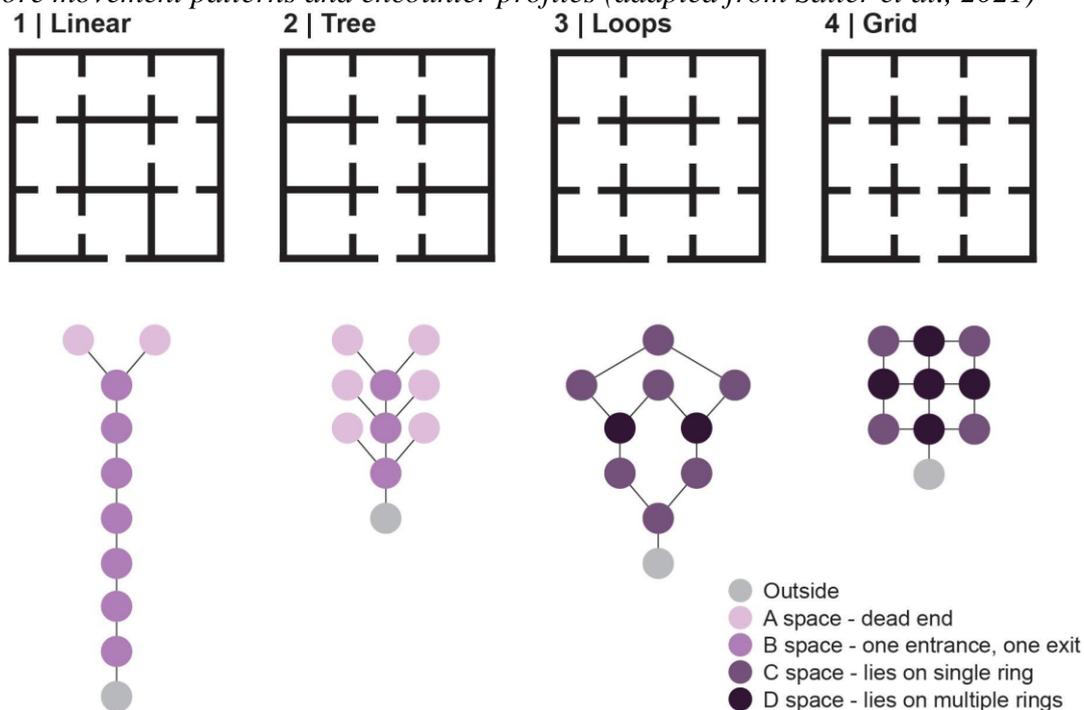
3.2 How will the office be organised spatially?

A hybrid policy allows an organisation to focus their office space on the important social interactions and collaborations that are evident from an organisation network analysis. More concentrated individual work might be more productively achieved from home. The problem here is that not all offices are designed to encourage collaborative work, and many will not be fit for purpose. To design an office suited to collaboration and other social encounters it is useful to turn to configurational thinking as introduced by Hillier and colleagues. Two different aspects are relevant here: 1) the overall physical structure of the office; 2) visibility across the office.

To address the first aspect, research has suggested that different spatial network structures have an impact on the movement and encounter potential in a workplace. Figure 2 illustrates four

different configurations of a simple system of 3x3 rooms. Following the classification of spaces by Hillier (1996) depending on the movement they engender, Sailer et al. have argued that “these configurational principles – a linear system, a tree, a loop or a grid – might result in different encounter profiles across an organisation occupying such an office structure” (Sailer et al, 2021, p.85). Linear as well as tree systems might engender more local movement and encounter, while a grid maximises overall random encounters and choice, whereas a loop structure works to avoid encounters. Thus, organisations planning for a hybrid office need to rethink what they want employees to do face-to-face and provide office structures that serve those needs, for instance in supporting collaboration and encounter potential.

Figure 2. Different combinations of connecting spaces result in distinct spatial qualities and therefore movement patterns and encounter profiles (adapted from Sailer et al., 2021)



The second aspect to consider is the degree to which workplaces allow for visibility. Extant research has shown that the majority of interactions in workplaces tends to be unplanned, short and fleeting (Penn et al., 1999) and arises from people walking past others (Backhouse and Drew, 1992). This means encounters and collaborative behaviour stem from visibility opportunities. More recently, however, research has shown that workplace satisfaction including with effective teamwork can be negatively affected by too much visibility and too large open-plan spaces (Sailer, Koutsolampros and Pachilova, 2021), which means a balance must be found in line with business objectives for the hybrid office.

3.3 How do management practices need to adapt?

Leaders often rely on in-person interactions that provide them with visual cues, for example whether their employees are working effectively and whether they are doing alright from a health and well-being standpoint (Laker & Roulet, 2021). Many leaders are trained to manage people based on these visual cues but with hybrid working many of these are absent. This means that leaders need to focus their attention on organisational outcomes rather than more traditional measures of productivity.

In this environment, purpose matters more than ever. A recent study showed that people who didn't feel their work contributed to their company's mission were 630% more likely to quit

their jobs than their peers who did (Fosslien, 2021). Managers need to tie each team member's work back to the bigger picture of why what they do matters. When assigning tasks, managers should consistently outline answers to: Why is this project important? How will it impact others? How does it fit into the company's broader mission? To help hybrid teams succeed, managers should clearly outline the milestones they'd like their employees to hit — and then let them figure out how to get there. Teams that index the highest on trust and psychological safety are 40% more productive than those who are low on these areas (Brock, 2021). In order to achieve this, most managers might require change management training.

3.4 What to do with existing real estate?

So far, our systematic approach to hybrid working decisions has used ONA to help decide who needs to be in the office and when. Configurational thinking has helped decide how the physical space should be organised and we have discussed how the resulting hybrid teams can be effectively managed. With these pieces of the jigsaw in place, an organisation is in a position to start making decisions about what to do with their real estate.

There was a temptation, particularly in the early days of the pandemic to downsize real estate footprints. Yet more recently another trend has become apparent – towards premium office space. Investors are eyeing opportunities in London, but this interest is focused on “prime” offices on the market which are modern and environmentally sustainable (Hammond, 2021). Flexibility is also increasingly in demand (Hassell, 2020). Prime offices make up just 10 to 15 per cent of the total UK market. Owners of “secondary” buildings face real challenges in attracting tenants and the prospect of deep valuation falls as a result.

Costs for building owners are set to rise as tenants demand more to make their workspace appeal to returning workers and environmental legislation will require commercial property to meet stringent energy efficiency standards by 2030. British Land and Landsec, said it would cost more than £100m each to comply with the new environmental regulations and both companies have relatively modern, well-maintained offices (Hammond, 2021). Owners of older buildings face these extra costs at the same time as vacancy rates rise. London's vacancy rate has risen from 5.7% immediately before the pandemic to 7.7%, with older offices hardest hit.

This trend is in line with the view that organisations are increasingly viewing their offices as social and collaborative hubs (described in 3.2 above). A value is being placed on social interaction, so organisations realise that for this to work employees must want to come into the office. Somehow, the physical office space needs to be attractive enough to outweigh the inconvenience and cost of commuting. In addition, sustainable design and well-being of employees matter even more than ever and those who choose to return to the office even part time need to be assured that their office space is environmentally friendly and caters for their mental and physical health. It is possible that with hybrid working, companies may need less office space than before the pandemic, but this office space needs to be of premium quality and designed in a way that encourages attendance. We would observe that some caution is needed in reducing office space too quickly, even if the organisation is committed to hybrid working and has a clearly thought through policy. The trend as the pandemic has worn on is for more and more companies to understand the value of face-to-face interaction and it is perfectly possible that this trend will continue.

3.5 What technology will support this?

We have deliberately left decisions about technology until last. Clearly, the technology that each organisation needs to put into place needs to support the decisions described above. The technological needs of each organisation will, in reality, vary a great deal. We believe that the focus of this key decision should be on well-being. There is a growing body of evidence that hybrid working is exhausting and not necessarily good for mental health. Polls continue to

show that a majority of people want to keep working from home part-time. However, in a recent global study, more than 80% of leaders reported hybrid working was exhausting for their employees (Tinypulse, 2021) and digital communication policies need to be in place to control for this.

Another downside to remote working is that the less time workers spent physically together, the more their social ties would weaken, as well as the attachment to an employer. Collaboration networks of employees would become more static and siloed, thus correspondent, with fewer bridges between disparate parts. Different meta collaboration platforms are currently flooding the market trying to be online game-like and mimic office environment settings in the metaverse, none of those can replicate the face-to-face conversation that workers could have in the physical office.

With a possible detachment from the physical workplace, work would simply become “less important” in our lives. However, work provides individuals with a wide range of benefits besides the opportunity to earn money – a time structure to the day, opportunities to interact with others outside the family, and the means of establishing an identity outside of the home.

4 HYBRID WORKING DECISIONS AND INTERDEPENDENCIES

The systematic framework proposed in this paper covers five distinct decision variables including work location, spatial organisation, management practices, existing real estate and technology, to help managers make decisions around a hybrid office. Under each of these variables, we listed parameters and decision tools (*Table 1*). For example, the number of days in the office could vary and ONA can help decision makers to identify the right number of days and people to come together in the office on the right days to enjoy meaningful and effective collaborations. In terms of spatial organisation, we highlighted the need to think configurationally to support work practices depending on the number of days employees would spend in the office. Spatial configuration analysis can be used to inform the layout of the space. The more people choose to work from home, the more management practices should focus on organisational outcomes and may require professional management training on how to manage online and manage change. Regarding real estate, the more companies want to attract people back to the office, the more the office needs to offer modern and environmentally sustainable spaces, amenities and conveniences, supporting health and well-being of employees. Different types of assessments e.g., energy efficiency, carbon footprint, daylight and views, and fit out, could be used to understand the current state of the office space and how to upgrade it to premium standards. Regarding technology, organisations need to decide on the collaboration platform they would like to use, establish digital communication policies, ways for staff to feel connected and enable meeting rooms with VC capabilities as well as small booths for quick calls with those at home depending on the level of hybrid working they would like to adopt.

Table 1. List of parameters to be considered when hybrid working is adopted including options, decision tools and potential outcomes

Decision Variables	Parameters	Decision Tools	Potential Outcomes
WORK LOCATION	<ul style="list-style-type: none"> ● No of days in the office ● Days of the week in the office ● Flexible or stable ● Correspondence 	<ul style="list-style-type: none"> ● ONA 	Collaborative Culture Learning Onboarding Knowledge Exchange
SPATIAL ORGANISATION	<ul style="list-style-type: none"> ● Overall physical structure ● Visibility 	<ul style="list-style-type: none"> ● Spatial configuration analysis 	Exchange Coordination

MANAGEMENT PRACTICES	<ul style="list-style-type: none"> ● Focus on organisational outcomes or productivity 	<ul style="list-style-type: none"> ● Change management 	Well-being
EXISTING REAL ESTATE	<ul style="list-style-type: none"> ● Upgrading to premium office space ● Sustainable design ● Introducing amenities and conveniences ● Flexibility 	<ul style="list-style-type: none"> ● Energy efficiency assessment ● Carbon footprint assessment ● Daylight and views assessment ● Fit-out assessment 	
TECHNOLOGY	<ul style="list-style-type: none"> ● Collaboration platform ● Digital communication policies 	<ul style="list-style-type: none"> ● Technological needs assessment 	

When adopting hybrid working practices, it needs to be taken into account that the parameters are interconnected (see figure 3).

Imagine an organisation A deciding that employees will come into the office 1-2 days, on different days of the week and mixed by function to avoid siloes. A more linear configuration as well as high levels of visibility would match to maximise encounters with the few people who are in. Managing outcomes would be most appropriate, however the organisation can afford to leave real estate rather basic and instead invest heavily in technology and digital policies.

In contrast, organisation B might choose 4 office days. Since staff will overlap anyway, it can set stable days, also by function as cross-departmental encounters happen naturally. A grid like configuration would be suitable to generate encounters among larger numbers of people. Visibility should be more limited to allow for concentration and local team identities. Leaders can manage more through presence. In this case technology can be more basic, while real estate needs to be premium.

In any case, a well-matched hybrid office strategy capitalising on the interplay of parameters can result in positive outcomes including collaborative cultures, learning, onboarding, knowledge exchange, coordination and well-being.

Figure 3. a) Framework: list of parameters to be considered for a hybrid work environment; b) Examples: organisation 1 and 2



This framework allows organisations to ask themselves a series of relevant and interconnected questions, helping to reflect on the hybrid office, its possible shapes and variations, and how those might support desired organisational outcomes.

REFERENCES

- Backhouse, A., P. Drew (1992), “The design implications of social interaction in a workplace setting”, *Environment and Planning B: Planning and Design*, v.19, pp. 573-584.
- Birkinshaw, J. Cohen, J., P. Stach (2020), “Research: Knowledge Workers Are More Productive from Home”, *Harvard Business Review*, 31 August 2020, available at: <https://hbr.org/2020/08/research-knowledge-workers-are-more-productive-from-home> (accessed 20 March 2022).
- Bock, L. (2021), “5 New Rules for Leading a Hybrid Team”, *Harvard Business Review*, 17 November 2021, available at: <https://hbr.org/2021/11/5-new-rules-for-leading-a-hybrid-team> (accessed 20 March 2022).
- Cavenish, C. (2022), “It’s time to admit that hybrid is not working”, *Financial Times*, 7 January 2022.
- Cross, R., P. Gray (2021) “Optimising Return-to-Office Strategies With Organisational Network Analysis”, *MIT Sloan Management Review*, 29 June 2021, available at: <https://sloanreview.mit.edu/article/optimizing-return-to-office-strategies-with-organizational-network-analysis/> (accessed 20 March 2022).
- Fosslien, L. (2021), “The top 5 reasons people quit their jobs: It’s not just about the money”, *Humu*, 2 November 2021, available at: <https://www.humu.com/blog/the-top-5-reasons-people-quit-their-jobs-its-not-just-about-the-money> (accessed 20 March 2022).

- Gibbs, M. Mengel, F., C. Siemroth (2021), “Work from Home & productivity: Evidence from personnel & Analytics Data on IT Professionals”, working paper, Becker Friedman Institute for Economics at UChicago.
- Hammond, G. (2021), “UK office owners left to sweat on the future of work”, *Financial Times*, 22 November 2021.
- Hassell (2020), “The elastic office building: How flexible office buildings will create value in the new world of work”, available at: <https://www.hassellstudio.com/uploads/Download-The-Elastic-Office-Building.pdf>
- Hillier, B. (1996), *Space is the machine. A configurational theory of architecture*, Cambridge: Cambridge University Press, available at: <http://eprints.ucl.ac.uk/3881/>
- Hillier, B., J. Hanson (1984), *The social logic of space*, Cambridge: Cambridge University Press.
- Jolly, J., R. Davies (2021), “Dyson tells many of UK staff to work in office even after plan B guidance change”, *The Guardian*, 13 December 2021.
- Laker, B., Roulet, T. (2021), “How Organisations Can Promote Employee Wellness, Now and Post-Pandemic”, *MIT Sloan Management Review*, 26 April 2021, available at: <https://sloanreview.mit.edu/article/how-organizations-can-promote-employee-wellness-now-and-post-pandemic/> (accessed 20 March 2022).
- Nachiappan, A. (2022), “Generation Z demands a flexible working week”, *The Times*, 24 March 2022, available at: <https://www.thetimes.co.uk/article/generation-z-demands-a-flexible-working-week-5bqsg57cz> (accessed 20 March 2022).
- Penn, A., Hillier, B. (1992), “The social potential of buildings: Spatial structure and the innovative milieu in scientific research laboratories”, *Corporate Space and Architecture International Symposium Proceedings*. Paris: Ministère de l'Équipement du Logement et des Transports.
- Penn A, Desyllas J, L. Vaughan (1999), “The Space of Innovation: Interaction and Communication in the Work Environment”, *Environment and Planning B: Planning and Design*, v.26(2), pp.193-218.
- Sailer, K., P. Koutsolampros, R. Pachilova, (2021) “Differential perceptions of teamwork, focused work and perceived productivity as an effect of desk characteristics within a workplace layout”, *PLoS ONE*, v.16(4): p. e0250058.
- Sailer K., M. Thomas (2019). “Correspondence and Non-correspondence. Using office accommodation to calculate an organisation’s propensity for new ideas.” in *Proceedings of the 12th International Space Syntax Symposium. International Space Syntax Symposium*; July 8–13, 2019 (Beijing).
- Sailer, K., M. Thomas (2020), “Socio-spatial perspectives on open-plan versus cellular offices”, *Journal of Managerial Psychology*, v.36(4), pp. 382-399.
- Sailer, S. Thomas, M. Pomeroy, R., R. Pachilova (2021), “The innovation deficit: The importance of the physical office post-COVID-19”, *Corporate Real Estate Journal*, v.11(1), pp.79-92(14).
- Samsung & The Future Laboratory (2021), “Hybrid Living Futures”, available at: <https://news.samsung.com/uk/hybrid-living-leaves-brits-in-pursuit-of-happiness> (accessed 20 March 2022).
- Tinypulse (2021), “State of Employee Engagement Q3 2021: Top Insights from People Leaders and Employees”, available at: <https://www.tinypulse.com/state-of-employee-engagement-q3-2021> (accessed 20 March 2022).

Designing the hybrid workplace at SMEs: Insights from a case study

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ABSTRACT

We conducted a case study at a small manufacturing firm and examined employees' responses following the switch to hybrid work with the outbreak of COVID-19. Our findings highlight how organisational identity and identification can serve as sources of stability and enable relational coordination following the disruption of routines. Our study offers additional insight into the sources of stability going through an unplanned change highlighting the relational coordination in organisations particularly focusing on the context of switching to hybrid work at a small manufacturing family company. We contribute to previous literature and practice by exploring the role of identification in unplanned change events.

Keywords

Hybrid work, Identification, Unplanned change during COVID-19.

SESSION 6B: WORKSPACES, INCLUSION AND CORPORATE SOCIAL RESPONSIBILITY

Understanding Sustainable Coworking

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ABSTRACT

This paper aims to understand what sustainable coworking is, using the perspective of a triple bottom line for sustainability. Theories from sustainable organisational behaviour and workplace research are used for a coworking context. Based on the previous theory of sustainable behaviour, we conceptualise the constructs for sustainable coworking from the perspective of a triple bottom line of sustainability. The constructs we propose are productivity, prosociality, and responsibility, representing economic, social, and environmental perspectives of sustainability, respectively. We applied a case study to collect empirical data from three coworking spaces in the city through twenty in-depth interviews, participant observations, and workshops. We identified several aspects for the proposed sustainable coworking constructs. Productivity consists of remaining focused, saving time, accomplishment of plan, and having new ideas. Prosociality was related to sharing resources with coworkers, helping coworkers with work-related matters, engaging socially, volunteering for additional tasks, helping coworkers with personal matters, and suggesting improvements that affect other coworkers. Responsibility was perceived as following the rules, concern for the environment, concern for coworkers, confronting irresponsible behaviour, and conforming to the norms. Our findings increase the understanding of what sustainable coworking is which is still under-researched. The conceptual model can be used as a basis for assessing sustainable coworking.

Keywords

Coworking, Sustainability, Productivity, Prosociality, Responsibility.

1 INTRODUCTION

A relatively new workplace phenomenon where knowledge workers unite in a shared space is known as coworking spaces. Coworking spaces are “*subscription-based workspaces in which individuals and teams from different companies work in a shared, communal space*” (Howell, 2022). This allows cost savings and convenience using common infrastructures, such as receptionist services, utilities, and equipment. It aligns with the global trend of sharing economy (Bouncken & Reuschl, 2018; Belk, 2014) which in itself can act as a puzzle piece for reaching some of the UN’s 17 goals for sustainable development (UN, 2021). Coworking spaces are not only about providing a shared space, but also about establishing community or ‘working alone together’ (Spinuzzi, 2012). It is especially attractive for remote workers to avoid the feeling of social isolation.

The popularity of coworking spaces has grown dramatically. According to the latest Global Coworking Survey, it is estimated that the number of coworking spaces has increased from 160

in 2008 to almost 19 000 at the end of 2018 (Deskmag, 2019). Due to the COVID-19 pandemic restrictions, the number of coworking members has temporarily decreased (Deskmag, 2020). However, it is expected to increase again in the post-pandemic world, not only for entrepreneurs and freelancers, but also for large companies (Howell, 2021). Giant companies such as Amazon, Google and Microsoft are already embracing coworking spaces to improve collaborations and broaden their innovation pipelines (Bouncken & Reuschl, 2018).

Will coworking spaces become the future workplace? According to research made by the British Council of Offices (BCO), a huge player in office research, embracing the sharing and circular economy will be a key feature for the future office (Partridge et al., 2019). Can coworking spaces contribute to the triple bottom line of sustainability, thus help reach the sustainable development goals? Unfortunately, this has been rarely investigated. A recent study (Oswald & Zhao, 2020) showed that there is a lack of consensus on what a sustainable coworking space is. Workplace sustainability is often focused on top-level corporate social responsibility (CSR) strategy and environmental management systems (e.g., ISO 14001/EMAS), but not on individual human behaviour (Davis & Challenger, 2013; Lülfs & Hahn, 2014). This study aims to understand what sustainable coworking is, using the perspective of a triple bottom line for sustainability. We focus on sustainable behaviours of the coworking space members. The insights will be useful for coworking providers to know how to move towards a more sustainable coworking. This study also contributes to the current literature on the future workplace and sustainable work behaviour.

2 THEORETICAL FRAMEWORK

2.1 Sustainable behaviour

Human behaviour plays a vital part in the sustainability issues that the world faces. This implies that it becomes necessary to focus on people's behaviour concerning sustainability (Corall-Verdugo et al., 2011; Oskamp, 2000). Habits such as wastefulness, contamination, and consumerism should be replaced by sustainable behaviours. Corall-Verdugo et al. (2010) define sustainable behaviour as the set of "*actions aimed at conserving the integrity of the socio-physical resources of this planet*". This definition emphasises that sustainable behaviour encompasses both social and environmental aspects.

Previous research suggests that sustainable behaviour possesses at least four interconnected constructs, namely pro-ecological, frugal, altruistic, and equitable behaviours (Tapia-Fonllem et al., 2013). Pro-ecological behaviour includes actions aimed at avoiding harm to and/or safeguarding the environment such as recycling and reducing energy consumption. Frugal behaviour concerns responsible use of resources to avoid excessive consumerism and waste. The altruistic dimension consists of prosocial behaviours i.e., behaviours that are intended to benefit others, without expecting anything in return such as donating and volunteering. Lastly, equitable behaviour is made up of actions that promote respect and the avoidance of discrimination. Furthermore, a more recent study by Corall-Verdugo et al. (2021) showed that sustainable behaviour can be reduced to a three-factor model organised around three perspectives that include sustainable behaviours directed towards oneself, other people, and the environment (Schultz, 2001).

These constructs on sustainable behaviour are however primarily focused on human behaviour in general and may not be directly applied in organisational workplace research. From the perspective of the triple bottom line (Elkington, 1997) of sustainability, the terms 'profit', 'people', and the 'planet' are used. Here it is not difficult to parallelly see that the three terms can correspond to oneself, other people, and the environment. However, a closer look to the sustainable behaviour construct (Schultz, 2001; Corall-Verdugo et al., 2021) reveals that it

encompasses a wide range of aspects and hardly focuses on profit or an economic perspective which is relevant for work and business.

2.2 Sustainable behaviour in coworking spaces

Here we contextualise sustainable behaviour (Schultz, 2001; Corall-Verdugo et al., 2021) to a coworking space setting using the perspective of a triple bottom line of sustainability. With respect to economic, social, and environmental sustainability, we propose, respectively, three corresponding constructs, namely, productivity, prosociality, and responsibility. This is to take into account the definition of coworking space as a “subscription-based workspace in which individuals and teams from different companies work in a shared, communal space” (Howell, 2022).

With respect to economic sustainability, we propose the construct ‘*productivity*’ considering that this is the reason for working as in the word ‘coworking’ itself. In the coworking literature, Jakonen et al. (2017) mentioned that many coworking members’ primary goal during their day is to work, thereby spending little time seeking encounters with other users and instead focusing on maximising output. Coworking spaces are designed to create a productive atmosphere (Bueno et al., 2018) and among the best-rated attributes of coworking spaces are flexibility and autonomy which illustrates members’ need to simply work. Productivity is important for every coworking member to ensure that their own work generates value, or their business can generate profit. Generally, productivity is an objective and quantifiable measure defined as the ratio of output to input (e.g. Djellal & Gallouj, 2013). However, the complexity of knowledge workers’ outputs and inputs, leads to a lack of a clear definition for such productivity (Haynes, 2007).

With respect to social sustainability, we propose the construct ‘*prosociality*’ considering that humans are social beings. People join a coworking space because they want to be part of a community (Spreitzer et al., 2015), to have the opportunity to network with others (Fuji, 2015), and to have social (Merkel, 2015) and work-related interactions (Fuji, 2015). Furthermore, Water-Lynch and Potts (2017) mentioned that the main reason to become a coworking member is the possibility of collaborating with other members when ideas, resources, and necessary information are lacking. In short, it goes without saying that connection and socialisation with other members is a big concern and to cover all these aspects, the large concept of prosociality, which was mentioned by Corall-Verdugo (2021), is a useful construct for sustainable behaviour in the coworking context. Research on prosocial behaviours in organisations is not new and several behaviours such as assisting co-workers with job-related and personal matters (Brief & Motowidlo, 1986), and arriving at work on time (McNeely & Meglino, 1994) have been identified as prosocial. Organisational research regarding prosociality have particularly focused on interpersonal organisational citizenship behaviours that includes pro-organizational and pro-individual behaviours (Motowidlo, 2000), or extra-role behaviours directed towards individuals in the workplace which fall outside of one’s job description, yet which nevertheless benefit the organisation and its employees (Baillet & Ferris, 2013). These types of prosocial behaviours are applicable in traditional workplaces but maybe not coworking spaces.

With respect to environmental sustainability, we propose the construct ‘*responsibility*’ considering that coworking space is a shared space. Richardsson (2015) wrote that the sharing economy, in general, requires that individuals take responsibility to perform well. According to Holdorf and Greenwald (2018), responsibility is a multidimensional construct with six manifestations, namely, accountability, commitment, concern for others, dependability, initiative, and receptivity. However, the construct of responsibility has not been contextualised to a coworking space. Consider if some members do not follow the clean desk policy, no one cleans the coffee mugs, or leave their expired food in the fridge. This would quickly lead to an unsustainable working environment and go against a professional appearance for the company

(e.g. Bouncken et al., 2020 & Appel-Meulenbroek et al., 2020). Furthermore, a common characteristic of coworking spaces is the open office layout which in itself comes with several challenges such as distractions, noise and lack of privacy (Robelski et al., 2019). Paradoxically, collaboration, which is one of the core values of coworking (Fuzi, 2014), requires expressing things, which is a ‘noisy’ phenomenon (Faure et al., 2020). How can one then collaborate in an open space without being responsible for other members sharing the same space? Another aspect is taking responsibility for the environment at large. Oswald and Zhao (2020) identified a user-category preferring coworking spaces that consider themselves environmentally friendly on a larger scale by, for example, encouraging to walk rather than drive, recycling, and using ‘green’ energy. In sum, taking responsibility for the work environment and the environment at large should be considered when discussing sustainable coworking.

3 RESEARCH METHODS

The study is based on a qualitative approach in order to gain deep insights in sustainable coworking. Based on the previous theory of sustainable behaviour, we described the constructs for sustainable coworking from the perspective of a triple bottom line of sustainability. Since these constructs have not been thoroughly investigated in a coworking context, we applied a case study involving three different coworking spaces in the city to concretize the constructs. The first place is a modern coworking space located at the campus of a large Swedish university in Gothenburg. They are wholly owned by a Swedish government enterprise and have a strong focus on the built environment. The second place is located in the city centre of Gothenburg, owned by a large real estate company, and compared to the first case, the atmosphere is more luxurious and gives a business-like feeling and the price of being a member is consequently higher. The third place is also located in Gothenburg’s city centre inside a shopping mall and is owned by another one of Sweden’s largest real estate companies. Out of the three places, this space is the newest and smallest.

Regarding the methods, the main source of data came from 20 interviews with coworking members to understand how they perceive productivity, prosociality, and responsibility in the coworking context. Interviews are interesting to conduct since they give an opportunity to get a thorough understanding of the coworking members point of view which is of high interest in this study. The interviewees consist of a wide range of entrepreneurs and employees of larger companies who have been members between 1 month and up to 4 years. There were two sampling techniques used, one where the coworking host recommended members who willingly wanted to participate in the study and one where the researchers recognized the member as interesting to interview after having an informal conversation with them. The data were collected through semi-structured interviews that were a mix of face-to-face and digital interviews, depending on the preference of the respondent. Interviews were approximately 45 minutes, and an interview guideline was followed which focused on elaborating on the three concepts. All the interviews were recorded. The respondents had the option to read the take-aways to ensure that they have been correctly interpreted. Finally, all records from the interviews were transcribed.

Next to interviews, participant observations were held, which allowed us to directly observe behaviour instead of only having an inferred explanation of the behaviour (Bryman & Bell, 2011). The observations in this case study consisted of more than 1000 hours of attendance in the coworking spaces to analyse coworking members behaviour. Additionally, the observations validate the data collected from the interviews. Field notes were written after seeing or hearing something interesting during the observations and photographs were taken to enrich the observations and to remember situations and scenarios.

Parallel with the interviews and the observations, a workshop was organised in the first space where one of the authors and thirteen members discussed what productivity, prosociality, and responsibility is. In the workshop, nine identified aspects were ranked on a five-point scale asking how relevant they were where '1' was fully disagree and '5' fully agree. This was done to reconcile with the members if the identified aspects were relevant for sustainable coworking and to collect more data from the open discussions.

Besides the interviews, observations and the workshop, additional methods were used to collect data. Additional data sources were informal conversations with coworking hosts, access to digital communication channels, and official websites linked to the studied coworking spaces. To analyse the data from the interviews, all records were transcribed and coded in NVivo, a qualitative analysis software, using the Gioia methodology (Gioia et al., 2013). This method helped us gain a deeper understanding of the various constructs of the study. The coding process was divided into three steps, first the interesting quotes (1st order), second, clustering the quotes into themes (2nd order), and third, combining overlapping themes into aggregate dimensions that we call aspects.

4 RESULTS

From the collected interview data, it was possible to concretize the three constructs and identify 15 aspects that coworking members perceive as productivity, prosociality, and responsibility. Some of the qualitative data are presented below and the full list of aspects is shown in Table 1. One of the most recurring themes related to productivity from the interviews is described with the following quote given by a coworking member who works as a project leader at a real-estate company.

"It is important for me to not be interrupted to remain productive." – Project leader

Out of the 20 interviews, 17 interviewees mentioned that being able to focus or avoid being disrupted, interrupted, and distracted was crucial for them to be productive. Some evidence of this could also be observed during visits in the coworking spaces. An example of this was observed when a member answered a telephone call while in an open office area and two other members quickly went away to their private office, looking irritated, and closed the door hard. Regarding the second construct, prosociality, several themes were recurring with similar frequency but the most popular one concerns effort. Many members say that while they are in a coworking space, they realise that socialisation with other coworkers does not happen automatically but requires some sort of effort. Below is a quote from an account manager working in a large technology company that emphasises the importance of engaging socially.

"If you are waiting for coffee with someone else, say hi, be interested. If you are at a social event, try to contribute. Effort is important." – Account manager

In the observations, it was possible to sometimes experience small chats at the coffee machine however it does not happen often. Additionally, during an organised community event arranged in the first space, only 8 out of approximately 70 active members showed up. These observations can potentially illustrate that there is a lack of social engagement in that particular coworking space. However, there can be several explanations of why members are not engaged, especially since a large part of this study was conducted during the COVID-19 pandemic. The most recurring theme, in this case related to responsibility, was to show concern for other users in the coworking space or, as many respondents phrased it, to show respect. To illustrate what is meant by respect, a quote by a member who works as HR manager is provided below.

"The main part of responsibility in the shared space concerns simple respect. If you see someone close to you, then you can talk less loudly, if you are in a telephone booth, don't occupy it for too long, clean up after yourself to avoid a messy environment etc." – HR manager

Members mentioned that while sharing a coworking space it is important to show concern for other users in order to be perceived as responsible. However, some users in the interviews also said that there are a few members who have issues with showing respect. Several incidents were observed when members, for example, did not put away their coffee cup, white boards were not being cleaned after usage, and members used “hop in-hop out room” for several hours despite clear instructions written on the door. This indicates that some members act irresponsibly. From the interview data and observations, it was possible to identify 15 aspects in total that are frequently recurring, four related to productivity, six related to prosociality and five related to responsibility. Table 1 presents an overview of the aspects and for each aspect a quote is presented to give a deeper understanding of the aspect.

Table 1. Summary of aspects (n=20)

Construct	Aspects	Frequency	Representative quote
Productivity	Remain focused	17	<i>“It is important for me to not be interrupted to remain productive.”</i>
	Save time	10	<i>“Compared to any alternative, the coworking space makes me save a lot of time and be more efficient. I don't have to do the boring tasks such as ordering coffee, printer service, unload the dishwasher etc.”</i>
	Accomplishment of plan	6	<i>“To do what is planned is to be productive.”</i>
	Have new ideas	7	<i>“There are two sides of productivity, one where you sit down and focus, and one, just as important, where you are creative and generate new ideas. Both are challenging to perform in an open space.”</i>
Responsibility	Follow rules	12	<i>“To me, responsibility concerns that you conform to the rules and norms that exist.”</i>
	Concern for the environment	5	<i>“I could have chosen any coworking space but one of the reasons why I stay here is because they seem to care more for the environment which aligns with my values.”</i>
	Concern for coworkers	18	<i>“The main part of responsibility in the shared space concerns simple respect. If you see someone close to you, then you can talk less loudly, if you are in a telephone booth, don't occupy it for too long, clean up after yourself to avoid a messy environment etc.”</i>
	Confront irresponsible behaviour	9	<i>“If someone is irresponsible, it is your responsibility to confront them and ensure order in the shared space. However, you can't expect everyone to conform to your personal preferences.”</i>
	Conform to social norms	5	<i>“You are allowed to talk on the phone in the open space, but should you? Norms are important”</i>

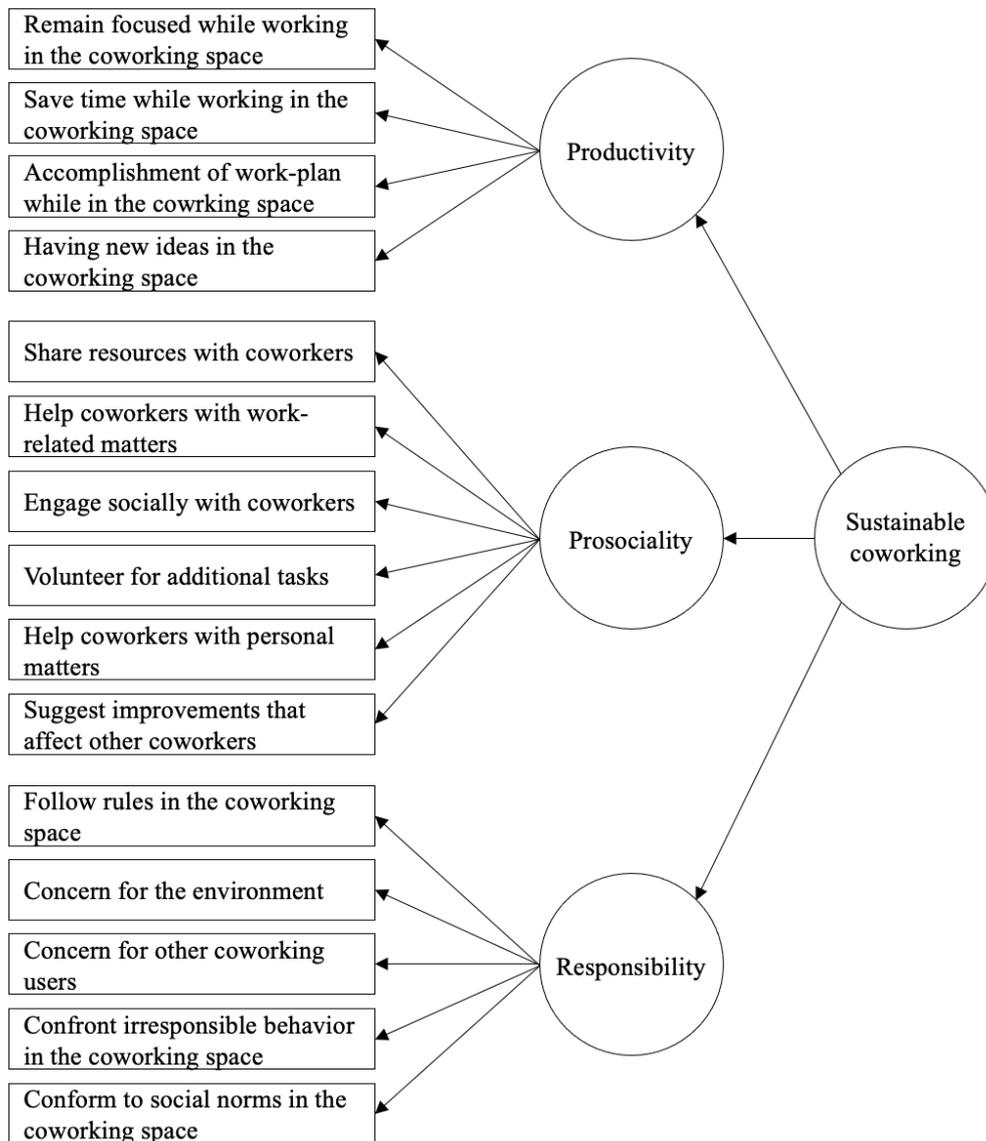
Prosociality	Share resources with coworkers	6	<i>"If someone asks me for a charger, I gladly share it if I do not need it myself."</i>
	help coworkers with work-related matters	10	<i>"For example, once there was a person that came into our office and had some issues with her computer. She was supposed to lead a lecture within a short time span. It was a simple issue and, of course, we assisted."</i>
	Engage socially	12	<i>"If you are waiting for coffee with someone else. say hi. be interested. If you are at a social event, try to contribute. Effort is important."</i>
	Volunteer for additional tasks	11	<i>"I am one of few who was interested and participated in all company presentations."</i>
	Help coworkers with personal matters	11	<i>"Recently I suffered a mental breakdown and being comforted by my colleagues helped me a lot."</i>
	Suggest improvements that affect other coworkers	5	<i>"I would like to see more enthusiasm. When you are in a traditional office, people usually suggest improvements but here, we somehow expect the provider to come up with suggestions."</i>

5 DISCUSSION AND CONCLUSION

The purpose of this paper was to understand what sustainable coworking is using the perspective of a triple bottom line for sustainability. On the basis of the general sustainable human behaviour constructs (Corall-Verdugo et al., 2021) and adding the economic perspective, we contextualised three constructs of sustainable coworking i.e., productivity, prosociality, and responsibility. Our research was set in the context of the relatively new phenomenon of coworking spaces combined with a focus on sustainable work behaviour. These two areas are still under-researched (Davis & Challenger, 2013; Corall-Verdugo et al., 2021; Kraus et al., 2022) and by further understanding sustainable coworking we contribute by extending the current research on the future workplace and sustainable work behaviour. The findings from the case study gave us insights of what productivity, prosociality, and responsibility are in a coworking space. First, the results show that productivity consists of remaining focused, saving time, accomplishment of plan, and having new ideas. Productivity is conventionally defined as the ratio of outputs to inputs (e.g. Djellal & Gallouj, 2013). Saving time means that the coworkers want to be streamlined and complete their tasks as efficiently as possible and increase their output per input. Accomplishment of plan is also positively affecting the input. By being effective and completing the correct tasks, coworkers can optimise their work plan. Focus, or rather the opposite, distraction, has long been regarded as something that has a negative impact on productivity (Haynes, 2007). Remaining focused allows coworkers to stay productive. Creativity is where knowledge workers clearly separate from manual workers and from the conventional definition, creativity would rather be seen as counterproductive. However, being creative and having new ideas is necessary to be innovative and do things differently or do the same things better. When trying to depict the productivity we observed that many of the respondents struggled when describing them and would rather explain factors that influence them. For example, common themes were motivation, ergonomics, and proximity, which potentially influences productivity, but they are not aspects of it. This goes well in line with the already known challenge of defining knowledge workers' productivity (Haynes, 2007). Second, prosociality includes sharing resources, helping

coworkers with work-related matters, engaging socially, volunteering for additional tasks, helping coworkers with personal matters, and suggesting improvements that affect other coworkers. These findings go hand in hand with some of the findings that Brief and Motowidlo (1986) found more than thirty years ago while investigating prosocial organisational behaviours. However, we see that the level of displayed prosociality in coworking spaces seems to be quite low since. This is not surprising since coworking members do not automatically belong to a community and do not necessarily know each other leading to low levels of trust. Additionally, since the members pay for the service, they seem to be expecting a community to be included in the service. Third, we found that responsibility contains following rules, concern for the environment, concern for other users, confronting irresponsible behaviour, and conforming to the norms. When trying to conceptualise responsibility, Holdorf and Greenwald (2018) also found that concern for others was one of the most frequently mentioned ways of describing responsible behaviour. From this perspective, selfishness is the opposite of being responsible. Since one of the studied coworking spaces has incorporated sustainability as a core-value in their business model, many of their members had an even larger perspective of responsibility and see it as their duty to protect the environment. To conclude our findings, we developed a conceptual model of sustainable coworking that includes the three concepts and all the identified aspects (see Figure 1 below). During the study, a challenge was the COVID-19 pandemic. When the entire business model of coworking spaces is based on people staying there, not home, a global pandemic is close to a worst-case scenario. As the observations happened, all the spaces were relatively empty, and the observed behaviour may not represent what happens in the post-pandemic world. Another limitation is that the three constructs may not be exhaustive. It would also be interesting to use a quantitative method to test the proposed model. We believe that an increased understanding of sustainable coworking can help coworking providers to further improve their coworking spaces, understand tensions, and move faster towards a more sustainable coworking space. Ultimately, this research can potentially contribute to changing the way that we work and make us more sustainable.

Figure 1. Conceptual model of sustainable coworking



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REFERENCES

- Appel-Meulenbroek, R., Weijs-Perrée, M., Orel, M., Gauger, F., Pfnür, A. (2020), "User preferences for coworking spaces; a comparison between the Netherlands, Germany and the Czech Republic", *Review of Managerial Science*, 15(6).
- Baillet, D., Ferris, D. L. (2013), "Ostracism and prosocial behaviour: A social dilemma perspective", *Organisational Behaviour and Human Decision Processes*, 120(2), 298-308.
- Belk, R. (2014), "You are what you can access: sharing and collaborative consumption online", *Journal of Business Research*, 67(8), 1595–1600.
- Bouncken, R. B., Reuschl, A. J. (2018), "Coworking-spaces: how a phenomenon of the sharing economy builds a novel trend for the workplace and for entrepreneurship", *Review of Managerial Science*, 12(1), 317-334.

- Bouncken, R., Ratzmann, M., Barwinski, R., Kraus S. (2020), "Coworking spaces: Empowerment for entrepreneurship and innovation in the digital and sharing economy", *Journal of Business Research*, 114 (June), 102-110.
- Brief, A. P., Motowidlo, S. J. (1986), "Prosocial Organisational Behaviours", *Academy of Management Review*, 11(4), 710-725.
- Bryman, A., Bell, E. (2011), *Business Research Methods*, 3rd ed. Oxford University Press.
- Bueno, S., Rodríguez-Baltanás, G., Gallego, D. M. (2018), "Coworking spaces: a new way of achieving productivity", *Journal of Facilities Management*, 16(4). 452-466.
- Corral-Verdugo, V., García, C., Castro, L., Viramontes, I., Limones, R. (2010), "Equity and sustainable lifestyles". In V. Corral-Verdugo, C. García, M. Frías (Eds), *Psychological Approaches to Sustainability*. New York: Nova Science Publishers.
- Corral-Verdugo, V., Mireles-Acosta, J., Tapia-Fonllem, C., Fraijo-Sing, B. (2011) "Happiness as Correlate of Sustainable Behaviour: A Study of Pro-Ecological, Frugal, Equitable and Altruistic Actions That Promote Subjective Wellbeing", *Human Ecology Review*, 18(2), 95-104.
- Corral-Verdugo, V., Pato, C., Torres-Soto, N. (2021), "Testing a tridimensional model of sustainable behaviour: Self-care, caring for others, and caring for the planet", *Environment, Development and Sustainability*, 23(9), 12867-12882.
- Davis, M. C., Challenger, R. (2013), "Environmentally sustainable work behaviours" In P.C. Flood & Y. Freeney (Eds), *Wiley Encyclopaedia of Management: Organisational Behaviour*, 3(11).
- Deskmag (2019), "2019 Coworking Forecast: Final Results", available at: <https://www.deskmag.com/en/coworking-news/2019-state-of-coworking-spaces-2-million-members-growth-crisis-market-report-survey-study> (accessed 10 March 2022).
- Deskmag (2020), "2020 Coworking space trends in Europe", available at: <https://coworkingstatistics.com/coworkingstatistics/2020-coworking-space-trends-europe> (accessed 10 March 2022).
- Djellal, F., Gallouj, F. (2013), "The productivity challenge in services: measurement and strategic perspectives", *The Service Industries Journal*, 33(3-4), 282-299.
- Elkington, J. (1997), *Cannibals with forks – Triple bottom line of 21st century business*. Stoney Creek, CT: New Society Publishers.
- Faure, S., Aroles, J., de Vaujany, F-X. (2020), "At the heart of New York practices: A paradoxical approach to silence in a coworking space", *Ephemera theory & politics in organisation*, 20(4), 307-322.
- Fuzi, A., Clifton, N., Loudon, G. (2014), "New in-house organisational spaces that support creativity and innovation: the co-working space", R & D Management Conference 2014. 3-6 June, Stuttgart.
- Fuzi, A. (2015), "Coworking spaces for promoting entrepreneurship in sparse regions: The case of South Wales", *Regional Studies, Regional Science*, 2(1), 461-469.
- Gioia, D. A., Corley, K. G., Hamilton, A. L. (2013). Seeking qualitative rigour in inductive research: Notes on the Gioia methodology. *Organisational research methods*, 16(1), 15-31.
- Goel, P. (2010), "Triple bottom line reporting: An analytical approach for corporate sustainability", *Journal of Finance, Accounting, and Management*, 1(1), 27-42.
- Haynes, B. P. (2007), "Office productivity: a theoretical framework", *Journal of Corporate Real Estate*, 9(2), 97-110.
- Holdorf, W. E., Greenwald, J. M. (2018), "Towards a taxonomy and unified construct of responsibility", *Personality and Individual Differences*, 132, 115-125.
- Howell, T. (2021), "Coworking spaces offer a post-pandemic office alternative", *MIT Sloan Management Review*, 63(2).

- Howell, T. (2022), "Coworking spaces: An overview and research agenda" *Research Policy*, 51(2): 104447.
- Jakonen, M., Kivinen, N., Salovaara, P., Hirkman, P. (2017), "Towards an Economy of Encounters? A critical study of affectual assemblages in coworking", *Scandinavian Journal of Management*, 33(4), 235-242.
- Johns, T., Gratton, L. (2013), "The third wave of virtual work", *Harvard Business Review*, January-February, 66- 73.
- Kraus S., Bouncken, R. B., Görmar, L., González-Serrano, M. H. (2022), "Coworking spaces and makerspaces: Mapping the state of research", *Journal of Innovation & Knowledge*, 7(1).
- Lülf, R., Hahn, R. (2014), "Sustainable behaviour in the business sphere: A comprehensive overview of the explanatory power of psychological models", *Organisation and Environment*, 27(1), 43-64.
- McNeely, B. L., Meglino, B. M. (1994), "The Role of Dispositional and Situational Antecedents in Prosocial Organisational Behaviour: An Examination of the Intended Beneficiaries of Prosocial Behaviour", *Journal of Applied Psychology*, 79(6), 836-844.
- Merkel, J. (2015), "Coworking in the city", *Ephemera Theory & Politics in Organisation* 15(1), 121-139.
- Motowidlo, S.J. (2000), "Some basic issues related to contextual performance and organisational Citizenship behaviour in human resource management", *Human Resource Management Review*, 10(1), 115-126.
- Oskamp, S. (2000), "A sustainable future for humanity?", *American Psychologist*, 55(5), 496-508.
- Oswald, K., Zhao, X. (2020), "What Is a Sustainable Coworking Space?". *Sustainability*. 12(24): 10547.
- Partridge, R., Blust, C., Taylor, S., Harris, E., Clements-Croome, D. (2019), "Making the Future Workplace. Materials and Methods Towards a Circular Economy" British Council for Offices.
- Richardson, L. (2015), Performing the sharing economy. *Geoforum*, 67(December), 121-127.
- Robelski, S., Keller, H., Harth, V., Mache, S. (2019). "Coworking Spaces: The Better Home Office? A Psychosocial and Health-Related Perspective on an Emerging Work Environment", *International Journal of Environment Research and Public Health*, 16(13): 2379.
- Schultz, P. W. (2001), "The structure of environmental concern. Concern for self, other people, and the biosphere", *Journal of Environmental Psychology*, 21(4), 327-339.
- Spinuzzi, C. (2012), "Working alone together: Coworking as an emergent collaborative activity", *Journal of Business and Technical Communication*, 26(4), 399-441.
- Spreitzer, G., Bacevice, P. Garrett, L. (2015), "Why people thrive in coworking spaces", *Harvard Business Review*, September 2015, 28-30.
- Tapia-Fonllem, C., Corral-Verdugo, V., Fraijo-Sing, B. Durón-Ramos, M. F. (2013), "Assessing sustainable behaviour and its correlates: A measure of pro-ecological, frugal, altruistic and equitable actions", *Sustainability*, 5(2), 711–723.
- UN (2021), "The sustainable development goals report", available at: <https://unstats.un.org/sdgs/report/2021/> (accessed 10 March 2022).
- Waters-Lynch, J. M., Potts, J. (2017), "The social economy of coworking spaces: A focal point model of coordination", *Review of Social Economy*, 75(4), 417-433.

Sustainability performance of the workspace: an analysis of the Best For The World 2021 companies

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ABSTRACT

Since the United Nations have articulated the 2030 Agenda for sustainable development (SD), companies have paid more attention to assessing corporate engagement against the Sustainable Development Goals (SDGs). In practice, these goals push companies to measure their sustainability performance using Environmental, Social, and Governance scores (ESGs). ESGs evaluate environmental, social, and economic responsibility strategies of companies. Although these indicators look at many different aspects of a company's sustainable performance, the workspace is not included as a criterion of evaluation, which is a significant limitation as the Architecture Engineering Construction and Operation industry (AECO) has an important role in reducing the environmental impact of organisations. Therefore, the present study aims to investigate how companies evaluate the sustainability performance of workspaces. After reviewing the scientific literature about the application of ESGs in the space dimension, the study analyses a sample of companies (the top 5% of all B Corporates, categorised by company size in 2021) that have been evaluated the "Best For The World 2021" in terms of SD. B Lab awards those companies that meet certain standards of transparency, accountability, sustainability, and performance looking at five major Impact Areas, namely Governance, Workers, Community, Environment, and Customers. Results show that B Corporation identified a link between environmental impact of buildings and the companies' sustainability performance. However, the Assessment of B Corporate doesn't perform a deep analysis and doesn't force certified companies to define sustainable strategies to minimise the environmental impact of their building portfolios.

Keywords

Office buildings sustainability, Workspace environmental performance, B Corporation.

1 INTRODUCTION

The climate change issue has shifted the business practices to sustainable principles. In 2015, the United Nations (COP21, 2015) presented the 17 Sustainable Development Goals (SDGs) to introduce sustainable development (SD) principles in national and international economies. In this contest, the real estate market, part of the Architecture, Construction, Engineering and Operation (AECO) industry, can play a key role in reducing the environmental degradation (Brouen & Marcato, 2018). Indeed, AECO consumes around 40% of total materials used in the global market and is responsible for about 50% of the total greenhouse gas emission (GHG) (Dixit et al., 2013). To overcome this issue, the European Commission (EUC) has established several legislative frameworks (Economidou et al., 2020). Since the beginning of the new Millennium, EUC has operated to firstly reduce the energy demand of buildings, for example through the 2000 Action Plan, that has been improved over the years (Geller et al., 2006). In

July 2021, EUC enacted the Climate Target Plan with the aim to reach zero-emission building stock by 2050 (EUC, 2021). Even if from the European framework AECO seems to impact only the energy consumption, buildings are responsible for consuming other resources (such as, water and construction materials), emitting pollutants, and impacting on users' life (Vanegas, 2003). Thus, considering energy the only impact of buildings is reductive (Kobayashi and Takaguchi, 2020) to introduce SD into AECO. Applying sustainability in this industry means to increase the efficiency and effectiveness of the built environment (Artistizàbal-Monsalve et al., 2022). In-use sustainable buildings need to adapt with the changes of users' needs overtime (Beadle et al., 2008). This characteristic introduces social and ethical aspects to the building system.

Indeed, investors are looking not only at financial effects, but also environmental and ethical concerns (Cajias, et al., 2011). Within the real estate market, the effects of more sustainable investments have received little attention. However, those studies that focused on the relationship between profit and sustainable issues (especially, social, and environmental) have shown the positive correlation for this market (Newell, 2008). This correlation is nowadays trying to be assessed through the Environmental, Social, and Governance (ESG) indicators, which aim to assess direct and indirect impacts of activities, assets, or companies (ERM, 2021). ESG refers to the central effects that measure sustainable impact (Brounen & Marcato, 2018). The capital market, which has the aim to commit to net zero portfolios, is incorporating ESG to make investment decisions (ERM, 2021). According to Deutsche Bank (2021) 95% of all investments will consider ESG factors by 2035. Real estate represents a key market for the global economy, and the global costs for environmental transition is about € 6.35 trillion per year (OCSE, 2021). Eichholtz et al. (2012) documented a link between the real estate market and energy efficiency of properties. This link suggests a positive correlation between the "greenness" of the portfolio, assessed through green certifications (such as, LEED), and the operating performance of the investment (Eichholtz et al., 2012).

The role played by the built environment in the global economy makes buildings the engine for sustainable innovation and growth (Vibeke et al., 2022). More investors became interested in contributing to the SD, which looks not only at companies' products and services, but also on companies' strategies and assets. Assessing the sustainable performance of office buildings may help to minimise the environmental degradation of the AECO industry. Since just 25% of the existing European building stock complies with the environmental standards (Verma, 2020), evaluating office buildings, which represent the 24% of European stock (Economidou et al., 2011), will determine strategies for the industry. Although office buildings are responsible for around 20% of the AECO energy and material consumption (EIA, 2013), companies seem to not report the impact of their assets in their sustainability reports (KPMG, 2021). However, according to CBRE (2022) and JLL (2021) this tendency is changing, as sustainability is becoming an important part of investment strategies into every stage of the property lifecycle. Therefore, the present study aims to investigate how companies evaluate the sustainability performance of office buildings.

Generally, companies face difficulties in addressing social and environmental issues for their practices (Carlos & Lewis, 2018). One recent effort to help companies has been made by B Corporation (B Corp). Thus, to define the sample of analysis, the present research looks at those companies that have been certified as the best in the world in 2021 (BFTW, 2021) for sustainability matters by B Corporation (B Corp). B Corp certifies the effectiveness of a company in developing sustainable policies and shows the improvement areas. The study analyses the top 5% of all B Corporates for 2021. After a brief introduction of B Corporation, the study presents the methodology, reports the results, and discusses conclusions.

1.1 B Corporation

A general sustainability evaluation's framework, based on ESG indicators, is B Corporation (B Corp), developed in 2006 by B Lab. The general aim of B Lab has been to create a community that meets rigorous standards of social, environmental, and economic performance. Thus, B Corp evaluates companies' profit missions and social responsibility. B Corp wants to create a community of sustainable companies by differentiating those from "greenwashing" ones (White, 2015).

To obtain B Corp, companies must demonstrate high social and environmental performance by carrying out a B Impact Assessment³⁵ (BIA). BIA is a questionnaire that measures five different areas of impact, namely:

- Governance: the company mission, engagement around its social and environmental impact, ethics, and transparency;
- Workers: the company contributions to employees' financial security, health and safety, wellness, career development, and engagement and satisfaction;
- Community: the company impact and engagement with the communities in which it operates, by assessing, for example, level of diversity, equity, inclusion, and supply chain management;
- Environment: the company overall environmental management practices (such as, its impact on the air, water, land, and biodiversity); and
- Customers: the company stewardship of its customers through the quality of its products and services, ethical marketing, data privacy and security, and feedback channels.

The completed BIA of a company is then reviewed by B Lab, which may ask for more details and documents. Finally, if the composite score is greater than 80 (out of 200), the company is eligible for becoming a B Corp. BIA has a validation of two years; after the company needs to retake the assessment.

2 METHODOLOGY

This study started with the collection of all those companies listed into the B Corp website, that scored a B Impact Assessment (BIA) equal to or greater than at least 80 points for 2021.

BFTW (2021) showed the 5% top companies in terms of BIA for each Impact (Governance, Workers, Community, Environment, and Customers) in each company size cluster.

For each company, the study collected several data, as follow:

- Company size: 5 cluster of number of employees (0 employees, 1-9 employees, 10-49 employees, 50-249 employees, and 250+);
- Specific type of industry (such as, Textiles, Solar Panels Installation, and Scientific R&D);
- Sector in which the company operates (such as, Manufacturing, Agriculture/Growers, and Service with Minor Environmental Footprint);
- Year of foundation;
- Geographical Area of foundation: Continent and Country;
- Impact: the companies' influences on sustainable development, which are divided into Impact Areas (Governance, Workers, Community, Environment, and Customers), and Overall Impact (the sum of all points scored in the BIA for all the five Impact Areas);
- Rank: companies that obtain a maximum-scored (MAX) or minimum-scored (MIN) BIA; and
- Impact Topics: categories that specifically defined each Impact Areas (such as, Ethics, Water, and Education).

³⁵ Accessed by: <https://bimpactassessment.net/>

Then, the study recognized two major clusters, namely Impact and Company size, that were combined into Specific Clusters (SCs) to perform the analysis (Table 1):

Table 1. SCs used for the present study analysis – elaboration of the authors

Specific Clusters (SCs)	Cluster 2: number of Employees				
Cluster 1: Impact Areas and Overall Impact	0	1-9	10-49	50-249	250+
Governance	Governance, 0	Governance, 1-9	Governance, 10-49	Governance, 50-249	Governance, 250+
Workers	Workers, 0	Workers, 1-9	Workers, 10-49	Workers, 50-249	Workers, 250+
Community	Community, 0	Community, 1-9	Community, 10-49	Community, 50-249	Community, 250+
Environment	Environment, 0	Environment, 1-9	Environment, 10-49	Environment, 50-249	Environment, 250+
Costumers	Costumers, 0	Costumers, 1-9	Costumers, 10-49	Costumers, 50-249	Costumers, 250+
Overall Impact	Overall Impact, 0	Overall Impact, 1-9	Overall Impact, 10-49	Overall Impact, 50-49	Overall Impact, 250+

The data relating to 5% of companies classified as B Corp were processed in a spreadsheet, highlighting all the aforementioned information. A total number of 808 companies, globally distributed, was collected. The initial spreadsheet was composed of 62 companies with 0 employees, 264 with 1-9 employees, 295 with 10-49 employees, 129 with 50-249 employees, and 58 with 250 or more.

The sample, examined through SCs, showed a random distribution among company size and Impact. Thus, the study used the Maximum Likelihood Estimator (Balakrishnan et al., 2002) to identify an equal sample of companies per each SCs. The homogenous criterion of analysis defined the MIN and MAX companies per each SCs. However, as some SCs presented more companies for both MIN and MAX, the study decided to consider all the overlapped companies. So, “Environment, 1-9”, “Overall impact, 1-9”, and “Overall impact, 10-49” presented two companies each equally MIN. Moreover, one company, Dr. Bronner’s³⁶, was MAX in three SCs, namely “Overall Impact, 250+”, “Community, 250+”, and “Environment, 250+”, and was calculated just one time.

Finally, for each company the Indicators, which define BIA, were collected through the B Corp website (BFTW, 2021). This allowed to analyse how companies have been evaluated by BIA and revealed which factors influenced the Impact. One company, Aboca Group³⁷, was excluded due to lack of additional data available on the B Lab website. It was initially classified as B Corp due to its MIN on “Governance, 250+”, however no Indicators were explained.

Therefore, the analysis has been conducted through 58 companies, listed in Appendix A.

3 RESULTS

The quali-quantitative analysis of the 58-company sample, 30 MIN and 28 MAX, was performed through two levels.

First, the quantitative analysis, that included geographical (location of foundation), historical (year of foundation), and sectoral (industries and sectors) criteria. This analysis was necessary to understand where the best performing companies were located, the relationship between the

³⁶ Accessed by: <https://www.drbronner.com/>

³⁷ Accessed by: <https://www.aboca.com/it/>

company size and the year of foundation, and the sector in which more companies were classified as BFTW 2021.

Second, a qualitative analysis on Impacts and their Impact Topics is performed to identify wherever the evaluation of building office impact is assessed by BIA.

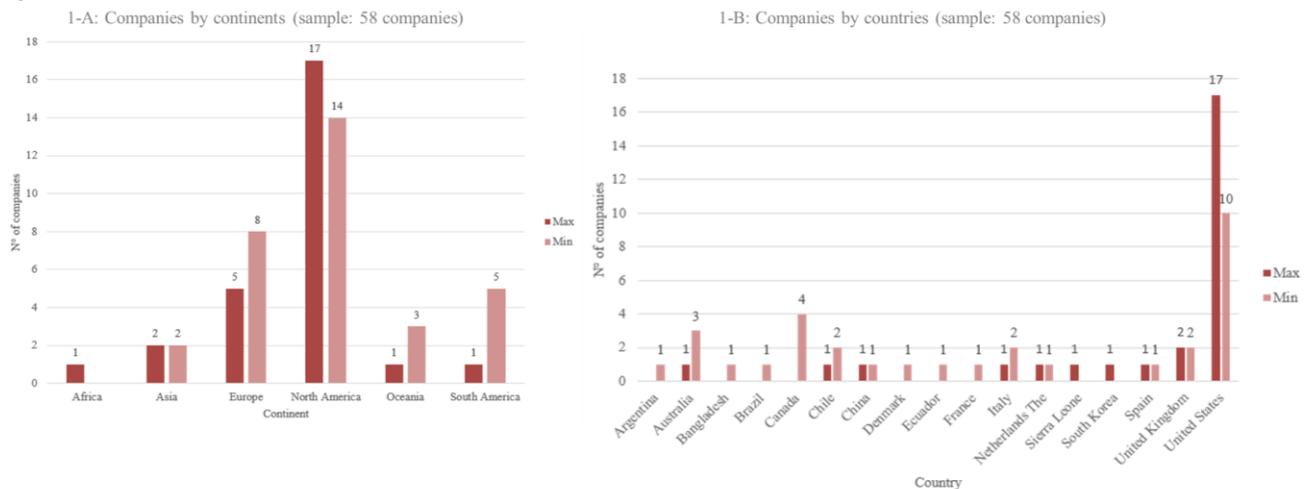
3.1 Geographical distribution: quantitative analysis

The geographical analysis was performed by looking at both the MAX and MIN companies. First, Figure 1-A makes evident that the highest concentration of B Corp is in North America, especially in the USA (Figure 1-B). Probably, this is because B Lab is an American organization, and evaluates North American companies since 2006. While it landed, for example in Europe, just in 2013 (Scuri, M., 2017).

Second, MAX companies are mainly located in the United States (Figure 1-B). Just one is in Africa, two in Asia, five in Europe, one in Oceania, and one in South America. These continents present more MIN companies. For example, Figure 1-B reports eight companies in Europe (in Denmark, France, Italy, The Netherlands, Spain, and UK), which is not far from the 14 Americans.

Finally, Figure 1-B shows that some of the developing countries are listed as BFTW 2021 companies. Sierra Leone is presented as a MAX company, and it is the only representative for Africa. While a MIN company represents both the Bengali and Ecuadorian economy.

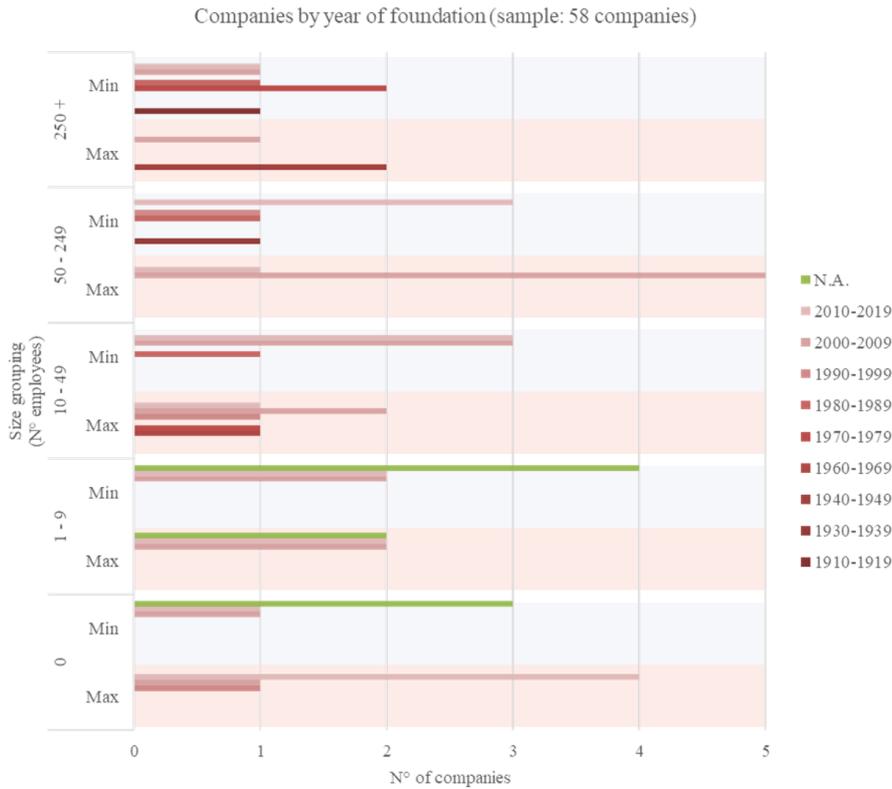
Figure 1. MAX and MIN companies by countries (Figure A), and by countries (Figure B)– elaboration of the authors



3.2 Year of foundation: quantitative analysis

The analysis of the year of foundation was performed by aggregated companies in decades. First, Figure 2 shows that small companies, between 0 and 9 employees, are the most recent. These companies were mainly born after 2010. Only 9 companies of this sub-sample were born between 1990 and 1999. Indeed, most of those companies with 0 employees, mainly identifiable as start-ups, were born after 2000. Second, very large companies, with 250+ employees, are mainly older in respect to the small companies. Finally, middle companies concentrate at the turn of the Millennium.

Figure 2. MAX and MIN companies by year of foundation, cauterized by number of employees – elaboration of the authors



3.3 Sectors: quantitative analysis

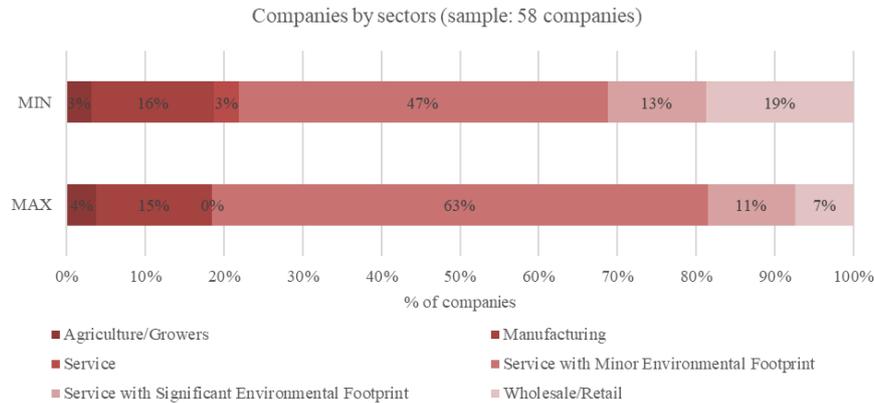
The analysis by sectors was performed by looking at the sectors' division made by B Corp, which identifies:

- Agriculture/Growers: companies that operate a farm, agro processing facility, or source crops directly from farmer-growers for a majority of raw input materials (e.g., fruit or vegetable farms, farmers' markets, coffee plantations, or coffee roasters);
- Manufacturing: companies that manufacture >10% of their own products, also sold by another company (e.g., contract manufacturers, assembly lines, breweries, or livestock producers);
- Service: companies that operate in banking branches (e.g., investment advising, or asset management);
- Service with Minor Environmental Footprint: companies that provide non-physical services/product (e.g., law firms, marketing/communications agencies, or software company);
- Service with Significant Environmental Footprint: companies that work in a service industry (e.g., hotels, restaurants, landscaping companies, or universities); and
- Wholesale/Retail: selling companies that don't operate the manufacturing processes (e.g., grocery stores, e-commerce retailers, consumer goods companies, or wholesalers of physical goods).

First, Figure 3 shows that most companies refer to the services sectors' sphere. Indeed, 47% of MIN companies and 63% of MAX companies belong to "Service with Minor Environmental Footprint"; and, 13% MIN companies and 11% MAX companies "Service with Significant Environmental Footprint". While few companies belong to "Agriculture/Growers" and "Manufacturing". These sectors deal with the transformation of raw materials into finished

products. Thus, their impact is usually greater than service companies even if they implement high-sustainable processes. For example, *African Clean Energy*³⁸ focused on making clean energy accessible for rural households through a solar charger. Or, *N&B Srl Società Benefit*³⁹ implemented a sustainable supply chain from organic farming to the production of beauty-products.

Figure 3. MAX and MIN companies by sectors – elaboration of the authors



3.4 Impact and Indicators Analysis: qualitative analysis

The analysis of Impact and Indicators is relevant to understand which factors affect BIA. BIA is divided into five stakeholders-focused, the Impact Areas (Governance, Workers, Community, Environment, and Customers) (BFTW, 2021). Each Impact Areas is organized into Impact Topics, which relate to the impact for companies’ daily operations or companies’ overall business model (Figure 4). Daily operations impact assesses the impact of companies’ facilities, purchases, internal policies, or governance structures. While business model impact assesses specific and positive impact for stakeholders. This impact is applied to companies based on their sector, size, and business.

Among all the Impact Topics, some look at the people sphere, such as “Health, Wellness, & Safety” or “Diversity, Equity, & Inclusion”; some at the business sphere, such as “Governance Metrics” or “Economic Impact”; some at the environmental sphere, such as “Water” or “Air & Climate”; and, some at the provision of products/services, such as “Customer Stewardship”.

³⁸ Accessed by: <https://africancleanenergy.com/>

³⁹ Accessed by: <https://www.nbnaturalisbetter.com/it/prodotti/>

Figure 4. Impact Topics associated to each Impact Area – elaboration of the authors of BFTW, 2021

Impact Topics	Company impact TO	Definitions
GOVERNANCE		
Mission & Engagement	Daily operations	Companies' mission and engagement expression and protection (such as, how the company integrates social and environmental performance into decision-making)
Ethics & Transparency	Daily operations	Companies' ethics, accountability, and transparency (such as, what information the company makes available and transparent)
Mission Locked	Overall business model	Protection of companies' mission and involving stakeholders in decision making
WORKERS		
Financial Security	Daily operations	Financial well-being (such as, the company's lowest wage)
Health, Wellness, & Safety	Daily operations	Physical well-being (such as, the health-wellness initiatives/policies that the company offer to workers)
Career Development	Daily operations	Career (such as, trainings provided by the company)
Engagement & Satisfaction	Daily operations	Social well-being (such as, supplementary benefits provided by the company)
Worker Owned	Overall business model	Level of workers' inclusion in the definition of distributive ownership model (such as, trade unions)
Workforce Development	Overall business model	Provision of job trainings for chronically underemployed populations
COMMUNITY		
Diversity, Equity, & Inclusion	Daily operations	Community-oriented problems (such as, how many women are managers in the company)
Economic Impact	Daily operations	Impact on the local economy development (such as, companies' local involvement)
Civic Engagement & Giving	Daily operations	Formal charitable giving commitments
Supply Chain Management	Daily operations	Fair trade sourcing or distribution via microenterprises (such as, the tenure of companies with their suppliers)
Supply Chain Poverty Alleviation	Overall business model	Specific strategies that reduce poverty
Microenterprise / Microfranchise	Overall business model	Micro-entrepreneurship opportunities for individuals
Local Economic Development	Overall business model	Strategies to strengthen local economies and national economic development
Producer Cooperation	Overall business model	Innovative organization of production, decision making, and profit distribution
Designed to Give	Overall business model	Specific policies and programs to give companies' profit to charitable causes
ENVIRONMENT		
Environmental Management	Daily operations	Environmental management practices (such as, green building standards)
Air & Climate	Daily operations	Impact on air and climate (such as, energy consumption)
Water	Daily operations	Impact on water sustainability (such as, water consumption)
Land & Life	Daily operations	Impact on land and biodiversity (such as, the programs used by the company to evaluate the reduction in waste generation)
Renewable Energy	Overall business model	Provision of products/services that reduce the greenhouse gas emissions
Land & Wildlife Conservation	Overall business model	Provision of products/services that reduce resource use
Toxin Reduction	Overall business model	Provision of products/services that preserve/restore natural environments
Resource Conservation	Overall business model	Provision of products/services that reduce/remediates toxins or pollution
Environmental Education	Overall business model	Provision of products/services that promote awareness about environmental issues
Environmental Innovation Practices	Overall business model	Comprehensive environmental practices that redesign traditional processes
CUSTOMERS		
Customer Stewardship	Daily operations	It evaluates a company's stewardship of its customers through the quality of its products and services, ethical marketing, data privacy and security, and feedback channels.
Basic Services	Overall business model	Provision of products/services that provide fundamental basic services to individual without prior access
Education	Overall business model	Provision of products/services that enhance skills and knowledge
Arts, Media, & Culture	Overall business model	Provision of products/services that promote/preserve artistic, cultural, or civic engagement
Economic Empowerment	Overall business model	Provision of products/services that assist the generation of income
Health & Wellness	Overall business model	Provision of products/services that promote the health and wellness of individuals
Support for Purpose Driven Enterprises	Overall business model	Provision of products/services that enable the financial or operational success of businesses
Impact Improvement	Overall business model	Provision of products/services that drive positive changes in organizations to improve social/environmental impact
Serving those in Need	Overall business model	Provision of products/services that target/benefit population
Industry Specific Addenda	Overall business model	Provision of products/services that benefit the specific industry in which the company is part of

The analysis of all the Impact Topics shows that few impact factors look at the buildings in which the certified companies operate. BIA provides a few questions related to the used buildings by the certified companies in the Environment Impact Area. First, BIA asks a general question about buildings, “*What kind of facilities does your business primarily operate in?*”, and proposes for answers “Company-owned office space”, “Leased office space”, “Co-

working Space”, or “Virtual or home offices”. Second, it assesses the % of companies’ building portfolio certified as green buildings. Third, it evaluates the improvements, in the matter of building energy, water, and waste, done by the companies. Fourth, it investigates the companies’ environmental management system, covering energy/water usage, carbon emissions and waste generation. Finally, it asks about the consumption of non-renewable and renewable energy, of water, the reduction of greenhouse gas emissions, and waste generation. Comparing the Environmental results of the 58 companies, sample of the present analysis, it emerges that not all Environmental Impact Topics are assessed. Only the first general question is assessed by all companies, while 66% of companies assessed “Land & Life”, “Water”, and “Air & Climate”, and 64% “Environmental Management”. The first environmental question related to the building used by the company is evaluated at maximum 74,1 points by MUD Jeans International⁴⁰, which produces jeans with ecology material. However, the sustainability report of these companies does not mention any impact of its building portfolio and doesn’t detail any improvement policies for offices and factors.

4 CONCLUSIONS

BIA of B Corp is well known as the highest standard to verify social and environmental performance, transparency, and legal accountability of companies. However, BIA lacks in assessing environmental impact of companies’ office buildings. Indeed, there are no direct questions related to buildings and their performance in the assessment. The analysis of Environmental Impact Topics, reported in the results, shows that B Corp doesn’t focus a lot on the effect of office buildings’ environmental impact on the overall sustainable performance of companies. Even Workers Impact Topics do not consider building related issues to determine employees’ physical and social well-being, and this is a missed opportunity to gain useful data and improve companies’ awareness on the subject. As stated by Brouen & Marcato (2018), AECO can play a key role in reducing environmental degradation, and this is the reason why, BIA should assess more information related to the building portfolios of certified companies in order to suggest sustainable policies, and push companies to a smart sustainable buildings philosophy. Moreover, the legislative frameworks established to reduce the energy demand of buildings should be strictly monitored to verify effectiveness and it should be expanded to also take into account resources such as, water and construction materials, emitting pollutants, and impacting on users’ life (Vanegas, 2003). It is not sufficient to consider one single aspect and expect to produce a positive effect on AECO. The present study offers some limitations. The quanti-qualitative analysis of Impact Areas and Impact Topics does not deeply compare the environmental results for buildings with the sustainability reports of companies. On one hand, to better understand companies’ policies related to buildings’ environmental impact, a deeper analysis of certified companies’ sustainability reports needs to be developed, which will be conducted in future developments of the study. On the other hand, B Corp doesn’t report an explanation of all the Impact Topics and their maximum scores. Moreover, as the BIA presents 50 variations on the Assessment, depending on size, industry, and geography of the company, scores are difficult to interpret. Future implementation of the study would use statistics to define the correlation among the obtained Overall Impact and the Impact Topics related to the evaluation of companies’ buildings portfolio.

⁴⁰ Accessed by: <https://mudjeans.eu/>

REFERENCES

- Artistizàbal-Monsalve, P., Vàsquez-Hernàndez, A., Botero L.F. (2022), “Perceptions on the processes of sustainable rating systems and their combined application with Lean construction”. *Journal of Building Engineering*, 46.
- Balakrishnan, N., Brain, C., Mi, J. (2002), “Stochastic Order and MLE of the Mean of the Exponential Distribution”, *Methodology And Computing In Applied Probability*, 4, 83-93.
- Beadle, K., Gibb, A., Austin, S., Fuster, A., Madden, P. (2008), “Adaptable Futures: Sustainable aspects of Adaptable Buildings”.
- Belani, D., Makwana, A.H., Pitroda, J., Vyas, C.M. (2014), “Intelligent building new era of today’s world”, *Trends and Challenges of Civil Engineering in Today’s Transforming World*, Surat, India, 1-16.
- BFTW (2021), Available at: <https://kb.bimpactassessment.net/support/solutions/articles/43000626369-best-for-the-world-2021> (accessed 31 December 2021).
- Brouen, D., Marcato, G. (2018), “Sustainable Insights in Public Real Estate Performance: ESG Scores and Effects in REIT Markets”, available at: <https://buildings.lbl.gov/sites/default/files/ESG%20measures%20FinalVersion.pdf> (accessed 28 March 2022).
- Cajias M., Fuerst F., McAllister P., Nanda A. (2011), “Is ESG Commitment Linked to Investment Performance in the Real Estate Sector?”, available at: <https://centaur.reading.ac.uk/22720/> (accessed 28 March 2022).
- Carlos, W. C., & Lewis, B. W. (2018), “Strategic silence: Withholding certification status as a hypocrisy avoidance tactic. *Administrative Science Quarterly*”, SAGE Journal, 63, 1.
- CBRE (2021), “ESG & Real Estate: Top 10 Things Investors Need to Know”, available at: <https://www.cbre.com/insights/reports/esg-and-real-estate-the-top-10-things-investors-need-to-know#introduction> (accessed 13 March 2022).
- Clery, J., Barrett, D., Holland, C., Sabir, H. (2021), “Overview of real estate companies’ environmental performance”, available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUK_Ewj67MOQhJT3AhUXR_EDHVclBhIQFnoECCsQAQ&url=https%3A%2F%2Fwww.manulifeim.com%2Fcontent%2Fdam%2Fmim-real-estate%2Fdocuments%2Fsustainability-%2F2021%2520Real%2520Estate%2520Sustainabil
- D’Oca, S., Hong, T., Langevin, J. (2018), “The human dimensions of energy use in buildings: a review”, *Renewable and Sustainable Energy Reviews*, Elsevier, 81, 731-734.
- Dieckmann, J. (2021), “What do investors expect from the bank with regard to sustainability?”, available at: https://www.db.com/news/detail/20210510-what-do-investors-expect-from-the-bank-with-regard-to-sustainability?language_id=1 (accessed 13 March 2022).
- Dixit, M. K., Lavy, S., Culp, C.H., Fernández-Solís, J. L. (2013), “System boundary for embodied energy in buildings: A conceptual model for definition”, *Renewable and Sustainable Energy Reviews*, Elsevier, 21, 153-174.
- Economidou, M. (2015), *Europe’s Buildings Under the Microscope*, BPIE, Brussel.
- Economidou, M., Todeschi, V., Bertoldi, P., D’Agostino, D., Zangheri, P., Castellazzi, L. (2020), “Review of 50 years of EU energy efficiency policies for buildings”, *Energy & Buildings*, 225, 1-20.

- Eichholtz, P. M. A., Kok, N., Yonder, E. (2012), “Portfolio greenness and the financial performance of REITs”, *Journal of International Money and Finance*, 31, 7, 1911-1929.
- Geller, H. Harrington, P., Rosenfeld, A. H., Tanishima, S., Unander, F. (2006), “Policies for increasing energy efficiency: thirty years of experience in OECD countries”, *Energy Policy*, 34, 5, 556-573.
- JLL (2021), “Valuing Net Zero & ESG for Offices”, available at: <https://www.jll.de/content/dam/jll-com/documents/pdf/research/jll-global-valuing-esg-net-zero-office-buildings-valuation-insights-report.pdf> (accessed 13 March 2022).
- Mavi, R. K., Gengetharen, D., Mavi, N. K., Hughes, R., Campbelland, A., Yates, R. (2021), “Sustainability in Construction Projects: A Systematic Literature Review”, *Sustainability*, 13, 1932, 1-24.
- Newell, G. (2008), “The strategic significance of environmental sustainability by Australian-listed property trusts”, *Journal of Property Investment and Finance*, 26, 6, 522-540.
- Proposal for a directive of the European Parliament and of the Council on energy efficiency (2021), available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0558> (accessed 13 March 2022).
- COP21 - The SustainAbility Institute by ERM (2021), Connecting ESG, Capital Markets, and CFOs.
- United Nations (2015), “Paris Agreement”, available at: https://unfccc.int/sites/default/files/english_paris_agreement.pdf (accessed 13 March 2022).
- Scuri, M. (2018), “*Certified B Corps in Italy: organization, motivations and change after the certification*”. Università Commerciali Luigi Bocconi.
- United Nations (2022), “Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development”, available at: <https://unstats.un.org/sdgs/indicators/indicators-list/> (accessed 28 March 2022).
- U.S. Energy Information Administration – EIA (2013), “Annual Energy Review”, available at: <https://www.eia.gov/totalenergy/data/annual/> (accessed 13 March 2022).
- Vanegas, J. A. (2003), “Road Map and Principles for Built Environment Sustainability”. *Environmental Science & Technology*, 37, 5363-5372.
- Verma, S. (2020), “The crest of the Renovation Wave: a toolkit to decarbonise the European building stock”, Build, available at: <https://www.buildup.eu/en/news/crest-renovationwave-toolkit-decarbonise-european-building-stock> (accessed 13 March 2022).
- White, T.J. (2015). “*Benefit Corporations: Increased Oversight through Creation Of The Benefit Corporation Commission*”. Journal of Legislation.

APPENDIX**APPENDIX A: List of the 58 selected companies – elaboration of the authors**

N°	MAX/MIN	Company name	Overall Impact	Employees
1	MIN	Abacus Wealth Partners, LLC	130,9	50-249
2	MIN	Ace of Air LLC	80,4	0
3	MIN	African Clean Energy BV	179,8	50-249
4	MIN	AlmaNatura Social SL	153	1-9
5	MIN	August Public Inc	91,2	10-49
6	MAX	BeyondAdmissions	81,9	0
7	MIN	BL évolution	106,2	1-9
8	MAX	Camp	136,5	1-9
9	MIN	Chandos Construction	88,9	250+
10	MIN	Community Services Group	90,4	250+
11	MAX	Dhana Inc.	124,1	1-9
12	MIN	Dictuc S.A	97,7	50-249
13	MAX	Dr. Bronner's	177,8	250+
14	MAX	Equilibrium	146,3	10-49
15	MIN	Ethelo	80,3	10-49
16	MIN	Fluid IT	141,2	10-49
17	MIN	Fratelli Carli SpA	98,3	250+
18	MIN	GeCo	107,6	10-49
19	MAX	Global Prairie	168,4	50-249
20	MAX	Good Capital Investment Group	96,1	0
21	MIN	Grameen Danone Foods Ltd	109,5	250+
22	MAX	Green Retirement, Inc.	162,7	0
23	MAX	Greenline Community Ventures LLC	110,7	0
24	MIN	Hugo & Hoby	80	0
25	MIN	Lucky Iron Fish Enterprise	80,9	1-9
26	MAX	Metis Consulting Group	149,6	10-249
27	MIN	Moonshot Academy	87	50-249
28	MAX	Mud Environmental	91,3	0
29	MAX	MUD Jeans International	124,7	1-9
30	MAX	N&B Srl Società Benefit	134,8	50-249
31	MAX	Nehemiah Manufacturing Company	112	50-249
32	MAX	Nodo Chile	93	1-9
33	MAX	Norlha	125,2	50-249
34	MIN	Northeast Solar Design Associates	90,9	10-49
35	MAX	Northwest Permanente	134,5	250+
36	MAX	OYORI Asia Co., Ltd.	120,4	10-49
37	MAX	PENSIUM, SL	133,8	10-49
38	MIN	PRANA	116,4	50-249
39	MIN	RetailOasis	80,3	10-49
40	MAX	Rising Academy Network	118,8	50-249
41	MAX	Savannah Consulting	117	0
42	MAX	Seacourt Ltd	124,3	10-49
43	MIN	Sezzle	80,7	50-249
44	MAX	Snowball	127,4	1-9
45	MIN	Solar Works	85,6	1-9
46	MIN	Soleventus	88,8	1-9
47	MAX	South Mountain Company, Inc.	184,1	10-49
48	MIN	Start Broadband	80	1-9
49	MAX	Sunrise Banks	144,2	250+
50	MIN	The Key - Prosperar na Nova Economia	90,9	0
51	MIN	The Underground Group	100,3	0
52	MIN	Too Good To Go ApS	81,6	250+
53	MIN	Tricordant	80,8	1-9
54	MIN	Trillium Asset Management	140,6	10-49
55	MIN	UpDIG	88,6	0
56	MAX	Urban Green Development, LLC	158,3	1-9
57	MAX	Virginia Community Capital	149,3	50-249
58	MIN	Wanderbus Ecuador	80	1-9

Inclusive workplace: a scoping review

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ABSTRACT

Nowadays the workforce is becoming more diverse. While Corporate Social Responsibility has become key to many organizations, it remains unclear how inclusion, equity and diversity principles are applied in office physical environments. Design for All and Universal Design strategies exist since the 1990s indicating that the built environment should be inclusive for all users, regardless of age, gender, culture, abilities, or disabilities. However, they often remain at a general level by listing principles more than operative design strategies. The aim of this paper is to explore how the scientific literature has addressed inclusive workplace design and management so far. A scoping review is adopted to answer the question of what is known from the existing literature about workplace design strategies to assure inclusive design. A preliminary analysis of 15 papers disentangles principal themes and strategies that characterise the way inclusion principles are applied in the workplace. As possible future research lines, this contribution will reflect on the opportunity to create operative design strategies and indicators for an inclusive workplace.

Keywords

Workspace, Inclusion, Diversity, Universal design, Design for all.

1 INTRODUCTION

The life expectancy of people with particularly severe or multiple impairments is increasing all over the world (WHO, 2011), as it is their quality of life, including the fact that people living with physical, sensory, mental health or intellectual impairments can finally access the world of work. At the same time, the 21st century society is becoming more diverse, which generates a growing complexity in meeting user needs (e.g., elderly, cultural issues, etc.). More than ever before, today's workforce is composed of people with a large age span, who have different origins and cultures. While the topic of diversity and inclusion (D&I) isn't new, since 2020 companies seem to place more attention on their D&I initiatives. The reason is multifold: there is a growing number of laws and requirements being enacted to support environmental, social and governance (ESG) criteria and the UN's Sustainable Development Goals; COVID-19 has placed further attention on health, safety, and inclusion; race-related incidents have stressed the fact that inequalities and inequities are not solved yet. Advancing workplace diversity is

extremely important today for organizations as, on the one hand, consumers are looking for companies with a proven commitment to D&I and, on the other hand, employees are looking to leadership to make a difference. Organizations must evolve or risk a shrinking candidate pool, reduced market share, and ultimately, lost profitability (Oracle, 2021).

This contributes to enhance the awareness of social issues within companies and workspaces comprehending Diversity, Equity and Inclusion (DE&I). Organizations that have reached maturity in gender parity are now addressing broader issues of diversity and inclusion: national and socioeconomic origins, culture, educational levels, work experience, sexual orientation, and disabilities (McKinsey, 2022). For instance, some companies are introducing the role of “Chief Diversity Officer”, are carrying out internal surveys to assess the mismatch between the company’s and their employees’ perception whether the corporate environment is inclusive, and are developing new measurements for benchmarking (Oracle, 2021). Organizations in some countries—such as Brazil, the United Kingdom, and the United States—have developed metrics assessing all forms of diversity. However, the regulatory and cultural environment often makes it difficult to gather data on any aspect of diversity beyond gender and age. A recent survey by McKinsey and Club 21e Siècle called “The French Corporate Diversity Barometer” asked 800 executives only about the diversity of origins and socioeconomic conditions (McKinsey, 2022). The results of this survey rise a couple of interesting matters. First, a considerable gap emerged between diversity as measured by objective data (e.g., national origin) and as reported by the personal perception of respondents. Second, McKinsey’s research concludes by saying that “*Companies must embed the diversity effort and action plan in a broader approach to inclusiveness implanted in the organization’s very culture. All employees should feel not only authorized but also encouraged to express every component of their personalities in their professional settings and daily activities.*” Answering the need of companies to embrace DE&I more extensively, professional courses have been launched by highly ranked universities to boost leaders’ awareness and commitment to such issues (e.g. <https://grow.stanford.edu/browse/leverage-diversity-and-inclusion-for-organizational-excellence>). Nevertheless, among the pillars supporting the adoption of an inclusive culture, the spatial component is missing. This despite physical space being recognized as one element of the symbolic corporate identity (Holtzhausen & Fourie, 2009). To what extent does the workspace support the principles of diversity and inclusion?

Some can argue that the principles of *Inclusive Design* already exist and just need to be further applied to workplace strategies. Different approaches to inclusive design exist in relation to the geographical context where they have been introduced. In 1995 Ron Mace coined the term *Universal Design* in the U.S. (Mace, 1985). *Design for All* was defined in 2004 as “*the design for human diversity, social inclusion and equality*” (EIDD, 2004), that allows everyone to take part in the activities and services of the society by providing the same experience of the environment, thus ensuring dignity of all users. It overcomes the concept of architectural barriers which focuses only on physical disabilities, to encompass more broadly the design of spaces accessible and usable by all sorts of different people regardless of age, gender, culture, abilities, or disabilities (Froyen, 2012). The expression *Inclusive Design* originated in the UK as a strategy to understand the user experience and to address marketing of particular design objects to the appropriate target (Clarkson & Coleman, 2015). However, all the theoretical approaches that go under the umbrella cap of *Inclusive Design* have the common objective to promote an environment able to satisfy the needs of the widest range of users with or without disabilities. In this paper we are going to use the term *Inclusive Design* to comprehend all the above-mentioned design strategies.

Regarding the application strategies of Inclusive Design, in 1997 the Center for Universal Design developed the 7 ‘Principles of Universal Design’ as guidelines to inspire designers, that

are: Equitable Use, Flexibility in Use, Simple and Intuitive Use, Perceptible Information, Tolerance for Error, Low Physical Effort, Size and Space for Approach and Use (Connell et al., 1997). These principles have been updated with the 8 Goals of Universal Design (Steinfeld & Maisel, 2012) that highlight the importance of social inclusion and equity. Indeed, aspects as social aggregation, privacy, cultural appropriateness, and well-being for different users are fundamental elements to design inclusive environments as well as physical usability and spaces' accessibility (Mosca & Capolongo, 2020).

Besides these conceptual frameworks, operative tools are much needed to support designers to identify users' physical and social needs within the built environment and translate them into inclusive design solutions (Ielegems et al., 2014). Only few building types have been evolving recently to embrace such concepts. Among them hospitals (e.g. St. Olav Hospital in Trondheim that won the Universal Design Awards in 2014), healthcare facilities, hotels, and few public buildings (e.g. service station Autogrill Villorosi Est that was assigned the Design for All Label). Nevertheless, these examples remain isolated best practices that are still far from becoming a standard, especially in the corporate real estate market. Even though inclusion and diversity are constantly stressed by Corporate Social Responsibility policies, they often remain at a general and conceptual level, by listing principles more than operative design solutions in the work environment.

The objective of this paper is to investigate to what extent the Inclusive Design principles have been adopted and studied in work environments and whether their implementation had any relevant effect, either on individual or organizational level. A review of the literature is undertaken to answer the following question: *“What is known from the existing literature about workplace design strategies to assure inclusive design?”*. A scoping review method is adopted to disentangle principal themes and strategies assuring that multiple layers of inclusion are taken into consideration in workplace design and management. Eventually, this contribution aims to reflect on the opportunity to create operative design strategies and indicators for an inclusive workplace.

2 METHODOLOGY

The scoping review methodology was adopted in order to provide a broad, in-depth overview of the existing literature and finally develop a synthesis of principal themes and strategies for inclusive workplace design and management. This research employs the framework by Arksey and O'Malley's (2005) for scoping reviews. The framework includes five stages. The first stage is *identifying research question* as the stage that guides the search strategy. As introduced above, the research question of this paper is: *“What is known from the existing literature about workplace design strategies to assure inclusive design?”*. The definition of the research question led to the first *screening of relevant studies* (stage two of scoping review). To start, existing publications on the topic were scouted through Scopus Database in order to assure high quality of contributions. As scoping reviews aim at being as comprehensive as possible, including both published and unpublished works in scientific and non-scientific outlets, future development of this preliminary study will extend the search to other databases as well as to grey literature from existing networks, relevant organizations and conferences in the field of inclusive design. After discussion among the authors, a structured search for titles, abstract and keywords in Scopus combined two sets of keywords: a first set related to inclusive design (i.e., “inclusive design” OR “universal design” OR “design for all” OR “includi*” OR “accessibility”), and a second set related to workplace design (i.e., “workspace*” OR “organiz* space*” OR “office space*” OR “office design”).

Altogether 383 references were listed, mostly published after year 2000. The study selection involved *post hoc inclusion and exclusion criteria* (third stage of scoping review). In this phase,

we excluded literature in mathematics; physics; earth sciences; biology; chemical sciences; agriculture; pharmacy; and immunology. Of note, results in disciplines emerged because the keyword “workspace” is intended in these scientific fields as the setting of lab experiments.

The titles and abstracts of the remaining 238 studies were independently analysed by all the authors to define their consistency with the research question. After the analysis, 157 papers were dropped because they were unrelated to the aim of this paper. Namely, these studies alternatively focused only on universal design, inclusive design or design for all but in other spatial context such as hospitals or schools or they were studies on workplace design but without an inclusive design lens. Among the remaining 81 studies, only 15 papers were unanimously considered by all authors as precisely targeting the research question. The analysis of the remaining 66 paper will require further discussion among the authors and will be elaborated in the future development of this research.

As to the fourth and fifth stage of the scoping review methodology – *charting the data* and *collating, summarizing and reporting the results* – this research adopted qualitative content analysis. Data was charted to *diversity features* that each paper targets and to *workspace features* under analysis. Finally, a summary framework was created to report the preliminary results (Table 1). The framework lists different aspects, including: the *diversity features* that were considered in each study (e.g., diversity of age, gender, race, abilities, etc.), the *objectives* of the specific study, the *methods* adopted to perform the study, the *workspace features* under consideration in terms of type of office layout / equipment / furniture, and the *outcomes* of the selected papers. Initial results and interpretation of the analysis are reported in the section below.

3 RESULTS AND DISCUSSION

3.1 Diversity

Out of 15 papers, eight focus on physical impairment (Bend & Priola, 2021; Branham and Kane, 2015; Kar and Mullick, 2014; Know, 2020; Mathiansen & Frandsen, 2016; Moschonas et al., 2014; Van Laer et al., 2020; Wang and Piper, 2018), considering both impairments depending on ageing (Moschonas et al., 2014; Kar and Mullick, 2014) and congenital impairment such as blind and deaf people, and people with motor difficulties. Other types of diversity that are considered in the other half of the sampled papers are: sexuality (Willis, 2009), gender, age and personality (Afacan, 2015; Marzban et al., 2021), individual culture and national background (Kämpf-Dern and Konkol, 2017), organizational culture (Lo & Diochon, 2019), and job security (Pacchi and Mariotti, 2021).

3.2 Objectives

The papers included in the review study either the material elements of the workspace or the immaterial aspects that affect inclusion. The former topic is typically addressed by papers that study how to improve the equipment and arrangement of workstations to make them more easily usable for all (Afacan, 2015; Branham and Kane, 2015; Kar and Mullick, 2014; Mathiansen & Frandsen, 2016; Moschonas et al. 2014). The latter topic, instead, is covered in a distinct set of papers. This includes a couple of papers that elaborate on power relations in the workplace (Lo & Diochon, 2019; Van Laer et al., 2020). In addition, this concerns also research on the perception of employees whether they feel the working environment being inclusive or not (Willis, 2009; Smolland and Morrison, 2019), which is in line with trends reported by a number of companies (Oracle, 2021). Even though the papers covering more immaterial aspects do not specifically analyse the spatial components of the workplace, they still intend the space as an important agent in underpinning a sense of inclusion for diverse categories of people. For instance, Lo & Diochon (2019) argue that the presence of a FabLab

into the Renault headquarters is the key factor empowering the emergence of innovative sub-cultures within the company.

Whereas most of the papers either consider exclusively the ‘diverse’ category of employees or consider ‘diversity’ only tangentially, interestingly, one paper (Van Laer et al., 2020) investigates the relations between disabled and non-disabled employees.

3.3 Methods

Most of the analysed papers are based on qualitative methods, while no one mention objective and quantitative methodologies adopted (e.g. rating systems). Interviews, participatory design, surveys and observations are the most common investigative methods in the field. A couple of papers entail a literature review (Kämpf-Dern and Konkol, 2017; Marzban et al., 2019). However, Kämpf-Dern and Konkol (2017) apply the term ‘inclusion’ to workplace change according to Inclusive Design, meaning that all the stakeholders (who might differ by age, gender, abilities, cultural or national background, experience and personal traits) should be involved in this kind of processes to understand the needs of various final users from the design phase (EIDD, 2004) to achieve the goal of performance-oriented workspaces. Similarly, Marzban et al. (2019) undertake a review of papers reporting positive and negative effects of Activity-Based Working (ABW) approaches to conclude that ABW might indeed support the accommodation of individual differences. Both the reviews, though, are very generic and only barely touch upon the topic of inclusion and diversity, which is not the real focus of the two critical analysis of the literature.

Only one paper relies on a survey of more than 300 people working in coworking spaces (Mariotti and Pacchi, 2021).

3.4 Types of workspace

The way research approaches spatial factors for inclusion is varied and crosses different scales. Some papers focus on specific devices that support daily work such as corridors, telephone, drawer, stapler, printer (Moschonas et al., 2014), counters (Kar and Mullick, 2014), lighting (Mathiansen & Frandsen, 2016). Others instead address layout and arrangement of workstations: Branham and Kane (2015) study shared workspaces, Mathiansen & Frandsen (2016) look at single and open-plan offices, open-plan settings are addressed by Afacan (2015) and Smolland & Morrison, 2019.

Some papers are a-specific regarding the type of workspace (Willis, 2009; Kämpf-Dern and Konkol, 2017; Van Laer et al., 2020; Know, 2020).

A couple of papers cover third spaces (Pacchi and Mariotti, 2021; Lo & Diochon, 2019), and one includes homes as workspaces (Wang and Piper, 2018).

No paper focuses on the relation between the outside and in the inside of the office, and mobility issues related to commuting. Especially with the emergence of COVID-19 and the increase in flexible working arrangements, the impact of alternative corporate real estate and workplace strategies that include multi-locality of work might be an interesting topic of investigation.

4 OUTCOMES

The outcomes range from more theoretical to more practical. Some studies come out with design specifications or identify specific factors influencing the experience of diverse categories of workers (Kar and Mullick, 2014; Branham and Kane, 2015; Afacan, 2015; Mathiansen & Frandsen (2016). Some studies only hint at the potential of certain spaces to empower the widest range of workers but without specific reference to workplace strategies or layout solutions (Lo & Diochon, 2019; Smolland & Morrison, 2019; Know, 2020; Marzban et al., 2021; Pacchi and Mariotti, 2021). Finally, some studies try to outline a conceptual framework (Kämpf-Dern and Konkol, 2017). The only paper introducing the concept of

innovative measures to assess the effectiveness of inclusive environments is Know (2020) who proposes to expand the approach of Deliberately Developmental Organization - DDO where the principle of productivity is not dominant, but continuous learning, growth and development are at the centre. However, this study does not specifically refer to design and architectural solutions.

5 CONCLUSION

This paper highlights that the topic of diversity, equity and inclusion in the workplace is still underdeveloped. The preliminary results of this literature review is a first attempt to analyse the application of Inclusive Design principles to workspace design and management. Even though the literature under examination still needs to be expanded with the addition of further sources, a few critical considerations can be already made.

First, studies tend to focalize their attention either on ‘diverse’ categories of employees or on ‘diversity’ as a tangential aspect. Namely research investigated how certain office features respond to diversity, and how diversity, in general, can be better accommodated in specific workspace environments. More research is welcome to disentangle the relations between disabled and non-disabled people in the workspace and to include a more comprehensive set of ‘diversities’.

Second, the times might be mature to perform more quantitative studies on Inclusive Design in the workplace. Qualitative studies are useful to understand specific user needs. Most of the reported papers interviewed or observed small samples of employees and executives. However, quantitative methods make it possible also to compare the performance of a wider number of case studies through an objective approach. It would be interesting to survey a large number of companies in different countries to understand how their human resource policies in Inclusive Design are combined with spatial arrangements, specific design solutions and facility management practices, and how these in turn affect the perception of employees, executives and even customers about inclusivity.

Moreover, Universal Design principles have been barely adopted in the analysed studies. If any reference was made to those principles that was indirect. No study took into account all 7 ‘Principles of Universal Design’ (Connell et al., 1997) nor the 8 ‘Goals of Universal Design’ (Steinfeld & Maisel, 2012) and studied whether their implementation had any relevant effect, either on individual or organizational level. Further research proving the advantages of adopting comprehensive spatial strategies to enhance Inclusive Design in the workplace is necessary to boost the development of such approach on a large scale in the corporate environment.

Table 1. Framework of the reviewed paper

Paper	Diversity	Objective	Method	Type of Office	Outcome
<i>Willis (2009)</i>	Queer (or non-heterosexual)	Understand how young people experience the workplace as queer workers and what they perceive as sexually exclusive and	Qualitative study - interviews with 34 young people	Workplaces	Workplaces can function as both sexually exclusive and inclusive spaces. Organizational relationships, teams and cultures can transcend these divisions and how employees and

Paper	Diversity	Objective	Method	Type of Office	Outcome
		inclusive workplaces			organizational leaders can foster respect and appreciation for sexual diversity.
<i>Moschonas et al. (2014)</i>	Elderly with motor, vision, hearing and cognitive impairment Fully capable VS strength limitations, motor deficiencies, Parkinsonians	Taking into account different users' capabilities, besides anthropometric s, when developing "design-for-all" workplaces with a Virtual Accessibility Assessment methodology	(Personas; Participatory design) Virtual User Models (VUMs) in lab simulations	Corridors, telephone, drawer, stapler, printer	Validation of the method
<i>Kar and Mullick (2014)</i>	Older adults and people-with-disabilities	How principles of Universal Design can be applied to Behind the counter (BhC) workspaces and enable employment opportunities for everyone	- Trace Study (a sequential process, is rooted in three stages: Observation, Analysis and Inference) - User Observations - User Interviews	Behind the counter (BhC) workspaces., namely, (i) library circulation counter, (ii) hotel check-in counter, (iii) airport check-in counter and (iv) office reception counter	Design specifications for a basic module, with provision to add-on features for specific work requirements 
<i>Branham and Kane (2015)</i>	Blind people	Accessibility	Qualitative field study of five workplaces from the perspective of blind employees	Shared Workspaces	Overview of accessibility issues in workspaces (mainly related to visual accessibility)
<i>Afacan (2015)</i>	Older workers	Design strategies for the ageing workforce in sustainable office buildings (LEEDS certified)	Field survey of 240 office workers (ranging in age from 55 to 75) in three recently	Three sustainable office (LEEDS certified buildings) – all with open office layout,	The study finds sets of common factors (IEQ factors) of a sustainable building system influencing the experience of older office workers.

Paper	Diversity	Objective	Method	Type of Office	Outcome
			constructed sustainable office buildings. Mixed method analysis (quantitative correlation + qualitative analysis of open responses)	located in Ankara, Turkey	Namely the factors are: – Comfortable indoor environmental quality – Intuitive wayfinding system – Flexibility and adaptability in use – Appropriate acoustic condition – User-adjustability in use – Adequate luminance level
<i>Mathiansen & Frandsen (2016)</i>	Disabled people (deaf and deaf-blind user in particular)	Build the most accessible office building in the world for the Disabled People's Organization Denmark, with a focus on universal lighting design	Post-occupancy evaluation (mixed method – interviews + quantitative measurement and qualitative studies) on the DPOD HQ	Lighting design (artificial and daylight) Both single offices (one-man) and open-plan offices	Importance of orchestrating the lighting environment individually for a successful universal design
<i>Kämpf-Dern and Konkol (2017)</i>	Not focused on a specific dimension of diversity. It, instead, considers conceptually the inclusion of individual characteristics (age, gender, cultural or national background, experience and personal traits) to design performance-oriented workspaces	Introduce a comprehensive framework that covers the major dimensions of performance-oriented office environments including involved actors and performance parameters on the one hand, and the processes and success factors of implementation and change management of such workspace	Review of literature and practice	None. The paper offers a conceptual framework for all the office types	The conceptual framework itself is the finding of the paper

Paper	Diversity	Objective	Method	Type of Office	Outcome
		projects on the other hand			
<i>Wang and Piper (2018)</i>	Deaf people	Understand how mixed-ability teams (deaf and hearing professionals) communicate and coordinate in technology-rich workspaces	Semi-structured interviews (7 deaf + 7 hearing people) and 6 observation sessions	Workplaces and home workplace	Deaf-hearing teams create accessibility in a complex process that is learned over time through their moment-to-moment interaction and develop strategies to manage the demands of visual communication
<i>Lo & Diochon, (2019)</i>	Culture and identity Diversity of innovation culture – creation of sub-culture	Understanding how a corporate Fab Lab enables low power actors to empower themselves	Participant observation + interviews Renault technocenter	Social and political dimension of spaces Third spaces (i.e. FabLab) Space arrangement and decoration allow for a permissive and inclusive context distinct from the usual business-units' spaces	Third spaces within companies can be a place for exploration and transgression compared to the dominant culture
<i>Smoll and & Morrison (2019)</i>	Not focused on a specific dimension of diversity. Workers and their individual perceptions	Compare different employee perceptions of the success of one change: a move to new offices and an open-plan design. What impact does the experience of new office space have on communication, organizational	25 interviews were carried out in a New Zealand law firm that six months earlier had moved to new premises.	Offices (open-plan setting)	Open-plan offices have positive impact on: attitudes and lack of complaints, recruitment and retention, efficiency, happiness, pride, openness to more change. Communication and organizational culture were fundamental aspects, both as causes and outcomes of processes of change in

Paper	Diversity	Objective	Method	Type of Office	Outcome
		culture and the acceptance of the change?			creating the new workspaces.
<i>Know (2020)</i>	Disabled workers (along with female and older workers) are discursively constructed as unable or unwilling to perform (the researcher himself is visually impaired)	Recognizing the discursive practices of employees with disabilities to construct positive identity in DDOs	Discourse analysis (interviews)	Workplace – alternative organizational space (Deliberately Developmental Organization - DDO) where the principle of productivity is not dominant, but continuous learning, growth and development are at the center	Research remains theoretical, DDOs are a promising alternative organizational space for inclusion (as it comprehends a vast spectrum of diversity – women, people of color, LGBTQ people, people with disabilities, and more)
<i>Van Laer et al. (2020)</i>	Employees with impairments	Understand how organizational spaces can disable employees with impairments and contribute to the unequal power relations between disabled and non-disabled employees.	65 in-depth interviews	Workplaces	Workspace's organization has impact (disabling or enabling) on productive participation, social inclusion, physical comfort and safety. The physical access is the minimum requirement to guarantee.
<i>Marzb an et al. (2021)</i>	Gender Age Personality (introverts VS extroverts, agreeableness) and more	Map findings from research conducted in workspaces designed to support ABW and describe negative and positive outcomes under organizational,	Literature review	ABW	ABW approaches can help meet individual needs in the after-Covid19 workplace

Paper	Diversity	Objective	Method	Type of Office	Outcome
		physical and human-related aspects to inform post-Covid19 workplaces			
<i>Bend and Priola (2021)</i>	Disabled men and women who work in sheltered employment	The paper analyses how the entanglement of socio-material practices affects disabled workers' co-constructions of work and disability	Participant observations and interviews with management and workers at a sheltered workshop	Shop Floor – open Plan	The entanglement of bodies, space, objects and discourses affects materialisations of disability in ways that appear more inclusive than in mainstream employment
<i>Pacchi and Mariotti (2021)</i>	Precarious workers	Understand if new shared workspaces act more as shelters from a difficult and exclusionary job market than a boost of job opportunities.	Survey – online questionnaires to 326 people in different Italian coworking spaces	Coworking spaces	Coworking spaces are places in which precarious and insecure professionals find some form of protection, but at the same time this does not become for them neither a springboard for securing more stable and profitable careers. Coworking spaces can provide benefit in terms of: knowledge sharing, proximity and the creation of communities as defensive strategies in a difficult labour market.

REFERENCES

- Arksey, H., O'Malley, L., (2005), *Scoping studies: Towards a methodological framework*, Social Research Methods, 8, 19–31.
- Clarkson, J.P., Coleman, R. (2015). History of Inclusive Design in the UK. *Applied ergonomics*, 46 Pt B, 235-47.
- Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, E., Story, M., G, V. (1997), *The Principles of Universal Design – Version 2.0*, North Carolina State University. https://projects.ncsu.edu/design/cud/about_ud/udprinciplestext.html

- European Institute for Design and Disability - EIDD (2004), *Stockholm Declaration*. <http://dfaeurope.eu/what-is-dfa/dfa-documents/the-eidd-stockholm-declaration-2004/>
- Froyen, H. (2012), *Universal Design, a methodological approach*, Institute for Human Centered Design, Boston.
- Holtzhausen, L., Fourie, L. (2009), Employees' perceptions of company values and objectives and employer-employee relationships: A theoretical model. *Corporate Communications: An International Journal*, 14, 3, 333–344. <https://doi.org/10.1108/13563280910980104>
- Ielegems, E., Herssens, J., Vanrie, J. (2014), “Towards a Design Methodology for More supporting an inclusive design attitude in the built environment”, Weber, C. et al. (Eds.), *Proceedings of the 20th International Conference on Engineering Design. ICED 15. 2015 Sept 27-30, Milan, Italy*, UHasselt - Hasselt University, Hasselt, 9, 259-268.
- Mace, R. (1985), *Universal Design, Barrier Free Environments for Everyone*, Designers West, Los Angeles.
- McKinsey (2022), *Beyond gender: Promoting diversity in French companies*. <https://www.mckinsey.com/featured-insights/diversity-and-inclusion/>
- Mosca, E.I., Capolongo, S. (2020), “A Universal Design-based framework to assess usability and inclusion of buildings”. Gervasi, O. et al. (Eds.), *Computational Science and Its Applications – ICCSA 2020. ICCSA 2020. Lecture Notes in Computer Science, vol 12253*, Springer, Cham. https://doi.org/10.1007/978-3-030-58814-4_22.
- Oracle (2021), *Addressing diversity and inclusion: Going beyond the benchmark*. <https://www.oracle.com/uk/human-capital-management/diversity-and-inclusion/report/>
- Steinfeld, E., Maisel, J. (2012), *Universal design: Creating inclusive environments*, John Wiley & Sons Incorporated.

Managerial understandings of hybrid work: Comparing Efficiency-focused, Human Resources focused, Team-focused and Corporate Social Responsibility-focused understandings

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ABSTRACT

Hybrid work, which involves using technologies to work between a workplace and a remote setting such as a home, cafe or public transport (Stephenson, Kuismin, Putnam & Sivunen, 2020) is set to become the dominant form of office work in a post-COVID 19 world (Colley & Williamson, 2020). To better understand the emergent phenomenon of hybrid work, and to address the limitations of the existing management literature, we answer the following research question: How do managers understand hybrid work? We identify four managerial understandings of hybrid work which differ based on how managers approach office space, technology and time. 1) Efficiency-focused managers maximise remote work by divesting from office space, investing in remote-working technology and emphasising productive time, 2) Human Resource-focused managers invest in collaborative offices and technologies to facilitate flexible use of time, 3) Team-focused managers emphasise face-to-face office work and minimise remote working technologies to facilitate synchronicity among employees, and 4) Corporate Responsibility-focused managers adopt approaches to office space, technology and time that help them to achieve social goals. By taking stock of how managers currently understand hybrid work, we provided insights into hybrid work in a world where it is the norm. In terms of practical outcomes, we identify risks and benefits associated with different managerial approaches to hybrid work and empower managers to choose the best approach to hybrid work for their own organisations.

Keywords

Remote working, Managing workplace support processes, Hybrid spaces for work.

1 INTRODUCTION

Hybrid work, which involves using technologies to work between a workplace and a remote setting such as a home, cafe or public transport (Stephenson, Kuismin, Putnam & Sivunen, 2020) is set to become the dominant form of office work in a post-COVID 19 world (Colley & Williamson, 2020). Although enforced remote work during the pandemic has reduced managerial resistance to employees working away from the office (Colley & Williamson, 2020), it has also revealed the importance of face-to-face office settings for some forms of collegiality, collaboration, and learning (Methot et al, 2021; Yang et al, 2022). As a result, many organisations have adopted hybrid models to combine the advantages of office-based and remote work (BBC, 2021).

While there are established bodies of research that explore office spaces, remote work and virtual work as separate phenomena, less attention has been given the emergent phenomenon

of hybrid work and the management of, “organisations and employees across physical and virtual workspace configurations” (Pinnington & Ayoko, 2021: 994). Given the widespread uptake of hybrid work, it is timely to revise dominant scholarly perspectives that theorise remote workers as a marginalised minority (e.g. Hafermalz, 2020; Sewell & Taskin, 2015) or which assume face-to-face settings are the default for office workers (e.g. Elsbach & Pratt, 2007). Moreover, when it comes to the physical environment of work, the management literature has somewhat surprisingly focused on the perceptions and experiences of employees, rather than those of managers (for rare exceptions see Dandalt, 2021; Franken et al., 2021). Understanding managers’ perceptions is important as they are responsible for making decisions about the hybrid work practices that organisations adopt. Moreover, existing research shows that managerial support significantly influences the outcomes of telework (Choi, 2017). To better understand the emergent phenomenon of hybrid work and to address the limitations of the existing management literature, we ask the following research question: How do managers understand hybrid work?

2 METHODS

As we know little about hybrid work as a mainstream (rather than a minority) experience, we adopt an inductive qualitative research design to explore managers’ understandings of hybrid work. We collected publicly available news articles quoting managers of Australian-based organisations speaking about hybrid work. Articles were published between January 2020 (the start of the pandemic when remote working became widespread) and September 2021 (when we collected the data). We used news articles as efficient way of ascertaining Australian managers’ understandings of hybrid work as this information is publicly available and accessible. To minimise the impact of media framing due to journalists reconstructing phenomena from their own point of view (Giles & Shaw, 2009), we focused on direct quotes from managers and supplemented news articles with social media posts from managers available on the corporate social media website, LinkedIn. Although manager’s comments in news and social media articles portray a positive image rather than reveal the (potentially ugly) realities of hybrid work, they nevertheless provide useful insights into managers’ idealised understandings, assumptions and expectations of hybrid work and are thus relevant for answering our research question.

We decided to focus on Australia as a country with a diverse experience of the pandemic, including the city that spent the greatest number of days in a government-mandated lockdown in the world (Melbourne 262 days across 6 lockdowns) as well as cities that remained almost free from COVID with occasional, short lockdowns (e.g. Brisbane, 52 days across 5 lockdowns). Variation in the level of mandated working-from-home in Australia means our data reveals a diverse range of approaches to hybrid work that are likely to resonate globally. To gather our data, we performed searches of Factiva, “a global news-monitoring and search engine” (Factiva, 2022) and of articles published on the corporate social media website, LinkedIn. We used the following search terms to identify articles: “flexible work”, “hybrid work”, “new normal”, “remote work”, “post-pandemic work”, “post COVID work”, “work from home”, “telework”, “telecommuting”. Our search revealed a total of 2199 articles. Analysis involved reading through each article to identify quotes by managers about hybrid work. We first grouped together manager’s quotes into themes which we labelled with *in-vivo* codes generated from the data (i.e. managers own words). Themes included flexibility, location agnostic jobs, work-life balance, future of cities and collaborative work. Second, we grouped together similar themes to identify distinct understandings of hybrid work. We found that manager’s understandings differed based on their approach to office space, technology, and time. We labelled these themes based on theoretical concepts from the management literature.

We identified four distinct understandings of hybrid work. These were: managers who focused on the cost savings associated with hybrid work (Efficiency-focused), those who focused on the role of hybrid work in attracting and retaining employees (Human Resources-focused), those who focused on interpersonal interactions and relationships (Team-focused), and those who focused on the societal impacts of hybrid work (Corporate Social Responsibility-focused).

3 FINDINGS

We identified four distinctive managerial approaches to hybrid work during the COVID-19 Pandemic. In this section we outline the nature of each approach in terms of the approach to office space, communication technology and time, as well as their key risks and benefits. These are summarised in Table 1.

Table 1. Managerial approaches to hybrid work

Managerial understanding	Approach to office space	Approach to technology	Approach to time	Key Benefit	Key Risk
<u>Efficiency-focused:</u> Maximise remote work to minimise costs.	Divest from office space to minimise the footprint of the office.	Invest in technology to make hybrid work efficient.	Productivity	Reduce unnecessary real estate and travel costs.	Employee disengagement.
<u>Human Resources-focused:</u> Give employees autonomy to choose when and where they work.	Invest equally in remote spaces (e.g., home offices) and office space.	Invest in technology to provide employees with options about where and when they work.	Flexibility	Improve employee attraction and retention. Improve diversity and equity.	Expensive to maintain remote work and office spaces. Failure to prioritise synchronous face-to-face interactions essential for developing organisational culture, relationships and learning.
<u>Team-focused:</u> Prioritise office work by mandating office working days.	Invest in office spaces that act as a hub for face-to-face interactions.	Limit use of technology as inferior to face-to-face interactions.	Synchronicity	Collaboration, collegiality and maintaining corporate culture happens naturally.	Lose talent and undermine diversity due to lack of flexible work practices.
<u>Corporate Social Responsibility-focused:</u> Leverage hybrid work to	Invest in office space that fits with the social aims of the organisation.	Invest in technology that fits with the social aims of the organisation.	Change-oriented	Positive social changes.	Unintended consequences.

drive social change beyond the boundaries of the organisation.					
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3.1 Efficiency-focused

“Efficiency-focused” managers are concerned with the cost-saving potential of hybrid work. They maximise remote work and minimise office work to reduce costs associated with corporate real estate and business travel.

In terms of office space, Efficiency-focused managers reduce the footprint of the office by encouraging or mandating employees to work from home where possible. For example, “[Law firm] Ashurst is using the shift to flexible work as an opportunity to cut its rent bill...[by] reduc[ing] its office space globally by 20 per cent by 2023” (Paul Jenkins, Managing Partner, Ashurst Law Firm, *The Canberra Times*, 18/03/2021). Efficiency-focused managers also sought to reduce costs by, “shrinking offices, particularly in ‘high cost’ cities” (Chris Ashton, Chief Executive, Worley Engineering Firm, *Australian Financial Review Online*, 10/06/2020). Efficiency-focused managers invest in technology that generate efficiencies and savings. For example, Chris Ashton (Chief Executive, Worley Engineering Firm) explains that his company is “developing an app for staff that will allow [employees] to search for available desks in offices if they want to work flexibly”, thus enabling a reduction in office space and associated costs (*Australian Financial Review Online*, 10/06/2020). Moreover, by developing remote working capabilities managers reduce travel costs associated with meetings. In short, “we're not going to fly as much [in order to save money]” (Chris Ashton, Chief Executive, Worley Engineering Firm, *Australian Financial Review Online*, 10/06/2020). For Efficiency-focused managers, the “increase to their spending... on business and digital consulting, followed by IT infrastructure services... serve[s] the dual purpose of driving digital while saving cash” (*Infosys, Canada NewsWire* 03/12/20). Efficiency-focused managers focus on the productive use of time. They seek to unlock the productivity benefits of hybrid work by allowing employees to minimise the distractions associated with working from the office. Dr Tim Harrison (Chief Executive, Ararat City Council) explains that “it's actually improved productivity to have the flexibility to work from home.... We've saved a lot of time through zoom calls rather than face to face meetings” (*Ararat Advertiser* 03/07/2020). A reduction in time spent commuting is also seen as a key benefit of hybrid work when it freed up time for employees engage in productive work. Unsurprisingly, the key benefit of an Efficiency-focused understanding of hybrid work is the reduction in unnecessary costs associated with office space and travel. However, the focus on remote work over office work together with cutting costs can harm employee engagement due to, “loss of routine, a lack of physical, emotional, and social separation between home and work, and lower morale and camaraderie” (Lucinda Anderson, *Mondaq Business Briefing*, 17/04/21).

3.2 Human Resources-focused

The “Human Resources-focused” manager maximises the autonomy of hybrid workers to choose when they engage in remote work and when they come into the office. Susan Ferrier (Group Executive of People and Culture, National Australia Bank) explains that “effectively everyone is working flexibly, even if you're full time.... [giving everyone] more autonomy over where and how and when they work. (*ABC News*, 25/05/21). Human Resource-focused managers see hybrid work as a way of attracting and retaining the best employees by delivering flexibility and work-life balance. When it comes to office space, Human Resource-focused managers assume that remote spaces and office spaces are equally important. For example,

Tony Macvean (Managing Partner at Hall & Wilcox Law Firm) argues that “although, our physical office will continue to be important... in the future, people will be even more empowered to decide where they work.” (Australian Financial Review Online, 25/07/2020). Thus, Mike Cannon-Brookes (Co-Founder, Atlassian Technology Company) invests in “an expensive new Sydney office” (Australian Financial Review, 24/09/2021), while also declaring that “employees could work from any location with an internet connection and... [are only required] to travel to their nearest office around four times a year” (Brisbane Times, 12/07/2021). Similarly, managers at software developer Company X, “invests as much in equipment and workstation assessments for remote staff as it does in those working from the office.” (Fuseworks Media, 19/05/2020). Human Resources-focused managers use technology to provide employees with choices regarding where and when they work. They use technologies that allow employees to work together across remote and office locations. For example, at software company Company-X, virtual “collaboration is enabled... by tools like Cisco Webex and Google Hangouts video-conferencing technology, Google Docs and Microsoft 365 office productivity suites and the Slack instant messaging platform” (Fuseworks Media, 19/05/2020). To facilitate hybrid work, Human Resource-focused managers embrace “cloud-based web and video conferencing, and also, of course, networking [technologies]” (Mark Iles, Tech Research Asia, Australian Reseller News, 03/07/20). Human Resources-focused managers understand hybrid work as linked to the flexible use of time. For example, managers at consulting firm Deloitte introduced a policy, “eliminating set start and finish times, with staff also able to move to 100 per cent remote working” (Australian Financial Review, 11/07/2021). Clare Harding (Chief Strategy Officer, Deloitte consulting firm) suggests that “flexible working is important so that our teams can balance their personal commitments with work and look after their wellbeing”. The key benefit of a Human Resource-focused approach to management is attracting and retaining the best employees. For example, Alex Badenoch (Transformation, Communications and People Group Executive, Telstra communications company) suggests that “employees would increasingly seek out employers who offered flexibility... and allowing jobs to be done from anywhere would also help Telstra snare the very best talent.” (Townsville Bulletin, 19/07/2021). This understanding is also likely to improve diversity and equity outcomes. For example, “given the parenting and educating burden still often falls to women, we also hope this level of flexibility to juggle their work and home lives will help us make great leaps forward when it comes to diversity in the workforce”, (Andy Penn, Chief Executive Officer, Telstra Communications Company, NT News, 15/07/2021). Alongside the expense of investing in both remote work technology and office space, the key risk associated with the Human Resources-focused understanding is the lack of synchronous face-to-face interactions essential for building organisational culture, collegiality, and collaboration. For example, Graeme Bevans (CEO, Toll Road Group logistics company) suggests that "in order to maintain culture one needs a period of time when people are meeting as an entire group so you get that cross-group interaction and people get to know each other not just in the particular group areas that they work in but across the broader organisation".

3.3 Team-focused

The “Team-focused” manager prioritises face-to-face collaboration, relationship-building and corporate culture often by mandating the days employees work from the office. In contrast to Human Resources-focused managers who prioritise employee’s autonomy, Team-focused managers want to optimise face-to-face interaction while providing the option of remote work. At telecommunications company Optus, “most staff spend three to four days a week in the office and the balance at home” (Kate Aitken, Vice- President of Human Resources, Optus telecommunications company, Brisbane Times, 12/07/2021).

Team-focused managers approach office spaces as hubs for face-to-face collaboration and serendipitous encounters which they see as key to maintaining corporate culture and collegiality. Team-focused managers prioritise office work over remote work, because “co-location fosters collaboration and innovation; you can't just ‘dial-in’ culture.” (Kate Aitken, Vice- President of Human Resources, Optus telecommunications company, Brisbane Times, 12/07/2021). As a result, Team-focused managers seek to redesign pre-pandemic office spaces with the technology, lighting and infrastructure to foster interactions (The Australian, 17/07/21). For example, “cubicles are replaced by ultra-modern and vibrant flexible workspaces, designed to... create a positive, community culture” (Cairns Post, 04/11/2020). Team-focused managers are distinct in their understanding of technology as generally inferior to face-to-face interaction. While technology has a place, “there's no substitute for in-person collaboration, so we want the vast majority of our people in the office” (Alan Joyce, CEO, Qantas airline, Australian Financial Review, 17/12/2020). For example, Alberto Calderon (CEO, Orica explosive company) suggests, “Zoom and others have been a good interim solution, but nothing can substitute for face-to-face meetings” (The Australian Financial Review, 17/12/20). Team-focused managers emphasise, “people do need to be together at times... We are in a creative business and Zoom or Teams are not always great tools for fostering creativity.” (James Warburton, CEO, 7 West Media, LinkedIn Post). Team-focused managers are concerned with synchronous time, which involves coordinating remote and office-based work. For example, Andrew Pike (Chief Executive, Herbert Smith Freehill Law Firm) argues that “the office will very much be an area for collaboration - and it's essential for building the culture of the organisation... [while employees will work from home] when they have to do deep thinking.” (Australian Financial Review, 25/06/2020). To ensure the right people are together in the office at the right time Kevin George (Executive Manager, Dexu real estate group) prefers employees to work in the office, “most days each week...[because] we certainly move faster when we come together in the office” (Brisbane Times, 12/07/2021). The key benefit of having a Team-focused manager is that “in-person offices provide far more opportunities to converse, collaborate and celebrate at a more frequent, organic level that remote working conditions can't capture” (SmartCompany, 12/07/2021). A key risk is that, “companies that are just doing [remote work] two days a week, they're going to really struggle because they are not going to attract or retain talent” (Scott Farquhar, Co-founder and Co-chief executive, Atlassian's technology company, SmartCompany, 30/03/2021). The lack of flexibility may also undermine, “real progress on flexible work, gender diversity and productivity in a hybrid-working workforce” (Libby Lyons, Director, Workplace Gender Equality Agency, The West Australian, 19/04/21).

3.4 Corporate Social Responsibility-focused

The “Corporate Social Responsibility-focused” manager leverages hybrid work to drive social change beyond the boundaries of their organisation. These managers perceive hybrid work as enabling changes such as developing regional areas or promoting gender equality. Corporate Social Responsibility-focused managers may have similar understandings of office space and technology to managers who are Efficiency-focused, Human Resource-focused, and Team-focused. However, they differ from the other managers in that their primary goal is to deliver change beyond their own organisations. Corporate Social Responsibility-focused managers' understanding of office space depends on their Corporate Social Responsibility goals. For example, consistent with their goal to develop regional areas, managers at Bendigo and Adelaide Bank “have signed up to the Regional Australia Council 2031, which is encouraging people to live and work in regional areas” (Australian Financial Review, 16/03/2021). By supporting remote work, they can ensure that “big careers and big businesses don't have to revolve around big cities.” (Lauren Andrews, Head of corporate affairs, Bendigo and Adelaide

Bank, ABC News, 28/05/2020). In the process Bendigo and Adelaide Bank is making “regions a priority, through a commitment to... jobs, population, liveability and leadership.” (Australian Financial Review, 16/03/2021). Corporate Social Responsibility-focused managers adopt technological solutions that align with the societal changes they want to promote through hybrid work. For example, managers at electricity company AGL make use of technology that facilitates gender equality. Bryce Binne (Scrum Master, AGL energy company) suggests that “The pandemic has shown us that we can be very productive while working from home, and with relatively flexible hours. Hopefully, this allows more fathers to prioritise the ‘little things’ to do with their kids more often.” (AGL Website, 04/09/21). Denise Ooi, (Accounting Manager, AGL Energy Company) argues that AGLs’ use of remote working technology allows them to provide the flexibility required for remote work and is evidenced by their, “Gold Employer status for LGBTI+ inclusion... [and employment of] two Heads of Finance, who are both culturally diverse women” (AGL Website, 11/09/21). Corporate Social Responsibility-focused managers understand time in terms of the long-term societal changes that hybrid work can create. Unlike managers who are focused on responding to the present situation of the pandemic, Corporate Social Responsibility-focused managers are oriented towards the future. For example, managers seeking to develop the regions through hybrid work are committed to, “creating a better future out bush, based around sustainability, balance and prosperous country areas that are no longer dominated by agricultural jobs” (Australian Financial Review, 17/03/2021) as well as “reinvigorating communities that had been losing residents to capital cities for decades” (Liz Richte, Regional Australia Institute, CEO, ABC News, 28/05/20). A key benefit of a Corporate Social Responsibility-focused manager is delivering positive social changes such as gender equity and revitalised regional areas. A key risk involves the unintended consequences of driving social change. For example, managers seeking to encourage employees to move to regional areas may contribute to population increases that strain existing infrastructure, services, and amenities in these communities (ABC News, 5/02/21). Moreover, the flexibility generated by hybrid work may undermine equity goals because, “people taking advantage of this two or three days at home maybe are disadvantaged in terms of career progression, which we know generally falls on to minorities and women.”

4 CONCLUSION

We explored the emergent phenomenon of hybrid work by answering the research question: How do managers understand hybrid work? Pre-pandemic research tended to explore remote and office work through the lens of control, presenting remote workers as a marginalised minority (e.g. Hafermalz, 2020; Sewell & Taskin, 2015). In contrast, we showed that many managers now embrace the benefits of hybrid work and believe it is likely to remain the dominant form of office work. We found that combining remote work with office work is now the norm in Australia. We extended the literature on managerial support and telework (e.g., Choi, 2018), by showing that managers did not simply support or oppose hybrid work. Instead, managerial support for hybrid work took different forms and had implications for the decisions managers made about office space, technology, and time. Efficiency-focused managers maximised remote work by divesting from office space, investing in remote-working technology and emphasising productive time. Human Resource-focused managers invested in collaborative offices and technologies to facilitate flexible use of time. Team-focused managers emphasised face-to-face office work and minimised the use of remote working technologies to facilitate synchronicity among employees. Corporate Responsibility-focused managers adopted approaches to office space, technology and time that helped them to achieve social goals. In terms of practical outcomes, managers can use our framework to identify and reflect on their own understandings of hybrid work. Managers can work to maximise benefits and

mitigate the risks associated with their current understanding or move to the understanding that better reflects the goals of their organisation. While news articles provided insights into managers' idealised understandings, assumptions and expectations of hybrid work, future research could use interviews with managers to better understand the messy realities of hybrid work. Research could explore whether managers adopting Efficiency-focused, Human Resources-focused, Team-focused, or CSR-focused understandings configure hybrid work arrangements differently, as well as the impact of these configurations on outcomes for organisations and employees. Researchers could also use interviews and surveys to understand employee's experiences of hybrid work in organisations where managers have different understandings of hybrid work.

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REFERENCES

- BBC (2021), "Facebook remote working plan extended to all staff for long term", 10 June 2021, available at <https://www.bbc.com/news/technology-57425636> (accessed 24 March 2022).
- Choi, S. (2018), "Managing Flexible Work Arrangements in Government: Testing the Effects of Institutional and Managerial Support", *Public Personnel Management*, 47, 1, 26-50.
- Colley, L. Williamson, S. (2020), "With management resistance overcome, working from home may be here to stay", *The Conversation*, 24 August 2020, available at: <https://theconversation.com/with-management-resistance-overcome-working-from-home-may-be-here-to-stay-144850> (accessed 24 March 2022).
- Dandalt, E. (2021), "Managers and telework in public sector organizations during a crisis", *Journal of Management & Organization*, 27, 6, 1169-1182.
- Elsbach, K. D., Pratt, M. G. (2007). "The physical environment in organizations", *Academy of Management Annals*, 1, 1, 181-224.
- Factvia (2022), available from: <https://www.dowjones.com/professional/factiva/> (accessed 24 March 2022).
- Franken, E., Bentley, T., Shafaei, A., Farr-Wharton, B., Onnis, L. A., Omari, M, (2021), "Forced flexibility and remote working: Opportunities and challenges in the new normal", *Journal of Management & Organization*, 27, 6, 1169 – 1182.
- Giles, D., Shaw, R. L. (2009), "The psychology of news influence and the development of media framing analysis", *Social and personality psychology compass*, 3, 4, 375-393.
- Hafermalz, E. (2021), "Out of the panopticon and into exile: Visibility and control in distributed new culture organizations", *Organization Studies*, 42,5, 697-717.
- Methot, J. R., Rosado-Solomon, E. H., Downes, P. E., Gabriel, A. S. (2021), "Office chitchat as a social ritual: The uplifting yet distracting effects of daily small talk at work", *Academy of Management Journal*, 64, 5, 1445-1471.
- Pinnington, A. H., Ayoko, O. B. (2021), "Managing physical and virtual work environments during the COVID-19 pandemic: Improving employee well-being and achieving mutual gains", *Journal of Management & Organization*, 27, 6, 993-1002.
- Stephenson, K. A., Kuismin, A., Putnam, L. L., Sivunen, A. (2020), "Process studies of organizational space", *Academy of Management Annals*, 14, 2, 797-827.
- Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J. Teevan, J. (2022), "The effects of remote work on collaboration among information workers", *Nature human behaviour*, 6, 1, 43-54.

SESSION 6C: WORKSPACES, CULTURE AND EXPERIENCES

Dynamic experience sampling method for evaluating workplace experiences

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ABSTRACT

Workplaces are designed to foster a range of activities, such as focused work, collaboration, and recovery, which create dynamic needs in work environments. We applied a context-sensitive experience sampling method (ESM) to collect space-specific data on employees' immediate experiences from individual workspaces to understand how they support employees' activities. Needs-supplies fit is a person-environment fit type that has been associated with the physical work environments. The fit formation depends on employees' activities, activity-related needs, and the surrounding work settings. Understanding the needs-supplies fit at the workplace design level is important, as the fit formation increases employees' workplace satisfaction. ESM is a repetitive inquiry method that permeates into employees' daily life, and it can be conceptualised to contain the following key elements: 1) natural environment, 2) immediacy of experience and 3) representative sampling. This study was designed to obtain information on employees' needs for interaction, privacy, and spatial atmosphere during individual or collaborative activities at assigned workstations, meeting rooms, and breakout area. Our dynamic signal-contingent study setup delivered the questionnaire to employees' smartphones upon switching the location to collect the immediate experience of the situation. The study was conducted before and during an intervention study, during which organisations' meeting rooms and a breakout area were refurbished. We qualitatively inspected the ESM parameters, employees' activities, and their workspace experiences to interpret the ESM results. The questionnaire data revealed differences in privacy, interaction, and atmosphere needs and a high need for appropriate videoconference and withdrawal spaces. Using contextual research methods, such as ESM, promotes understanding of diverse workspaces in relation to activities. Our research draws attention to collaborative workspaces, the surroundings of videoconference meetings, spaces of recovery, and the needs related to their spatial atmospheres.

Keywords

Experience sampling, Work environment satisfaction, User-centred workplace design, Workplace evaluation, Combi-office.

1 INTRODUCTION

Several studies have assessed work environments and employee satisfaction (Bodin Danielsson & Bodin, 2009; Brunia et al., 2016; Budie et al., 2018; de Been & Beijer, 2014; Groen et al., 2019; Haapakangas et al., 2018; Hoendervanger et al., 2019; van der Voordt, 2004). Understanding the factors contributing to workplace satisfaction has become more important due to the remote work caused by the COVID-19 pandemic and subsequent return to the offices. In addition, more information is needed on how to apply the research knowledge to workplace design processes on a practical level. Experienced work environment satisfaction is influenced by office typology and its unique combination of spatial layout, level of openness, ergonomics, comfort, employees' personal experiences, and indoor qualities (Brunia et al., 2016). Therefore, workplace interior design strategies are important, such as design for comfort or supporting health, healthy behaviour, and restoration (Colenberg & Jylhä, 2021). While such strategies can guide the result of the design process, they do not consider the activity-related needs at a detailed level. The needs-supplies fit model describes the match between the employees' needs and the supplies of the environment (Kristof-Brown et al., 2005). This is linked to the employees' work environment satisfaction which is defined by how the physical work environment meets the employees' needs (van der Voordt, 2004). Although the main examples of needs-supplies fit for work environment satisfaction have been studied in the context of activity-based work environments and their privacy-related needs (Gerdenitsch et al., 2018; Hoendervanger et al., 2019), a more detailed understanding of the fit formation is needed to support workplace design processes that also consider collaboration and recovery. Our research aims to elucidate the connections between workplace design and employees' work environment support and satisfaction. For this purpose, we have studied the activity- and workspace-related needs and spatial support with experience sampling in a combi-office. Combi-offices resemble activity-based work environments in different activity-supporting spaces except for assigned workstations in open work areas (de Been & Beijer, 2014; Vos & van der Voordt, 2002) and shared or private office rooms (Bodin Danielsson & Bodin, 2008, 2009). The study was organized during the COVID-19-pandemic; thus, the results indicate the present and future needs for individual, collaborative, and recovery activities for both face-to-face and hybrid events. Although organisational behaviour research has used ESM frequently (Fisher & To, 2012), work environment research adaptations are still scarce. Examples include research on environment comfort on momentary well-being and productivity (Roskams & Haynes, 2020), face-to-face interactions (Weijs-Perrée et al., 2019), work environment usage behaviour (Markkanen et al., 2019), and perceived fit of work settings and activities (Hoendervanger et al., 2019, 2022). We incorporated an indoor positioning system into our study setup to send prompt signals dynamically when the participants left the workspaces they had been using: this enabled us to focus signalling prompts on the moments immediately after the activities and different situations in an unobtrusive manner to ongoing tasks.

1.1 Experience sampling method

Experience sampling method was developed in the late 1970s to improve data enrichment during a study that first used the diary method: participants were requested to summarise the activities and experiences of their daily highlights in a diary. When the study failed to produce the intended outcome, the researchers tested prompting the reporting events with electronic pagers to notify participants to fill the self-report diaries (Hektner, 2007; Larson & Csikszentmihalyi, 1978). The key elements in an ESM study consist of the natural environment, the immediacy of the studied experience, and representative sampling. With signal prompts, the researchers can ask their study participants questions and thus enabling experience capture as closely as possible in the participants' natural environment (Beal, 2015).

Essentially, ESM collects a representative sampling of the context and the immediate experiences in one's daily life in a natural environment (Beal, 2015; Hektner, 2007). The traditional self-report methods include interval-contingent (experiences are reported at regular intervals), signal-contingent (use of fixed or random signals to prompt reports), and event-contingent (experiences are reported when a defined event occurs) methods (Wheeler & Reis, 1991). The form of self-reports ranges from open- and close-ended questions regarding participants' objective situation and subjective state of being (Csikszentmihalyi, 2014; Hektner, 2007). The mobile technologies enable both signal-prompting and data-collection using smartphones (Pejovic et al., 2016; van Berkel et al., 2017) and wrist- and head-worn devices (Hernandez et al., 2016). Experience sampling design needs to consider the dynamics of collected experiences and how they are subjected to change over different parameters, such as time or location, to collect a representative sample and capture a wide range of individual experiences (Beal, 2015).

2 METHODOLOGY

This research study was implemented in an international company providing smart technology solutions for healthcare. At the start of this study, the company's headquarters occupied approximately 600 m² of space (presented in Figure 1) with 50 employees. Employees in this combi-office had assigned workstations, and the workspaces ranged from private and shared offices to open work areas and meeting rooms. The company also had recovery, production, and testing areas.

2.1 Workspaces and workplace intervention study

Prior to the intervention study, we organised a participatory design study with semi-structured interviews (n = 15) and a participatory design workshop (n = 15) to elucidate the user needs, daily activities, and work tasks (manuscript in preparation). In this intervention study, the functionality of the spaces remained as such, and the spatial changes aimed to improve the atmosphere and comfort. No changes were implemented at the assigned workstations. The intervention area (see Figure 1) consisted of:

- Meeting rooms
 - Multi-functional workspace – for quick meetings and individual work
 - Formal meeting room – for board meetings and onsite visitors
 - Informal meeting room – for team meetings, product development, and brainstorming
- Recovery
 - Breakout area – for lunches and coffee breaks, weekly hybrid meetings with remote offices and teams

The intervention design for each space included improvements for lighting, curtains, and optionally, new furniture, drawing boards and acoustic elements. The changes were designed based on the design needs and inspirations that emerged during the participatory design workshops.

2.2 ESM inquiry and setup

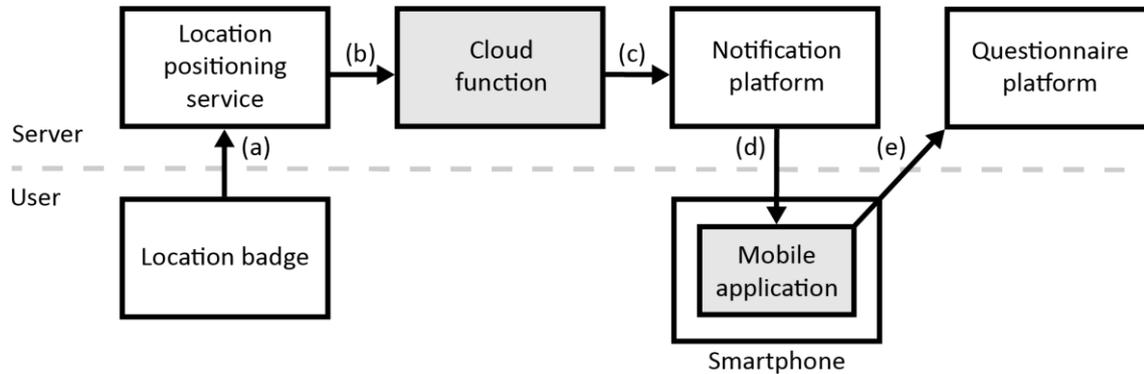
We augmented an ESM approach with an indoor positioning system to gather contextual information on different workspaces and situations. The ESM system can be triggered by movement in the workplace, enabling a novel implementation of an event-based questionnaire delivery (van Berkel et al., 2017; Markkanen et al., 2019). The ESM inquiry targeted the participants' assigned workstations, other workstations, the multi-functional workspace, the formal meeting room, the informal meeting room, and the breakout area.

Figure 1. Office layout, beacon placement, and intervention design



We ran a pilot data collection phase (three days, June 2021) with two participants to test the system onsite. The ESM was used before (3 weeks, August 2021) and during the workplace design intervention study (3 weeks, November 2021).

Figure 2. Experience sampling method system diagram. The applications we developed are highlighted in grey



The overall signal delivery system is described in Figure 2. The location positioning system (Noccela) uses physical location badges and beacons (see Figure 1 for beacon locations) that communicate (a) with the backend server to determine users' locations in real-time. This approach provided sufficient precision for tracking, and the indoor positioning system has a web interface where we marked areas in the workplace that trigger events when entering or exiting it. The events were then monitored (b) in the main logic of the ESM system, deployed on the Google Cloud Functions. The cloud functions forwards events where the users exited a room, and they had been in the room for more than 20 minutes and less than 10 hours (to filter out overnight events). We sent (c) a notification request from the cloud function to the notification platform (OneSignal) through its application programming interface (API), which in turn delivered (d) the notifications to users of the iOS mobile application (Conno) we developed. The mobile application serves two purposes: first, to show the ESM notifications and second, to register users' smartphones to the notification platform with their location badge ID. Finally, when the user clicks the notification on their smartphone, it opens (e) the questionnaire platform (Webropol) in the browser, with the users' ID as a prefilled parameter.

Table 1. Experience sampling questionnaire

Variable	Categories	Measurement level
Location	<ol style="list-style-type: none"> 1. Assigned workstation 2. Other workstation 3. Multi-functional workspace 4. Formal meeting room 5. Informal meeting room 6. Breakout area 7. Other 	Nominal
Activity	<ol style="list-style-type: none"> 1. I was working alone 2. We were working together 3. We were working together on the phone 4. We were working together on the videoconference 5. I was recovering alone 	Nominal

	6. We were recovering together 7. Other	
Task-complexity	Evaluate how difficult the activity was.	Likert scale 1 – 5, from easy to very demanding
Need for privacy	Evaluate how important privacy was in the situation.	Likert scale 1 – 5, from not important to very important
Need for interaction	Evaluate how important interaction was in the situation.	Likert scale 1 – 5, from not important to very important
Need for atmosphere	Evaluate how important the atmosphere was in the situation.	Likert scale 1 – 5, from not important to very important
Spatial support	How well did space support the situation?	Likert scale 1 – 5, from very poor to very well

3 RESULTS OF DYNAMIC EXPERIENCE SAMPLING

Before (1) and during the intervention (2), the study phases had 9 participants. However, only 6 participants partook in both study phases. The report numbers were before intervention $n = 184$ and during intervention $n = 161$. This study was conducted during the COVID-19 pandemic: although remote work recommendations were active, the data-collection phases were pushed to periods when onsite working was also possible. This also reflected the location of work within the office and the number of face-to-face meetings.

3.1 Locations of reported activities and task-complexity

The collected dataset was organised in Table 2 to reveal the locations of different activities. Due to the low number of reports from the intervention area, the dataset was not subjected to statistical analysis but qualitatively inspected to reveal differences in activity-related locations and needs. Therefore, the results are not validated but indicative in nature. Tables 3 and 4 present the mean and standard deviation (SD) values of reported Likert scale values (low, moderately low, moderate, high, and very high) of task complexities, needs and spatial support, categorised according to location or activities. The location analysis of activities revealed a substantial number of videoconference meetings in addition to individual work reports at assigned workstations. Overall, the collaborative work activities were distributed at meeting rooms and workstations and group recovery in the breakout area. We noticed several individual recovery events tagged at “other location,” indicating a lack of suitable space for recovery alone. Evaluation of work-related task complexities showed only low variation between studied activities, ranging from low to moderately low. Interestingly, the task-complexity in multifunctional workspace and formal meeting room events were rated as more complex.

Table 2. Location- and situation-categorised self-reports

Location	Study phase	Number of reports (n)	Individual work (n)	Work together (n)	Phone (n)	Video-conference (n)	Recovery alone (n)	Recovery together (n)
Assigned workstation	1	102	53	9	3	37	0	0
	2	86	50	3	0	30	0	0
Other workstation	1	15	1	9	2	1	1	1
	2	10	3	4	0	3	0	0
Multifunctional workspace	1	0	-	-	-	-	-	-
	2	8	0	2	0	6	0	0
Formal meeting room	1	11	0	4	0	7	0	0
	2	7	0	3	0	4	0	0
	1	12	0	5	0	7	0	0

Informal meeting room	2	13	0	5	1	7	0	0
Breakout area	1	24	1	2	0	0	4	17
	2	22	1	1	0	0	2	18
Other location	1	20	4	2	1	0	9	4
	2	15	0	3	0	0	12	0

3.2 Collaboration increases the need for privacy, interaction, and atmosphere

The location-linked data revealed higher privacy needs in the multi-functional workspace and meeting rooms than in workstations. The videoconference meetings had particularly high privacy needs. The interaction needs were reported high in multi-functional workspace and meeting rooms as well as during collaborative work activities. However, the difference between interaction and privacy needs between the assigned workstation and individual work was notable as the locational needs increased due to videoconference meetings.

The need for the atmosphere was included in the questionnaire as the intervention design focused on improving the spatial atmosphere and comfort. The term atmosphere was used in the participatory design phase of the study based on our earlier research (Markkanen et al., 2022); thus, participants and researchers had a shared understanding that the term described spatial qualities through a combination of symbolic and aesthetic expression, for example, as peaceful, playful, or formal. Locational analysis revealed a lower need for the atmosphere at workstations, while the collaborative spaces were reported with a moderate need for atmosphere. Accordingly, the need for an atmosphere was higher for working together, phone meetings and videoconference meetings.

Table 3. Location-based analysis

Location	Study phase	Reports (n)	Task complexity Mean \pm SD.	Need for privacy Mean \pm SD.	Need for interaction Mean \pm SD.	Need for atmosphere Mean \pm SD.	Experienced spatial support Mean \pm SD.
Assigned workstation	1	102	2,74 \pm 1,07	2,9 \pm 1,35	2,80 \pm 1,64	2,56 \pm 1,09	3,37 \pm 0,84
	2	86	2,22 \pm 1,01	2,98 \pm 1,44	2,45 \pm 1,54	2,74 \pm 1,16	3,8 \pm 0,82
Other workstation	1	15	1,87 \pm 0,99	1,47 \pm 0,74	3,87 \pm 0,99	2,53 \pm 1,13	3,40 \pm 0,74
	2	10	2,00 \pm 0,82	2,50 \pm 1,51	3,00 \pm 1,41	1,80 \pm 0,79	4,00 \pm 0,82
Multifunctional workspace	1	0	-	-	-	-	-
	2	8	3,00 \pm 0,76	4,25 \pm 0,71	4,63 \pm 0,52	3,63 \pm 1,19	4,25 \pm 0,71
Formal meeting room	1	11	3,18 \pm 1,08	3,55 \pm 1,21	4,64 \pm 0,67	3,64 \pm 0,67	3,73 \pm 0,47
	2	7	3,29 \pm 1,11	3,86 \pm 1,07	4,57 \pm 0,53	3,71 \pm 0,85	4,43 \pm 0,79
Informal meeting room	1	12	2,17 \pm 0,94	2,83 \pm 1,03	4,42 \pm 0,51	3,25 \pm 0,87	3,67 \pm 0,65
	2	13	2,69 \pm 0,95	3,92 \pm 0,86	4,31 \pm 0,85	3,92 \pm 0,64	4,46 \pm 0,66
Breakout area	1	24	1,29 \pm 0,62	1,13 \pm 0,34	3,38 \pm 1,47	3,83 \pm 0,96	3,38 \pm 0,97
	2	22	1,36 \pm 0,49	1,23 \pm 0,69	3,68 \pm 1,32	4,23 \pm 0,81	4,36 \pm 0,66

Table 4. Activity-based analysis

Activity	Study phase	Number of reports (n)	Task complexity Mean \pm SD.	Need for privacy Mean \pm SD.	Need for interaction Mean \pm SD.	Need for atmosphere Mean \pm SD.	Experienced spatial support Mean \pm SD.
Individual work	1	59	2,61 \pm 1,14	2,59 \pm 1,48	1,39 \pm 0,79	2,42 \pm 1,25	3,49 \pm 0,92
	2	54	1,91 \pm 0,87	2,61 \pm 1,28	1,35 \pm 0,68	2,59 \pm 1,16	3,80 \pm 0,94
Work together	1	31	2,10 \pm 1,08	2,13 \pm 1,28	4,39 \pm 0,84	2,94 \pm 1,06	3,52 \pm 0,72
	2	21	2,62 \pm 0,86	2,86 \pm 1,77	4,14 \pm 0,79	3,38 \pm 1,28	3,86 \pm 0,73

Phone meeting	1	6	2,83 ± 0,75	2,5 ± 1,52	4,17 ± 0,75	3,00 ± 1,26	3,50 ± 1,22
	2	1	3,00 ± 0,00	4,00 ± 0,00	2,00 ± 0,00	4,00 ± 0,00	4,00 ± 0,00
Video-conference	1	52	2,90 ± 1,03	3,25 ± 1,14	4,33 ± 0,65	2,77 ± 0,94	3,37 ± 0,74
	2	50	2,76 ± 1,08	3,92 ± 1,10	4,30 ± 0,79	3,28 ± 1,13	4,10 ± 0,74
Recovery alone	1	14	1,07 ± 0,27	2,57 ± 1,91	1,36 ± 0,93	2,64 ± 1,39	3,14 ± 0,53
	2	14	1,36 ± 0,63	3,86 ± 1,88	1,07 ± 0,27	2,57 ± 0,85	3,07 ± 0,27
Recovery together	1	18	1,44 ± 0,70	1,06 ± 0,24	4,06 ± 0,87	3,78 ± 0,88	3,22 ± 0,94
	2	18	1,39 ± 0,50	1,28 ± 0,75	3,89 ± 1,23	4,33 ± 0,69	4,56 ± 0,51

3.4 Individual and group recovery activities have different need profiles

The questionnaire distinguished recovery events alone and together, revealing differences: While task complexity for both events was low, the need for privacy was notably higher for recovery alone and, alternatively, the need for interaction higher for recovery together. Also, the highest scores for the need for an atmosphere were detected for recovery together during the intervention study. Importantly, the recovery alone events were reported outside the research area, thus indicating the lack of proper spaces for individual recovery and withdrawal.

3.5 Perceived spatial support increased during the intervention

The overall perceived spatial support was moderate in the research area. Both workstation-related support and intervention space-related support increased during the intervention. However, we note that out of the small number of participants in the study, one third changed between the collected data sets, thus impacting the workstation related experience. From the activity point of view, the spatial support increased for the videoconference meetings and recovery together. The qualitative analysis through semi-structured interviews (manuscript in preparation) revealed increased satisfaction with the intervention spaces.

4 CONCLUSIONS

The dynamic approach to signal-contingent experience sampling enabled data collection that combines the spatial and situational context. Our study setup aimed to extend the workspace specific understanding of the needs-supplies fit formation through assessing the activity, task complexity, and the need for privacy (Hoendervanger et al., 2019), with the need for interaction and atmosphere. The limited dataset evaluated the experienced spatial support in the re-designed spaces positively, thus indicating the fit formation.

This study was done during the COVID-19 pandemic, which limited the data collection but provided information on needs in the office during the pandemic and indications for future spatial needs: the high number of videoconference meetings in the dataset implicate essential hybrid-work-related needs for the organisation. The hybrid and multi-locational work (Bosch-Sijtsema et al., 2010; Halford, 2005) increased during the pandemic. The new workplace policies support hybrid work. Some employees have personal preferences to collaborate online (Appel-Meulenbroek et al., 2022); therefore, the work environment design needs to include remote collaboration through videoconference meetings as an office activity with different needs from individual work or in-person collaboration. In this case study, the frequent occurrence of videoconference meetings increased the overall need for privacy and interaction for assigned workstations, which in shared offices and open work areas impose a mismatch for concurrent individual work or other collaborative events.

This paper draws focus on designing meeting rooms and recovery spaces to support employees' needs beyond individual workstations. A recent survey during the pandemic revealed that while workplace flexibility and working from home supports productivity and work environment satisfaction, the importance of corporate offices remains as they were significantly preferred for formal and work meetings, socialising, and training activities (Yang et al., 2021).

Understanding the needs-supplies fit formation on a spatial level is important for office design and refurbishment projects to fit present needs better. Several studies focus on switching behaviour and individual work circumstances in activity-based offices (Appel-Meulenbroek et al., 2011; Göçer et al., 2017; Häne & Windlinger, 2021; Hoendervanger et al., 2016). There is only a little research on how different spaces, such as meeting rooms, concentration supporting spaces and recovery areas, support finding the right fit for different tasks, work environment satisfaction, and needs-supplies fit formation (Brunia et al., 2016). In this case study, the combi-office with assigned workstations provided fewer options for switching behaviour than an activity-based work environment. Nevertheless, this office provided activity-supporting spaces, meetings rooms, a multi-functional workspace for concentration and collaboration, and a breakout area. Our data revealed high interaction needs in meeting rooms and breakout areas. The higher atmosphere needed in collaborative spaces and recovery areas over assigned workstations implicates the significance of design choices in these spaces – the comfort and satisfaction towards the work environment are likely to influence employees' return to the office.

The COVID-19 pandemic and the subsequent return to offices will present workplace design challenges: the decreased number of employees present in the office sets pressure for efficient space use, the changes should also support multi-locational work and employee gathering. The workplace should also provide equally available and satisfactory workstations for employees who work onsite infrequently. Notably, the workplaces' spatial qualities should be inviting to promote employees' office presence and in-person collaboration. The work environment change processes will benefit from decisions based on actual user needs: experience sampling can be used to gain knowledge about the spaces perceived as supportive and comfortable and, importantly, about the lack of appropriate spaces and needs for improvement. While randomized ESM methods collect data broadly from holistic workplace experience, dynamic location-based methods can be designed to focus the data collection to specific areas, such as meeting rooms or recovery areas in our study. Furthermore, combining the location-based experience sampling with big data collection, such as health or stress measurements, opens new research opportunities for understanding how spaces affect employees.

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REFERENCES

- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), "An end-user's perspective on activity-based office concepts." *Journal of Corporate Real Estate*, 13(2), 122–135. <https://doi.org/10.1108/14630011111136830>
- Appel-Meulenbroek, R., Kemperman, A., van de Water, A., Weijs-Perrée, M., Verhaegh, J. (2022), "How to attract employees back to the office? A stated choice study on hybrid working preferences." *Journal of Environmental Psychology*, 81, 101784. <https://doi.org/10.1016/j.jenvp.2022.101784>
- Beal, D. J. (2015), "ESM 2.0: State of the Art and Future Potential of Experience Sampling Methods in Organizational Research." *Annual Review of Organizational Psychology and Organizational Behavior*, 2, 383–407. <https://doi.org/10.1146/annurev-orgpsych-032414-111335>

- Bodin Danielsson, C., Bodin, L. (2008), "Office type in relation to health, well-being, and job satisfaction among employees." *Environment and Behavior*, 40(5), 636–668. <https://doi.org/10.1177/0013916507307459>
- Bodin Danielsson, C., Bodin, L. (2009), "Difference in Satisfaction with Office Environment Among Employees in Different Office Types." *Journal of Architectural and Planning Research*, 26(3), 241–257.
- Bosch-Sijtsema, P. M., Ruohomäki, V., Vartiainen, M. (2010), "Multi-locational knowledge workers in the office: Navigation, disturbances, and effectiveness." *New Technology, Work and Employment*, 25(3), 183–195. <https://doi.org/10.1111/j.1468-005X.2010.00247.x>
- Brunia, S., de Been, I., van der Voordt, T. (2016), "Accommodating new ways of working: lessons from best practices and worst cases." *Journal of Corporate Real Estate*, 18, 30–47. <https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216>
- Budie, B., Appel-Meulenbroek, R., Kemperman, A., Weijs-Perree, M. (2018), "Employee Satisfaction with the Physical Work Environment: The Importance of a Need Based Approach." *International Journal of Strategic Property Management*, 23(1), 36–49. <https://doi.org/10.3846/ijspm.2019.6372>
- Colenberg, S., Jylhä, T. (2021), "Identifying interior design strategies for healthy workplaces – a literature review." *Journal of Corporate Real Estate*. Ahead-of-print <https://doi.org/10.1108/JCRE-12-2020-0068>
- Csikszentmihalyi, M. (2014), "Flow and the Foundations of Positive Psychology." Springer, eBook. <https://doi.org/10.1007/978-94-017-9088-8>
- de Been, I., Beijer, M. (2014), "The influence of office type on satisfaction and perceived productivity support." *Journal of Facilities Management*, 12(2), 142–157. <https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216>
- Fisher, C., To, M. (2012), "Using experience sampling methodology in organizational behavior." *Journal of Organizational Behavior*, 33, 865–877.
- Gerdenitsch, C., Korunka, C., Hertel, G. (2018), "Need-Supply Fit in an Activity-based Flexible Office: A Longitudinal Study during Relocation." 50(3), 273-297, *Environment and Behavior*.
- Göçer, Ö., Göçer, K., Ergöz Karahan, E., İlhan Oygür, I. (2017), "Exploring mobility & workplace choice in a flexible office through post-occupancy evaluation." 61(2), 226-242. *Ergonomics*. <https://doi.org/10.1080/00140139.2017.1349937>
- Groen, B., van der Voordt, T., Hoekstra, B., van Sprang, H. (2019), "Impact of employee satisfaction with facilities on self-assessed productivity support." *Journal of Facilities Management*, 17(5), 442–462. <https://doi.org/10.1108/JFM-12-2018-0069>
- Haapakangas, A., Hallman, D. M., Mathiassen, S. E., Jahncke, H. (2018), "Self-rated productivity and employee well-being in activity-based offices: The role of environmental perceptions and workspace use." *Building and Environment*, 145, 115–124.
- Halford, S. (2005), "Hybrid workspace: Re-spatialisations of work, organisation and management." *New Technology, Work and Employment*, 20(1), 19–33. <https://doi.org/10.1111/j.1468-005X.2005.00141.x>
- Häne, E., Windlinger, L. (2021), "Switching behaviour in activity-based working environments: an exploration of the reasons and influencing factors." Ahead-of-print. *Journal of Corporate Real Estate*. <https://doi.org/10.1108/JCRE-12-2020-0072>
- Hektner, J. M. (2007), "Experience sampling method: measuring the quality of everyday life." Sage Publications, Thousand Oaks.
- Hernandez, J., McDuff, D., Infante, C., Maes, P., Quigley, K., Picard, R. (2016), "Wearable ESM: differences in the experience sampling method across wearable devices." *MobileHCI*

- '16: *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services*, 195–205. <https://doi.org/10.1145/2935334.2935340>
- Hoendervanger, J. G., de Been, I., van Yperen, N. W., Mobach, M., Albers, C. (2016), "Flexibility in use Switching behaviour and satisfaction in activity-based work environments." *Journal of Corporate Real Estate*, 18(1), 48–62.
- Hoendervanger, J. G., van Yperen, N. W., Mobach, M. P., Albers, C. J. (2019), "Perceived fit in activity-based work environments and its impact on satisfaction and performance." *Journal of Environmental Psychology*, 65, 101339.
- Hoendervanger, J. G., van Yperen, N. W., Mobach, M. P., Albers, C. J. (2022), "Perceived Fit and User Behavior in Activity-Based Work Environments." 54(1), 143-169, *Environment and Behavior*. <https://doi.org/10.1177/0013916521995480>
- Kristof-Brown, A. L., Zimmerman, R. D., Johnson, E. C. (2005), "Consequences of Individuals' Fit At Work: a Meta-Analysis of Person-Job, Person-Organization, Person-Group, and Person-Supervisor Fit." *Personnel Psychology*, 58, 281–342.
- Larson, R., Csikszentmihalyi, M. (1978), "Experiential correlates of time alone in adolescence." *Journal of Personality*, 46(4), 677–693.
- Markkanen, P., Juuti, E. Herneoja, A. (2022), "Exploring ways to study the workplace design in a small knowledge work company", *Journal of Corporate Real Estate*, ahead-of-print. <https://doi.org/10.1108/JCRE-01-2021-0006>
- Markkanen, P., van Berkel, N., Visuri, A., LeSaint, A., Ferreira, D., Herneoja, A. (2019), in Sousa, J. P., Henriques, G. C., Xavier, J. P. (Eds.) *eCAADe SIGraDI 2019: Architecture in the age of the 4th industrial revolution proceedings: the Conference on Education and Research in Computer Aided Architectural Design in Europe & the 23rd Conference of the Iberoamerican Society Digital Graphics*, Faculty of Architecture, University of Porto, Porto, Vol. 2, pp. 837-846.
- Pejovic, V., Lathia, N., Mascolo, C., Musolesi, M. (2016), "Mobile-Based Experience Sampling for Behaviour Research." M. Tkalčič, B. de Carolis, M. de Gemmis, A. Odić, & A. Košir (Eds.), *Emotions and Personality in Personalized Services: Models, Evaluation and Applications* (pp. 141–161). Springer International Publishing, Switzerland. https://doi.org/10.1007/978-3-319-31413-6_8
- Roskams, M., Haynes, B. (2020), "An experience sampling approach to the workplace environment survey." *Facilities*, 38(1), 72–85. <https://doi.org/10.1108/f-04-2019-0050>
- van Berkel, N., Ferreira, D., Kostakos, V. (2017), "The Experience Sampling Method on Mobile Devices." *ACM Comput. Surv. Article*, 50(6), 93:1-40.
- van der Voordt, T. (2004), "Productivity and employee satisfaction in flexible workplaces." *Journal of Corporate Real Estate*, 6(2), 133–148.
- Vos, P., van der Voordt, T. (2002), "Tomorrow's offices through today's eyes: Effects of innovation in the working environment." *Journal of Corporate Real Estate*, 4(1), 48–65. <https://doi.org/10.1108/14630010210811778>
- Weijs-Perrée, M., Buck, L., Appel-Meulenbroek, R., Arentze, T. (2019), "Location choices of face-to-face interactions in academic buildings: an experience sampling approach." *Ergonomics*, 62(12), 1499–1514. <https://doi.org/10.1080/00140139.2019.1660419>
- Wheeler, L., Reis, H. T. (1991), "Self-recording of everyday life events: Origins, types, and uses." *Journal of Personality*, 59(3), 339–354.
- Yang, E., Kim, Y., Hong, S. (2021), "Does working from home work? Experience of working from home and the value of hybrid workplace post-COVID-19." *Journal of Corporate Real Estate*, Ahead-of-print, <https://doi.org/10.1108/JCRE-04-2021-0015>

Real World Spaces and Creative Thinking

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ABSTRACT

Neuroscientists have comprehensively assessed how design can support creative thinking, most often in studies that detail the effects of a single physical factor. Creativity-linked design elements that have been identified include colour (surface and light), visual complexity, plants in view, natural light, visible wood grain, aesthetic factors, soundscapes, comfortable environmental control, audio and visual distractions, ceiling height, opportunities for movement, access to needed tools/task support, nonverbal messages sent by a space, and chance for cognitive restoration, for example (e.g., Batey et al., 2021; Studente et al., 2016; Weitbrecht et al., 2015). For the study reported here, multiple factors linked by previous research studies to enhanced creative performance were investigated simultaneously in real-world settings to determine their potential roles in creative thinking. Study participants first completed a task that assessed their individual creativity at a particular moment in time (Green et al., 2017). Then they categorized/described the components of the physical environment in which they did that task using the criteria noted above (e.g., surface colours). Findings confirmed many hypothesized consistencies between aspects of the physical environment previously identified as supporting creative thinking and the design of spaces where participants whose creativity test scores were among the highest 25% (the “higher scorers”) completed the creativity task. Data from the higher scorers indicated that, compared with other participants, they were more likely to have answered the creativity test questions in spaces with, for example, plants in view, visible wood grain, possible natural lighting, nature sounds audible, surface colours with saturation and brightness levels that support cognitive work, comfortable environmental control, ceiling heights linked to enhanced creative performance, and that were perceived to support mental work. Designers can apply the information derived by this study to develop environments that support creative thinking/problem solving and researchers generally can also use reported findings to better understand data collected at different study sites.

Keywords

Workplace design, Creative performance, Environmental psychology.

1 INTRODUCTION

Neuroscientists have comprehensively assessed how design can support creative thinking, most often in studies that detail the effects of a single physical factor. This study simultaneously probed multiple factors linked by previous research studies to enhanced creative performance via data gathered in real-world settings. Data collected indicate consistencies between aspects

of the physical environment previously identified as supporting creative thinking and the design of spaces where participants thought most creatively.

For the purposes of this research, creativity was conceptualized as generating high quality, novel ideas related to the topic of concern (Sternberg, 2001). The focus of this study is individual creativity, not the creative performance of people working together.

2 CREATIVITY AND SPACE DESIGN – ABRIDGED LITERATURE REVIEW

Researchers consistently link particular physical environments to superior creative outcomes (e.g., Csikszentmihalyi, 1996; Sailer, 2011; Malinin, 2016). Mood, which is influenced by environmental design (e.g., Desmet, 2015), has also been tied to creative performance, with people in slightly energized, more positive moods generally thinking more creatively than people in neutral or more negative ones (e.g., Isen et al., 1985; Isen et al., 1987; Cote, 1999; Grawitch et al., 2003; Baas et al., 2008; Byron et al., 2010; Hennessey and Amabile, 2010). Sander et al. (2019) also directly relate environmental design that promotes more positive moods and enhanced creative performance. Veitch (2012) shares that working under preferred conditions can generate “a state of positive affect that in turn leads to benefits in the form of... increased creativity.”

Byron and colleagues (2010) also associate experiencing environmental stressors to degraded creative performance; dealing with/understanding stressors consumes finite stocks of mental energy, leaving less available for other mental tasks, such as creative thinking.

Beyond the deleterious effects of environmental stressors on creative performance, other aspects of the physical environment have been linked to creative performance/achievement via objective neuroscience research using quantified, not impressionistic, measures. For example:

- Seeing *shades of green*, even very briefly, has been tied to enhanced creative performance (Lichtenfeld et al., 2012; Studente et al., 2016).
- *Colours* that are relatively *unsaturated but light* have been linked to viewer energy levels and moods consistent with creative performance (i.e., the positive, slightly energized moods described earlier in this document) (Valdez and Mehrabian, 1994; Martens, 2011).
- Viewing *moderate visual complexity* has been associated with enhanced creativity (McCoy and Evans, 2002; Ceylan et al., 2008; Vohs et al., 2013). Residential environments designed by Frank Lloyd Wright generally have moderate visual complexity, for example (Vaughan and Ostwald, 2014).
- Being in *naturally lit* interior spaces has been related to higher levels of creativity (Meinel et al., 2017). Additional research ties experiencing natural light with lower stress levels (via its ability to influence circadian rhythms) (Boyce et al., 2003) and synchronization of circadian rhythms with location on Earth has been linked to better moods and cognitive performance generally (Beute and de Kort, 2014).
- Creativity is enhanced in *warmer* (say, 3000 K) but not cooler (around 4500 or 6000 K) *artificial light* (Weitbrecht et al., 2015; Abdullah et al., 2016). Slightly dimmer light levels (for example, 150 vs. 500 or 1500 lux) have also been linked to enhanced creative performance (Steidle and Werth, 2013).
- Wu et al. (2021), via data collected, in part, in makerspaces, learned that people are more likely to think creatively in *rounded, as opposed to more angular physical environments*. In more rounded environments corners, shapes, furniture, and other design elements, for example, are curved and in angular physical environments objects, etc., have sharper corners and are generally more rectilinear than curvilinear. In the curved environment noted by the Wu team, a round table was used while in the angular one the round table was replaced by one of the same size that was square, for instance.

- Wijesooriya and Brambilla (2021) associate *biophilic design* in general with enhanced creative performance. Use of natural materials is an important tenet of biophilic design. Looking at wood grain reduces human stress levels (Fell, 2010) and along with the use of other natural materials such as stone, has been tied to more creative thinking when compared to situations in which natural materials are absent (McCoy and Evans, 2002; Enso, 2020).
- Researchers report that performance on creative tasks has been positively affected by the presence of *green leafy plants* (e.g., Shibata and Suzuki, 2002; Studente et al., 2016; Hall and Knuth, 2019; Hahn et al., 2021).
- Having *views of nature through windows* has been tied to more creative thinking than when nature views are absent by McCoy and Evans (2002), Ceylan et al. (2008), Dul and Ceylan (2011), Loder and Smith (2013), and Van Rompay and Joi (2016). Research by groups such as Batey et al. (2021) indicates that the same boosts in creativity ensue when individuals look at *printed images (posters) of nature scenes*.
- Browning and Walker report on research linking hearing *nature soundscapes* to higher levels of creative thinking (2018).
- Consistent with the information on stressors noted earlier, *audio distractions* have been tied to *reduced creative performance* compared to conditions in which they were absent (Meinel et al., 2017). People are also less creative in spaces that are so quiet that sound levels approach silence (Burkus, 2017).
- Samani et al. (2015) and Thoring et al. (2019) generally relate the presence of *environmental distractions to degraded creative performance*.
- *Physical movement* and creativity have been positively associated, by, for example Rominger et al. (2020). Oppezzo and Schwartz (2014) had earlier tied walking (inside or outside, on a treadmill or not) to boosts in creative performance while walking and shortly after doing so; “Walking opens up the free flow of ideas, and it is a simple and robust solution to the goals of increasing creativity and increasing physical activity.” Muralo and Handel’s 2022 findings echo those of Oppezzo and Schwartz. There is also evidence that people think more creatively while standing (Baker et al., 2018).
- *Higher ceilings* have been tied to enhanced creative performance (Meyers-Levy and Zhu, 2007). Meyers-Levy and Zhu compared creative thinking in spaces with 8-foot and 10-foot ceilings and recorded more creativity in the areas with 10-foot ceilings. Building on Meyers-Levy and Zhu’s work, Zhu and Mehta (2017) report that “when the room ceiling is perceived to be relatively high (vs. low) it should enhance consumer creativity.”
- Samani, Rasid, and Sofian (2015) and Martens (2011) directly link having comfortable amounts of *environmental control* to enhanced creative thinking. Veitch (2012) does as well, through control’s effects on more positive moods.
- *Nonverbal messages* sent by the physical environment can boost creative performance (Fong, 2006; Martens, 2011) particularly when signal interpretation indicates support for the tasks-at-hand (McCoy, 2005; Dul and Ceylan, 2011; Dul and Ceylan, 2014; Thoring et al., 2019; Thoring et al., 2021).

The aspects of the physical environment linked to individual creative performance noted in this section were probed as potential supports for creative performance in real world environments; learning more about the physical environment’s role in creative thinking was the goal of this study. There are additional environmental factors that have been tied to enhanced creative performance, but their presence in the participants’ test-taking environment was not investigated; they are not mentioned in this brief literature review.

3 METHODOLOGY

Study participants completed an online survey in an indoor location of their choosing; it took approximately 10 minutes to answer all questions posed.

The administered survey had two major sections.

In the first section, study participants took an instantaneous test of creativity (an analogy completion exercise) detailed in Green et al. (2017). It determined their creative performance at a particular time, not their trait creativity more generally.

In the second section of the survey, participants answered a series of multiple-choice questions to provide information about the environment in which they completed the instantaneous creativity test mentioned in the last paragraph. Participants were asked about aspects of the places where they completed the instantaneous test of creativity such as colours present (surface and light), visual complexity, plants in view, presence of natural light, wood grain visibility, aesthetic factors, soundscapes experienced, incidence of comfortable environmental control, audio and visual distractions, ceiling height, opportunities for movement, access to needed tools/task support, nonverbal messages sent by the space, and chances for cognitive restoration. A projective question was used to collect information related to visual complexity and colour swatches embedded in the survey were utilized to study surface colours in place. Study participants were asked about their mood using the system developed by Desmet (2015). The original research plan called for this survey to be completed in workspaces provided to participants at their employers' offices. The work-from-home requirements of the COVID-19 pandemic led to individuals answering all survey questions in alternate locations.

Study participants were recruited via social networks (for residential communities and undergraduate alumni groups, for instance) that the researchers are members of.

People participating in this study were required to answer all questions indoors and could not be designers. Ultimately, after two rounds of survey administration, 70 completed surveys were available for analysis. These surveys met minimum criteria established by the researchers (answering all creativity test questions, correctly following the directions for the creativity test, and not answering the creativity questions in a predetermined sequence not related to the questions being asked (i.e., "pattern" answering)).

The environmental conditions present in the physical environments used by participants whose scores on the creativity test were in the top 25% of all participants tested as part of this project were compared to the conditions in the areas where the remainder of the study participants (i.e., all those not in the top 25%) answered the questions posed. Analyses completed included t-tests and ANOVAs (as appropriate), chi-square tests, and the calculation of percentages (for multiple choice options selected to describe physical parameters at test-taking locations in second section questions).

4 RESULTS

ANOVAs and t-tests (as appropriate) were conducted for numeric scores on the creativity test and each of the environmental conditions investigated. None of the ANOVAs conducted produced results that were statistically significant at the .05 level and few t-tests were significant at that level. Any tests completed with significant results are noted below.

In addition, chi-square tests were conducted comparing the answers to the multiple-choice questions related to conditions in which survey questions were answered of study participants in the higher and lower creativity test score groups.

The data collected indicated that many of the relationships that would be expected between environmental conditions and more creative performance were present:

- Participants whose creativity scores were among the top 25% (hereafter called "higher scorers") were more likely to be able to see green leafy plants as they took the test (47%)

than people with lower scores (36%).

- Among the higher scorers, 59% indicated that the colours they could see on the surfaces around them as they took the test had the creativity supporting levels of saturation and brightness described in the research noted above, while 40% of the lower scorers reported this palette. When answering this surface colour question, study participants selected a response from three colour samples (two chromatic, one white) that were embedded in the survey question. When the data from those who selected the white option were eliminated, the chi-square test statistic was nearly statistically significant (3.64, p value = .056).
- Higher scorers on the creativity test were more likely to see wood grain as they worked (88%) than people with lower scores (79%).
- The possibility that the test taking site would be lit by natural light if the sun was out was greater among higher scorers (100%) than among other participants (77%). A t-test showed this difference to be statistically significant ($t=2.624$, 2-tailed significance = .011) and a chi-square test with participants dichotomized into higher and lower scorers was nearly significant (2.39, p value = .12).
- Among the higher scorers, 27% could hear nature sounds as they answered survey questions, compared to 14% of the lower scorers. An ANOVA was nearly significant ($F = 1.767$, significance = .068). A chi-square test was statistically significant when study participants were dichotomized into higher and lower scorers (11.864, p value = .0184). Other acoustic response options provided were heating/air conditioning/fan in-operation noises, other people talking, something else, or no sounds at all.
- Higher scorers were more likely to perceive that they had control over their physical environments. Specifically, 100% of the higher scorers felt they could turn on or off the lights in the space where they were answering the survey questions. Also, 83% of the higher scorers could open or close a door to the room they were in (compared to 79% of lower scorers) and 65% of the higher scorers could open or close a window in the area where they were answering questions, while 68% of lower scorers could do so. If only the data from people in areas with windows are considered, 79% of the higher scorers could open or close a window while 72% of the lower scorers could do so.
- 12% of the higher scorers answered survey questions in a space with ceilings over 12 feet tall, while 8% of lower scorers did so. None of the higher scorers answered questions in a space with ceiling heights below 8 feet while 6% of lower scorers did. The results of the related ANOVA neared significance ($F = 2.306$, significance = .085).
- 87% of the higher scorers felt that the design of the space where they answered the creativity test questions would help them do some sort of mental work while 80% of the lower scorers did so.

The data related to several of the expected relationships between environmental conditions and creativity test scores were inconclusive:

- It was anticipated that test scores would be best in spaces with moderate visual complexity. 35% of the higher scorers answered test questions in spaces with moderate visual complexity while 37% of the lower scorers did so.
- 82% of the higher scorers could see a window to the outdoors as they answered the survey questions while 85% of the lower scorers could do this.
- Study participants were asked if they answered questions while working at a sit-stand desk as a proxy for opportunities to move and stand while working. Among the higher scorers, 12% worked at a sit-stand desk while 13% of lower scorers did.

Some data collected indicated relationships between scores on the creativity test and environmental conditions that were unexpected based on published research:

- For 71% of the higher scorers for whom natural light might potentially have been present, natural light was in place as questions were answered; natural light was present for 93% of the lower scorers for whom natural light might have been in place. A related chi-square test was significant (5.31, p value = .012). Information on time of survey completion was not collected, so it is possible that some of those for whom no natural light was present answered survey questions after the sun had set.
- Among higher scorers who could see a window, 43% had a view mainly of nature (as opposed to buildings and other manmade things), while 60% among the lower scorers who could see a window had a view that was mainly of nature.
- Among higher scorers, surface colours were more likely to be warm for 53%, while this was true for 38% of the lower scorers. Research noted above indicates that seeing the colour green seems to enhance creative performance and this question on colour temperature was asked to probe test site colours. Three response options were provided to study participants, warm, cool, and shades of white. 21% of lower scorers and 29% of higher scorers selected the shades of white option.
- When asked to report the colour of the light in the area where they were answering survey questions, 35% of the higher scorers indicated the light was warm while 60% of the lower scorers did so. This difference leads to a statistically significant chi-square test (3.84, p value = .0500) when the few people in each group (6% of higher scores and 8% of lower scorers) who could not decide if the light in the area was warm or cool were removed from the analysis.
- When asked to categorize lines present in the environment where they answered the creativity test questions, 100% of the higher scorers and 87% of the lower scorers described relatively more of those lines as straight as opposed to curving ones.
- Distractions were more likely to be an issue for higher scorers than lower scorers. Among higher scorers, 35% were distracted by something they could hear while answering survey questions while 15% of lower scorers were distracted by something audible. The chi-square test of this relationship was nearly significant (3.285, p value = .0700) as was the t-test (t = 1.771, 2-tailed significance = .081). In addition, among higher scorers, 31% were distracted by something that they could see while answering survey questions, while this was true of 11% of lower scorers. Again, statistical tests neared significance (chi-square = 3.643, p value = .056; t = 1.771, 2-tailed significance = .081).
- The moods of lower scorers were generally more positive than those of higher scorers. Among higher scorers, 74% categorized their mood as positive while 85% of those whose scores were lower on the creativity test did so.

Many of this study's findings are consistent with those of previous efforts to better understand the design of environments in which people are most likely to think creatively. All of the data collected do not align with those of previous studies, however. There are several potential reasons for this:

- Previous studies have generally only investigated one aspect of the environment and its relationship to creative thinking (with some notable exceptions such as *Studente et al., 2016*) while the effects of multiple factors were probed in this study.
- The sample size was relatively small.
- The online survey format used presented challenges when study participants were taking the survey on phones or other relatively small screened devices. This may have frustrated users and thereby degraded the quality of data collected.
- If study participants had provided photographs of the areas where they completed the survey, trained professionals could have directly coded environmental conditions present

which might have enhanced the quality of the data set; as long as pictures sent were of adequate acuity and included all environmental aspects of interest (e.g., if a window with a nature view was present, pictures sent would need to include that window, not cut off to the left or right of it).

- More creative individuals may have chosen to answer survey questions in different sorts of spaces than less creative people; they might have previously customized their work areas, etc., in ways not yet reported in the peer-reviewed literature and investigated in the course of this project.
- All data analysed were from people who answered all creativity test questions, correctly followed the directions for the creativity test, and did not “pattern” answer creativity test questions. Roughly half of all people who returned surveys met these criteria; environmental data from people who did not satisfy these criteria were not evaluated because of suspicions raised by pattern answering, etc. It is possible that the environmental conditions noted as unexpected for lower scorers (based on previously published research linking space design and creative performance) supported respondents’ efforts to read directions, etc., and therefore boosted likelihood of inclusion in the data analysed, even if they can not be associated with elevated performance on the creativity test.

5 CONCLUSION

Findings confirmed many hypothesized consistencies between aspects of the physical environment previously identified as supporting creative thinking and the design of spaces where higher scorers completed the creativity task. Data from the higher scorers indicated that, compared with other participants, they were more likely to have answered the creativity test questions in spaces with, for example, plants in view, visible wood grain, possible natural light, nature sounds audible, surface colours with saturation and brightness levels that support creative work, comfortable environmental control, ceiling heights linked to enhanced creative performance, and that were perceived to support mental work.

This exploratory study produced multiple useful preliminary findings that can be further probed with a programme of future studies with larger sample sizes, an enhanced survey administration platform, etc. This investigation also established a protocol for studying links between creative thinking and design.

Administering a similar future survey in environments with conditions that are known to researchers but that are challenging for study participants to evaluate (for example, if surveys were completed in a workplace with known (to the researchers) ventilation rates or soundscape volumes) would allow additional factors to be evaluated as supporters of, or detractors from, elevated creative thinking.

Designers can apply the information derived by this study to develop environments that can be anticipated to support creative thinking and researchers generally can also use these findings to better understand data collected at different study sites.

REFERENCES

- Abdullah, S., Czerwinski, M., Mark, G., Johns, P. (2016), “Shining (blue) light on creative ability”, *Proceedings, UbiComp '16*, September 12-16, Heidelberg, Germany, Association for Computing Machinery, New York, New York (no editor noted or pagination).
- Baas, M., De Dreu, C., Nijstad, B. (2008), “A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus?”, *Psychological Bulletin*, 134, 6, 779-806.

- Baker, R., Coenen, P., Howie, E., Lee, J., Williams, A., Straker, L. (2018), “A detailed description of the short-term musculoskeletal and cognitive effects of prolonged standing for office computer work”, *Ergonomics*, 61, 7, 877-890.
- Batey, M., Hughes, D., Crick, L., Toader, A. (2021), “Designing creative spaces”, *Ergonomics*, 64, 1, 139-146.
- Beute, F., de Kort, Y. (2014), “Natural resistance: Exposure to nature and self-regulation, mood, and physiology after ego-depletion.” *Journal of Environmental Psychology*, 40, 167-178.
- Boyce, P., Hunter, C., Howlette, O. (2003), *The Benefits of Daylight Through Windows*, Rensselaer Polytechnic Institute, Troy, New York.
- Browning, B., Walker, D. (2018), *An Ear for Nature: Psychoacoustic Strategies for Workplace Distractions and The Bottom Line*, Terrapin Bright Green, LLC, New York New York.
- Burkus, D. (2017), “Why you can focus in a coffee shop but not in your open office”, *Harvard Business Review*, available at: <https://hbr.org/2017/10/why-you-can-focus-in-a-coffee-shop-but-not-in-your-open-office> (accessed 15 March 2022).
- Byron, K., Khazanchi, S., Nazarian, D. (2010), “The relationship between stressors and creativity: A meta-analysis examining competing theoretical models”, *Journal of Applied Psychology*, 95, 1, 201-212.
- Ceylan, C., Dul, J., Aytac, S. (2008), “Can the office environment stimulate a manager’s creativity?”, *Human Factors and Ergonomics in Manufacturing*, 18, 6, 589-602.
- Cote, S. (1999), “Affect and performance in organizational settings”, *Current Directions in Psychological Science*, 8, 2, 65-68.
- Csikszentmihalyi, M. (1996), *Creativity*, HarperCollins, New York, New York.
- Desmet, P. (2015), “Design for mood: Twenty activity-based opportunities to design for mood regulation”, *International Journal of Design*, 9, 2, 1 – 19.
- Dul, J., Ceylan, C. (2011), “Work environments for employee creativity”, *Ergonomics*, 54, 1, 12-20.
- Dul, J., Ceylan, C. (2014), “The impact of a creativity-supporting work environment on a firm’s product innovation performance”, *The Journal of Product Innovation Management*, 31, 6, 1254-1267.
- Enso, S. (2020), “10 reasons why wooden buildings are good for you and the scientific research to back it up”, available at: <https://info.storaenso.com/wood-house-effect> (accessed 15 March 2022).
- Fell, D. (2010), “Wood in the human environment: restorative properties of wood in the built indoor environment”, Dissertation, The University of British Columbia.
- Fong, C. (2006), “The effects of emotional ambivalence on creativity”, *The Academy of Management Journal*, 49, 5, 1016–1030.
- Grawitch, M., Munz, D., Elliott, E., Mathis, A. (2003), “Promoting creativity in temporary problem-solving groups: The effects of positive mood and autonomy in problem definition on idea-generating performance”, *Group Dynamics: Theory, Research, and Practice*, 73, 200-213.
- Green, A. E., Spiegel, K., Giangrande, E., Weinberger, A., Gallagher, N., Turkeltaub, P. (2017), “Thinking cap plus thinking zap: tDCS of frontopolar cortex improves creative analogical reasoning and facilitates conscious augmentation of state creativity”, *Cerebral Cortex*. 27, 4, 2628-2639.
- Hahn, N., Essah, E., Blanusa, T. (2021), “Biophilic design and office planting: A case study of effects on perceived health, well-being and performance metrics in the workplace”, *Intelligent Buildings International*, 13, 4, 241-260.

- Hall, C., Knuth, M. (2019), "An update of the literature supporting the well-being benefits of plants: A review of the emotional and mental health benefits of plants", *Journal of Environmental Horticulture*, 37, 1, 30-38.
- Hennessey, B., Amabile, T. (2010), "Creativity", Fiske, S., Schacter, D., Zahn-Waxler, C. (Eds.), *Annual Review of Psychology*, volume 53. Annual Reviews: Palo Alto, CA, 569-598.
- Isen, A., Johnson, M., Mertz, E., Robinson, G. (1985), "The influence of positive affect on the usualness of word associations", *Journal of Personality and Social Psychology*, 48, 6, 1413-1426.
- Isen, A., Daubman, K., Nowicki, G. (1987), "Positive affect facilitates creative problem solving", *Journal of Personality and Social Psychology*, 52, 6, 1122-1131.
- Lichtenfeld, S., Elliot, A., Maier, M., Pekrun, R. (2012), "Fertile green: Green facilitates creative performance", *Personality and Social Psychology Bulletin*, 38, 6, 784-797.
- Loder, A., Jerry Smith, J. (2013), "Designing access to nature", *HealthCare Design*, 13, 5, 58-63.
- Malinin, L. (2016), "Creative practices embodied, embedded, and enacted in architectural settings: Toward an ecological model of creativity", *Frontiers in Psychology*, 6, article 1978.
- Martens, Y. (2011), "Creative workplace: Instrumental and symbolic support for creativity", *Facilities*, 29, 1/2, 63-79.
- McCoy, J. (2005), "Linking the physical work environment to creative context", *Journal of Creative Behavior*, 39, 3, 167-189.
- McCoy, J., Evans, G. (2002), "The potential role of the physical environment in fostering creativity", *Creativity Research Journal*, 14, 3-4, 409-426.
- Meinel, M., Maier, L., Wagner, T. and Voigt, K. (2017), "Designing creativity-enhancing workspaces: A critical look at empirical evidence", *Journal of Technology and Innovation Management*, 1, 1, 1-11.
- Meyers-Levy, J., Zhu, R. (2007), "The influence of ceiling heights: The effect of priming on the type of processing people use", *Journal of Consumer Research*, 34, 2, 174-186.
- Murali, S., Handel, B. (2022), "Motor restrictions impair divergent thinking during walking and during sitting", *Psychological Research*, available at: <https://doi.org/10.1007/s00426-021-01636-w> (accessed 15 March 2022).
- Oppezzo, M., Schwartz, D. (2014), "Give your ideas some legs: The positive effect of walking on creative thinking", *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 40, 4, 1142-1152.
- Rominger, C., Fink, A., Weber, B., Papousek, I., Schwerdtfeger, A. (2020), "Everyday bodily movement is associated with creativity independently from active positive affect: A Bayesian mediation analysis approach", *Nature Scientific Reports*, 10, 11985.
- Sailer, K. (2011), "Creativity as social and spatial process", *Facilities*, 29, 1/2, 6-18.
- Samani, S., Rasid, S., bt Sofian, S. (2015), "Individual control over the physical work environment to affect creativity", *Industrial Engineering and Management Systems*, 14, 1, 94-103.
- Sander, E., Caza, A., Jordan, P. (2019), "Psychological perceptions matter: Developing the reactions to the physical work environment scale", *Building and Environment*, 148, 338-347.
- Shibata, S. Suzuki, N. (2002), "Effects of the foliage plant on task performance and mood", *Journal of Environmental Psychology*, 22, 3, 265-272.
- Steidle, A., Werth, L. (2013), "Freedom from constraints: Darkness and dim illusion promote creativity", *Journal of Environmental Psychology*, 35, 67-80.

- Sternberg, R. (2001), "What is the common thread of creativity? Its dialectical relation to intelligence and wisdom", *American Psychologist*, 56, 4, 360-362.
- Studente, S., Seppala N., Noemi Sadowska, N. (2016), "Facilitating creative thinking in the classroom: Investigating the effects of plants and the colour green on visual and verbal creativity", *Thinking Skills and Creativity* 19, 1-8.
- Thoring, K., MilGoncalves, M., Mueller, R., Desmet, P., Badke-Schaub, P. (2021), "The architecture of creativity: Toward a causal theory of creative workspace design", *International Journal of Design*, 15, 2, 17-36.
- Thoring, K., Mueller, R., Badke-Schaub, P., Desmet, P. (2019), "An inventory of creative spaces: Innovative organizations and their workspace", In *Proceedings of the 22nd international conference on engineering design*, Technical University Delft, The Netherlands, August 5-8, 39048 (no editor noted).
- Valdez, P., Mehrabian, A. (1994), "Effects of color on emotions." *Journal of Experimental Psychology: General*, 123, 4, 394-409.
- van Rompay, T., Tineke Jol, T. (2016), "Wild and free: Unpredictability and spaciousness as predictors of creative performance", *Journal of Environmental Psychology*, 48, 140-148.
- Vaughan, J., Ostwald, M. (2014), "Quantifying the changing visual experience of architecture", Madeo, F., Schnabel, M. (Eds.), *Across: Architectural Research Through to Practice: 48th International Conference of the Architectural Science Association*, The Architectural Science Association and Genova University Press, 557-568.
- Veitch, J. (2012), "Work environments", Clayton, S. (Ed.), *The Oxford Handbook of Environmental and Conservation Psychology*, Oxford University Press, New York, 248-275.
- Vohs, K., Redden, J., Rahinel, R. (2013), "Physical order produces healthy choices, generosity, and conventionality, whereas disorder produces creativity", *Psychological Science*, 24, 9, 1860-1867.
- Weitbrecht, W., Barwolff, H., Lischke, A., Junger, S. (2015), "Effect of light color temperature on human concentration and creativity", *Fortschritte der Neurologie, Psychiatrie*, 83, 6, 344-348.
- Wijesooriya, N. Brambilla, A. (2021), "Bridging biophilic design and environmentally sustainable design: A critical review", *Journal of Cleaner Production*, 283, 124591.
- Wu, Y., Lu, C., Yan, J., Chu, X., Wu, M., Yang, Z. (2021), "Rounded or angular? How the physical work environment in makerspaces influences makers' creativity", *Journal of Environmental Psychology*, 73, 101546.
- Zhu, R., Mehta, R. (2017), "Sensory experiences and consumer creativity", *Journal of the Association for Consumer Research*, 2, 4, 472-484.

People – Activity – Place Typology - Literature Review of the Status of Research

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ABSTRACT

Designing and implementing “state-of-the-art” work environments are highly complex undertakings given the variety of dimensions to be considered, such as people, activity, work organization/leadership culture, and workplace, tools, and services. Therefore, evidence-based guidelines that effectively support work environment designers and organizational developers in configuring “performant” workspaces would be helpful. We are convinced that multi-dimensional preference patterns can be identified as an empirical foundation for such guidelines, even though we do not know the details of these patterns yet. What we know is that to detect them, it is necessary to simultaneously consider people, job activities, and/or work environment parameters. The first step in a more comprehensive empirical research project is therefore to identify theories and previous research projects that have addressed or investigated at least two, but preferably all three of the above-mentioned areas simultaneously to build on their findings regarding most relevant pattern dimensions and criteria. An exploratory literature review was conducted to capture the current state of research. This first step is intended to form the basis for a more extensive systematic literature analysis. Studies and theories could be identified that examine personality, job activities, and work environment parameters and their relationship. However, no existing classification could be found that considers all three dimensions together. The development of a holistic concept of multidimensional preference patterns forms the basis for the successful design and planning of work environments that can cope with the diverse challenges of today's working world.

Keywords

Personality, Work environment, Performance, Work activities, Employee satisfaction.

1 INTRODUCTION

The Corona pandemic has changed the view of the office. Employees have become familiar with the home office as a new workplace that is equivalent to the corporate office. Although some look forward to returning to the office, getting all employees back into the “swing of things” is a challenge for many organizations. Reading the current headlines, the return to the office is causing controversy. “Are Workers Ready To Return To The Office” (McCandless, 23.03.2022) or “How to Overcome Return-to-Office Resistance” (Bailey and Rehman, 2022) are examples which show that not all employees are happy to return to the office.

In its new study on returning to the office after the Corona pandemic, the Fraunhofer Institut für Arbeitswirtschaft und Organisation (IAO) emphasises that future organisations will have to focus on innovative office concepts with learning and experience-oriented forms of operation to encourage employees to return to the office. They found that above all, communication with colleagues is the greatest incentive to return (Bockstahler *et al.*, 2022). The creation of spaces

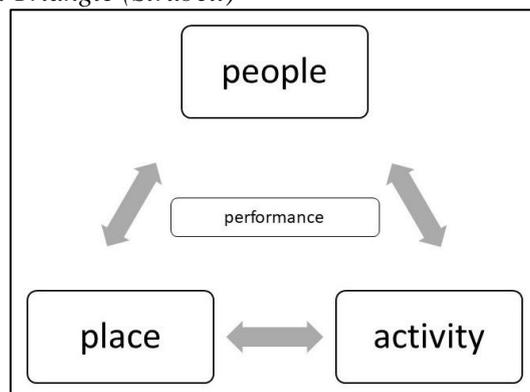
that enable both communication and undisturbed concentrated work, depending on the work tasks, needs and preferences of the employees, as well as social and recreation spaces, will be the challenge of future planning.

A variety of factors must be considered for such planning. The aim of this research project is to investigate the link between people, work activities and work environment parameters, and to identify multidimensional preference clusters. The first step is to identify and summarize previous research in these areas. In the following, we briefly recapitulate the theoretical foundation and then present the results of the first literature screening. The aim is to use the current state of research as a basis on which a systematic literature analysis can be developed. This analysis should capture the dimensions and their interactions in a holistic way and identify measurement scales to create a new measurement instrument for the investigation of multidimensional preference clusters.

2 PEOPLE, ACTIVITY, AND PLACE: AN INTERCONNECTED TRIANGLE

In planning and designing office spaces, which promote the satisfaction, health, and performance of employees, many aspects must be considered. One model that takes a holistic approach is the office ecology framework for effective workplace design by Kämpf-Dern and Konkol (2017). As key factors influencing the performance of employees (“people”), they identify employees’ personal characteristics, leadership/organisational culture, physical workplace, work tasks / activities, workplace services, and technology. They emphasize that none of these factors alone can ensure an optimal working environment. The model holistically captures the factors that need to be considered in the work environment for successful change processes. For the exploration of multidimensional preference clusters, three dimensions can thus be distilled from the office ecology framework and depicted in an interconnected triangle: *people*, *place* and *activity* with *performance* as intended outcome. The layout of the dimensions can be depicted as follows.

Figure 1. An Interconnected Triangle (Strubelt)



2.1 People

The dimension *people* includes demographic factors such as age, gender and cultural/national origin, as well as the personality traits of the employees. Personality traits describe underlying patterns of behaviour and emotion and are intended to provide information about how “the individual feels and acts on average, and what kind of physiological and behavioural response arises” (Kallio *et al.*, 2020). The most common model for describing and measuring personality traits is the BIG FIVE model. It is based on decades of research and includes the most empirically proven personality traits. The model divides personality into the five dimensions of openness to experience, conscientiousness, extraversion, agreeableness and neuroticism (Schmitt and Altstötter-Gleich, 2010).

The assessment of personality traits and demographic factors is essential for the planning of workplaces because the perception of the environment is not objective, but depends on one's personality and socialisation. The personality traits influence the individual's perceptions and preferences and thereby determine the needs of the individual.

2.2 Activity

Activity includes all actions that employees perform in the context of their work. These “enable the organization to fulfil its purpose through their people” (Kämpf-Dern and Konkol, 2017). There are many different approaches to cluster work activities. In the office ecology framework, the authors distinguish between individual work, team/group work, work support, and socializing/regeneration. Furthermore, it is critical to distinguish work activities by the amount of concentration they require. Additionally, it is important to consider the purpose and degree of cooperation. Work activities are furthermore divided by the degree of mobility.

An office concept that is oriented towards the differentiation of work activities was proposed by Stone and Luchetti back in the 1980s: *activity-based working* (ABW). Here, employees do not have a fixed workstation where they perform all work activities, but choose the one that best suits their current task from a range of differently designed work environments (Budd, 2001).

2.3 Place

Kämpf-Dern and Konkol define the dimension of the physical workspace based on its material, ambient and socio-spatial environment. The physical environment includes aspects such as the office location, the building, and the furnishings. Many studies focus on specific design aspects in offices, such as layouts, desk position, or window-to-wall-ratio, and how these affect employees' satisfaction within the indoor environmental quality (Kwon *et al.*, 2019).

The ambient environment describes the physical factors, such as the indoor climate, air quality, noise, light and how much control employees have over these factors. Previous research into the physical working environment focuses on indoor environmental quality (IEQ). Like the ambient environment, IEQ includes physically measurable variables such as temperature, air pressure, light, noise and others. These can have a negative impact on the health, productivity, and stress levels of employees. The IEQ is integrated into the Environmental Comfort Theory (ECT), according to which environmental effects can support employees' activities. Vischer (2007) distinguishes between three dimensions: physical, psychological and functional. The physical factors are influenced by building design and operation. The psychological factors include the aspects of territory and the possibility of shaping and controlling the environment, which have an influence on perception. Vischer summarises functional factors based on how well the working environment supports the individual. Privacy, territoriality, and social density are summarized in the socio-spatial environment.

Based on the ECT, Samani und Alavi (2020) highlight that employees perform better when they feel that the work environment meets their needs and they feel safe. Being able to control and personalise their own environment has a positive effect. In relation to previous research, they emphasise that “[p]rior studies support the finding of this study and suggest that environmental satisfaction is considered as a key indicator of employees' well-being and performance at work” (Samani and Alavi, 2020).

2.4 Interaction and resulting performance

The ECT and the concept of ABW already show that the dimensions are interrelated. They interact on how they affect employees and their work.

Whether an employee can do his or her job in the best possible way for the company depends on several factors and their various fits. The basic prerequisite is to find the right employees. The traditional basis for this is the person-job fit theory. This examines the fit of the employee's

skills with the challenges and tasks of the job. This basis has been extended by theories such as the Person-Organization Fit or the Person-Environment Fit (Sekiguchi, 2004).

However, the person-job fit is not enough. As the previous illustrations show, a person-place fit and - concurrently - an activity-place fit are also required. Additionally, the three dimensions person-place-activity not only influence each other, but also have an impact on the employees' *performance*, both individually and in interaction. By performance improvement, Kämpf-Dern and Konkol refer to results such as cost savings, increased concentration and productivity, improved cooperation, a reduction in sick days, and increased engagement.

Based on this model, it is assumed that the adjustment of dimensions using preference clusters has a positive effect on performance. To lay the groundwork for exploring preference clusters, this review focuses on the above-mentioned three dimensions and their interaction. How exactly their interaction affects performance should be the focus of further analysis.

3 METHOD

This exploratory literature review is intended to provide an overview of current research on the three dimensions and their interaction, and will be used to develop a further systematic literature review.

This review used Google Scholar and EBSCO as the search databases. Studies from the last five years were included to capture the current state of research.

The initial search used keywords such as matching / aligning workers / employees with the workplace, work environment, and workplace design. To better focus the search on the three dimensions, the terms listed above were combined in the subsequent search with a second or third keyword such as personality, psychological needs, and work activities / tasks. Studies were selected that addressed work in an office context. Studies dealing with the work of teachers or personnel in the health sector were excluded, as their working environments are subject to different requirements. The selected relevant papers are summarized below in a table sorted by the included dimensions.

Table 1. Included Papers

Authors	Year	Dimensions	Based on	Influence on
Kwon <i>et al.</i>	2019	place	IEQ	Satisfaction
Samani and Alavi	2020	place	ECT	Satisfaction, well-being, outcome
Apple-Meulenbrock <i>et al.</i>	2022	people, place	Social Interference Theory	Workplace preference
Bankins <i>et al.</i>	2021	people, place	Person-Space Fit	Outcome, social network activity
Hartog <i>et al.</i>	2018	people, place	Empirical Studies	satisfaction
Kallio <i>et al.</i>	2020	people, place	IEQ	Stress, productivity
Haynes <i>et al.</i>	2019	place, activity	Empirical Studies	EWA, perceived productivity
Jurecic <i>et al.</i>	2018	place, activity	Empirical Studies	satisfaction, motivation, performance
Nenonen and Sankari	2022	place, activity	Empirical Studies	Hybrid work pro-files
Roskams and Haynes	2021	place, activity	Job Demands-Resources theory	EWA, productivity
Hoendervanger <i>et al.</i>	2019	people, place, activity	Person-Environment Fit	Satisfaction, performance

Markkanen <i>et al.</i>	2022	people, activity	place,	Empirical Studies	user-needs
Marzban <i>et al.</i>	2022	people, activity	place,	ABW	Satisfaction, well-being, productivity
Oseland	2022	people, activity	place,	Environmental psychology, ABW	Satisfaction, well-being, productivity
Roskams and Haynes	2019	people, activity	place,	Person-Environment Fit	Perceived workplace requirements
Van den Berg <i>et al.</i>	2020	people, activity	place,	ABW	Workplace preferences

4 Literature review

4.1 People – Place

Studies examining the physical workspace reveal that employees have different demands on their working environment. “A Handbook of Theories on Designing Alignment Between People and the Office Environment” is a new work that collects theories and perspectives from different disciplines on the interplay between people and environment (Appel-Meulenbroek and Danivska, 2021). The central element here is the concept of Employee–Workplace Alignment (EWA), which is based on the theory of the Person–Environment Fit (PE-Fit). The concept of PE–Fit comes from the field of psychology and originally describes that stress is caused by an imbalance (misfit) between a person and his or her environment. In relation to the work environment, a harmony between the characteristics of the employee, the work environment and the work tasks has a positive influence on performance and satisfaction (Hoendervanger *et al.*, 2019). The theory clarifies that “the perception of the workplace is just as important as the quality of the place itself in determining how employees experience their work environment” (Appel-Meulenbroek and Danivska, 2021). The authors note that with the PE–Fit theory, research has focused primarily on the organisational and psychosocial environment. Therefore, they want to emphasise the physical environment with the EWA concept. Bankins *et al.* (2021), on the other hand, reshape the PE–Fit concept into a Person–Space Fit model that focuses on the employee's perception of his or her own compatibility with the work environment. This can act as a moderator between employees and their work environments. In the interaction of people and environment, the question arises whether certain preferences can be attributed to demographic factors or personality traits. Kallio *et al.* (2020) found in their study that more extraverted individuals are more stressed by insufficient environmental quality or are more sensitive to it under stress. A further investigation of the influence of personality on individual perception and a possible design of workplaces according to personality categories is, thus, declared to be an interesting approach.

Another study looks at the influence that personality has on employee satisfaction in multi-tenant offices (Hartog *et al.*, 2018). Employees were more likely to be satisfied with the characteristics of the multi-tenant office if they were more extraverted, more agreeable, and open to new experiences. More introverted employees prefer private work environments and have more difficulty adapting to open work environments (Marzban *et al.*, 2022). However, demographic factors and work-related characteristics had a much greater influence. While Roskams and Haynes (2019) similarly found that employees who prefer segregated workstations tend to be more introverted and prone to distractions, their study found this to be especially true for men as well. While men tend to prefer segregated workplaces, the personalisation of their own desk is more important for the well-being of women. Yet women in particular are more likely to be dissatisfied in the office with Indoor Environmental Quality factors than men (Appel-Meulenbroek *et al.*, 2022). Individual environmental control is

considered more crucial for women as they are more sensitive to temperature fluctuations than men. In order to explore which factors promote the satisfaction and performance of individual employees, both demographic factors and personality characteristics must be taken into account.

4.2 Place – Activity

This axis of the proposed triangle represents the connection between the workplace and work activities. Given a choice, would employees focus all activities on their desk, or adjust the location depending on the work suite task? The Fraunhofer IAO developed a work type model. They investigated the connection between office design and working methods and defined seven work types. The types differ in terms of their communication with colleagues, the difficulty of their tasks and the concentration required. For these, they determined the respective space requirements. Based on this typology, organisations can adapt their spaces to the way their employees work (Jurecic *et al.*, 2018). Another framework has been studied by Nenonen and Sankari (2022) and distinguishes between different hybrid knowledge work profiles. This model could be implemented in the *activity-based working* (ABW) concept. It is beyond the scope of this paper to exhaustively discuss the advantages and disadvantages of this design principle for office places. However, reinforced by the changes caused by the Corona pandemic and the establishment of the home office, this concept is the focus of several studies. Van den Berg *et al.* (2020) asked knowledge workers about the aspects that are important for them in activity-based workspaces. The study found that psychosocial design aspects such as noise and workplace enclosure played a more important role in the choice of workplace than indoor environmental quality aspects. Additionally, Roskams and Haynes (2019) found that "more location-dependent employees have a higher requirement for familiar and homely working areas". Employees who are more location-dependent place more value on the comfort of their workplace and individual control over environmental conditions. Correspondingly, Haynes *et al.* (2019) found that employees who are more place-bound tend to attribute a negative impact on their productivity to their work environment. They suggest that a balance must be found between individual private space and team space with a collaborative spirit. Despite a range of different working environments, a significant proportion of employees in ABW environments tend to retain their territorial working style. This arises, among other things, from the fact that many workplace behaviours are motivated by the desire to create a more suitable work environment (Roskams and Haynes, 2021). It becomes clear that, in addition to personality and demographic factors, the way employees work has a great influence on which working environments they prefer.

4.3 People – Activity

The search so far has not yet been able to find any studies on the people-work-activity axis. This is surprising at first, since the fit between people and work activity is well researched in general - but primarily in the context of recruitment, staffing, and aptitude, and less so in the context of the workplace. In this respect, the search needs to be revisited. Here, the theory of fit between person and workplace (Sekiguchi, 2004), among others, can be taken up.

4.4 People – Place - Activity

It has become clear how the three dimensions *people*, *place* and *activity* may interact. However, the overall goal is to find out whether preference patterns exist that configure all three dimensions in such a way that satisfaction, health, and performance are optimised. There are studies that address all three dimensions (Roskams and Haynes, 2019; van den Berg *et al.*, 2020). Hoendervanger *et al.* (2019) emphasises that both task requirements and psychological needs must be addressed in the design of work environments. In their study, they investigated the perceived PE fit in an ABW environment and what influence it has on satisfaction and performance. They found higher employee satisfaction and performance in private

environments compared to ABW when doing highly complex tasks. From this, they conclude that needs are both people-related and task-related, and that optimising satisfaction and performance in ABW environments requires a fit between personal traits, work settings and activity. In a small experimental setting Markkanen *et al.* attempted to design workstations based on prior research findings and found “while general task-related user-needs are available in work environment research literature, understanding user-needs in a contextual manner is important for the design process, as workplace-specific user-needs depend on employees’ job descriptions” (Markkanen *et al.*, 2022). Marzban *et al.* (2022) conducted a review of research on ABW environments that comprehensively discusses the positive and negative aspects. They found that no effect on employees in ABW environments was consistent across studies. The flaws are mainly in the implementation and use.

Nigel Oseland (2022) analyses in his new book ‘Beyond the Workplace Zoo’ the flaws of the modern open plan office. Combining theories from different disciplines, he designs a workplace solution that puts employee at the centre of planning and design a modern work environment. This initial, exploratory literature review revealed that the axes of the proposed interconnected triangle have already been researched from various perspectives, so that theories and criteria constructs can be drawn upon for a holistic empirical study. Based on the theories, current studies and the related keywords presented here, the procedure for a systematic analysis can now be defined. This will comprehensively substantiate the dimensions and identify scales that are necessary for the development of a survey tool.

5 CONCLUSION

The Corona pandemic has changed the way we look at work and work environments. Research into healthy working environments that encourage and support employees in their activities and performance is gaining higher significance. This initial review of the current state of research illustrates that the effect of the various dimensions on employees’ work is already theoretically well-founded and has been studied many times. While some studies include all three dimensions, no comprehensive typology could be found. The existing typologies only focus on two dimensions. This gap can be filled by studying multidimensional preference patterns. An aspect that needs further investigation is the output variable. Performance as well as satisfaction, productivity and the impact on health can be found in the literature. Not all studies define this outcome variable precisely. A more detailed investigation of these different aspects, their definition, their interaction and how they can be measured and distinguished should, therefore, be focus of further research.

Additionally, as the literature review to date has been limited to publications from the last five years, to identify changes in research focus, one could expand the publication period and divide it into pre- and post-Corona periods. Furthermore, the identified studies must be reflected in the context of the countries in which they were conducted since the results are also influenced by cultural differences. This literature review provides the basis for a systematic literature review to address these issues. On the one hand, the effect of the dimensions should be summarized and compared holistically. On the other hand, the measurement scales and methods used should be compiled. Based on this systematic analysis, a measurement instrument should be designed that captures all three dimensions and creates the data basis for the investigation of multidimensional preference patterns. This will be our next task.

REFERENCES

Appel-Meulenbroek, R., Danivska, V. (2021), A Handbook of Theories on Designing Alignment between People and the Office Environment. London: Routledge.

- Appel-Meulenbroek, R., Kemperman, A., van de Water, A., Weijs-Perrée, M., Verhaegh, J. (2022), How to attract employees back to the office? A stated choice study on hybrid working preferences. *Journal of Environmental Psychology*, 81, 101784, <https://doi.org/10.1016/j.jenvp.2022.101784>
- Bailey, J. R., Rehman, S. (2022), How to Overcome Return-to-Office Resistance, <https://hbr.org/2022/02/how-to-overcome-return-to-office-resistance>
- Bankins, S., Tomprou, M., Kim, B. (2021), Workspace transitions: conceptualizing and measuring person–space fit and examining its role in workplace outcomes and social network activity. *Journal of Managerial Psychology*, 36, 344–65, <https://doi.org/10.1108/JMP-09-2019-0538>
- Bockstahler, M., Jurecic, M., Rief, S. (2022), Homeoffice Experience 2.0 - Veränderungen, Entwicklungen und Erfahrungen zur Arbeit aus dem Homeoffice während der Corona-Pandemie. Stuttgart: Fraunhofer IAO.
- Budd, C. (2001), The Office: 1950 to the present. In: J. Greenspun, editor. *Workspaces. Design and contemporary work styles*. New York: Museum of Modern Art. pp. 26–35.
- Hartog, L., Weijs-Perrée, M., Appel-Meulenbroek, R. (2018), The influence of personality on user satisfaction: multi-tenant offices. *Building Research & Information*, 46, 402–16, <https://doi.org/10.1080/09613218.2017.1307015>
- Haynes, B. P., Suckley, L., Nunnington, N. (2019), Workplace alignment. *Facilities*, <https://doi.org/10.1108/F-07-2018-0082>
- Hoendervanger, J. G., van Yperen, N. W., Mobach, M. P., Albers, C. J. (2019), Perceived fit in activity-based work environments and its impact on satisfaction and performance. *Journal of Environmental Psychology*, 65, 101339, <https://doi.org/10.1016/j.jenvp.2019.101339>
- Jurecic, M., Rief, S., Stolze, D., editors (2018), Office analytics. Erfolgsfaktoren für die Gestaltung einer typbasierten Arbeitswelt, success factors for designing a worktype-based working environment. Stuttgart: Fraunhofer Verlag.
- Kallio, J., Vildjiounaite, E., Koivusaari, J., Räsänen, P., Similä, H., Kyllönen, V., et al. (2020), Assessment of perceived indoor environmental quality, stress and productivity based on environmental sensor data and personality categorization. *Building and Environment*, 175, 106787, <https://doi.org/10.1016/j.buildenv.2020.106787>
- Kämpf-Dern, A., Konkol, J. (2017), Performance-oriented office environments – framework for effective workspace design and the accompanying change processes. *Journal of Corporate Real Estate*, 19, 208–38, <https://doi.org/10.1108/JCRE-03-2017-0009>
- Kwon, M., Remøy, H., van den Bogaard, M. (2019), Influential design factors on occupant satisfaction with indoor environment in workplaces. *Building and Environment*, 157, 356–65, <https://doi.org/10.1016/j.buildenv.2019.05.002>
- Markkanen, P., Juuti, E., Herneoja, A. (2022), Exploring ways to study the workplace design in a small knowledge work company. *Journal of Corporate Real Estate*, <https://doi.org/10.1108/JCRE-01-2021-0006>
- Marzban, S., Candido, C., Mackey, M., Engelen, L., Zhang, F., Tjondronegoro, D. (2022), A review of research in activity-based working over the last ten years: lessons for the post-COVID workplace. *Journal of Facilities Management*, <https://doi.org/10.1108/JFM-08-2021-0081>
- Mccandless, M. E. (23.03.2022), Are Workers Ready To Return To The Office? *Facility Executive Magazine*.
- Nenonen, S., Sankari, I., editors (2022), Hybrid profiles for knowledge workers - flexible workplace and time.

- Oseland, N. (2022), *Beyond the Workplace Zoo : Humanising the Office*. Humanising the office. London, New York: Routledge.
- Roskams, M., Haynes, B. (2019), Employee-workplace alignment. *Facilities*, 38, 282–97, <https://doi.org/10.1108/F-09-2018-0105>
- Roskams, M., Haynes, B. (2021), Environmental demands and resources: a framework for understanding the physical environment for work. *Facilities*, 39, 652–66, <https://doi.org/10.1108/F-07-2020-0090>
- Samani, S. A., Alavi, S. M. S. Z. (2020), Are Open-Plan Office Designs Still Popular After Coronavirus Pandemic? *Performance Improvement*, 59, 24–32, <https://doi.org/10.1002/pfi.21931>
- Schmitt, M., Altstötter-Gleich, C. (2010), *Differentielle Psychologie und Persönlichkeitspsychologie kompakt. Mit Add-on*. Weinheim: Beltz Verlagsgruppe.
- Sekiguchi, T. (2004), Person-organization fit and person-job fit in employee selection: A review of the literature. *Osaka keidai ronshu*, 54, 179–96.
- van den Berg, J., Appel-Meulenbroek, R., Kemperman, A., Soththewes, M. (2020), Knowledge workers' stated preferences for important characteristics of activity-based workspaces. *Building Research & Information*, 48, 703–18, <https://doi.org/10.1080/09613218.2020.1726169>
- Vischer, J. C. (2007), The Concept of Workplace Performance and its Value to Managers. *California Management Review*, 49, 62–79, <https://doi.org/10.2307/41166383>

SESSION 7A: THEORIES OF HYBRID WORKING

Hybrid world of work – what is keeping us from working in ‘the matrix’?

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ABSTRACT

With increasing remote work practices, meetings and events turned into virtual or hybrid settings, causing frustrations in organisations (and people) regarding organisation, participation, and usefulness of those. Current research is also divided in terms of the effectiveness of online gatherings, claiming that virtual interactions cannot replicate face-to-face meetings. However, much of that research is based on videoconferencing settings and not a virtual reality (VR) world. In this research, we investigate the VR environment as an alternative to a physical space and its suitability for knowledge sharing and creation. This paper is based on a case study of an annual global hospitality think tank that was arranged fully remotely with different collaborative settings: VR and videoconferencing for synchronous and online platform and emails for asynchronous collaboration. Data was gathered through observations of online events, semi-structured interviews, and an experience survey. Here, the preliminary findings of the study are reported based on the analysis of ‘ba’ and knowledge creation and –sharing in these different settings. The results show that overall participants were happy with the virtual setting and different tools used to collaborate. New insights were generated and then shared virtually. The VR environment facilitated a more immersive event experience and more ‘natural’ socialisation opportunities, compared to ‘standard’ videoconferencing tools. However, as the VR world is still in its infancy in terms of adoption for collaboration and virtual meetings there is still a lot of development going on, especially in communication and interaction culture. Thus, more research is needed. The study improves the understanding of the VR environment as a possible alternative for or an addition to face-to-face or videoconferencing meetings. It investigates the potential obstacles and advantages of VR meetings with the aim to further reduce distance between physical and digital workplaces. Improved understanding on the merging of physical and virtual environments is useful for all types of organisations. For academics, the study encourages further discussion on hybrid work and user requirements in terms of physical and virtual spaces allowing more distributed work.

Keywords

Virtual reality, Hybrid events, Facilitation, Satisfaction, Distributed work.

Job demands and resources of hybrid teleworking: a literature review

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ABSTRACT

Estimates for post-pandemic work organisation based on employers' surveys show that the number of people who work at least partly from home will double or even triple. The surveys show that employees prefer hybrid forms of teleworking, which will thus be the most common way of working in the post-pandemic era. However, we do not know how hybrid teleworking affects employees' well-being. This structured literature review aims to answer the following research question: What are the job demands and resources of hybrid teleworking based on existing academic literature? The findings of the literature review are categorised based on the job demands-resources (JD-R) model. In this literature review, 45 articles about hybrid teleworking are analysed, and findings show that the main gaps in existing knowledge are related to ICT usage and management practices. On the basis of the analysed literature, this study presents a conceptual JD-R model for hybrid teleworking, which will help leaders and HR professionals establish better strategies for the well-being of their hybrid working employees.

Keywords

Hybrid telework, The Job Demands-Resources model, Employee' well-being, Post-pandemic working.

1 INTRODUCTION

Even before the COVID-19 pandemic, information and communications technology development fostered the growth of virtual organisations and made workplace and worktime more flexible. The coronavirus pandemic has reinforced these trends and forecasts show that there is no way back and many employees and employers will have to adapt to the new reality. According to the European Commission (2020), in 2019, 5,4% of EU27 workers usually worked from home, and 9% worked at least sometimes from home. Estimates for post-pandemic work organisation based on employers' surveys show that the amount of people who work at least partly from home will double (McKinsey, 2020) or even triple (Federal Reserve, 2020). Yet, we do not know what this massive shift means to the well-being of employees.

In the last five decades, different concepts of working have evolved: telework, telecommuting, remote work, hybrid working, blended working, etc. The most common ways of working for the post-pandemic era will most likely be hybrid forms of telework, as these arrangements are preferred by employees ("The impact of...", 2021). The focus of this paper is to give a comprehensive review of job demands and resources of various forms of hybrid teleworking, and this term is used throughout this paper as an umbrella term for working partly remotely and partly from the office.

This paper strives to answer the following research question: What are the job demands and resources of hybrid teleworking based on existing academic research? The findings of this literature review are categorised based on the job demands-resources (JD-R) model (Demerouti et al., 2001). Over the years, the job demands-resources (JD-R) model has proved to be a practical and heuristic tool for accounting employees' well-being. Telework is changing the

nature of work itself (Boell et al., 2013), and even though job resources and demands may be thoroughly studied for conventional work, they may differ from hybrid teleworking.

The novelty of this paper stems from three facts: 1) it presents results of a comprehensive review of various forms of hybrid teleworking; 2) it composes a conceptual JD-R model for hybrid teleworking, which divides job resources and demands into four categories to make research gaps more evident for further studies; 3) it outlines existing research data to help employers and employees to undergo this massive shift towards remote work in a way that supports employee well-being. From the practical point of view, the results of this study help leaders and HR professionals establish better strategies for the well-being of their employees in hybrid workspaces.

2 MAIN CONCEPTS

2.1 The job demands-resources (JD-R) model and employee well-being at work

The concept of well-being at work is ambiguously defined. Some researchers prefer focusing only on workers' mental well-being or health (Well-being at work... 2013, 1). However, the concept of employee well-being is multi-dimensional (Inceoglu et al., 2018, 179). Thus, the International Labour Organization (ILO) emphasises that workplace well-being relates to all aspects of working life, from the quality and safety of the physical environment, to how workers feel about their work, their working environment, the climate at work and work organisation. This view has a broad acceptance also in the academic literature (e.g., Schulte and Vainio 2010, Grant et al., 2007) and is also followed in this article. Demerouti et al. introduced the job demands-resources model in 2001, and the core idea of the model is that well-being at work is shaped by the interaction of job resources and demands. The JD-R model is based on the premise that psychosocial work characteristics can be divided into two groups, regardless of the type of job: job resources and job demands (Hakanen et al., 2008, Demerouti et al., 2001).

Job demands refer to “those physical, psychological, social, or organisational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills associated with specific physiological and/or psychological costs.” (Demerouti et al., 2001) Examples are high work pressure, an unfavorable physical environment, irregular working hours (Bakker, Demerouti 2007).

Job resources, on the other hand, refer to “those physical, psychological, social, or organisational aspects of the job that either/or: (1) are functional in achieving work goals; (2) reduce job demands and the associated physiological and psychological costs; (3) stimulate personal growth, learning, and development.” (Demerouti et al., 2001). Thus, resources are not only necessary to deal with job demands, but they also are important in their own right. (Demerouti, Bakker 2011, 2). Examples are job control, professional development, task/skill variety, job security, supervisor support (Demerouti et al., 2001). The JD-R model proposes that job demands and job resources may elicit two different, but connected, processes: (1) an energetic (strain) process of wearing out, in which high job demands exhaust employee mental and physical resources and may thus lead to burnout and eventually to ill health and (2) a motivational process in which job resources foster engagement and organisational commitment (Yoo et al., 2020, Schaufeli and Bakker, 2004). The JD-R model indicates that employees are at risk of stress and burnout if demands exceed resources (Schaufeli, Taris 2014).

2.2 An overview of the concepts of hybrid forms of teleworking

The study of the European Parliament ("The impact of..." 2021, 35) states that the most common ways of working for the post-pandemic era will more likely be hybrid forms of telework, as employees prefer these arrangements. More specifically, employees would like to work some days a week at the workplace and some distance working either from home or

from co-working spaces. For finding relevant studies for this literature review, it was necessary to broaden the selection of concepts of hybrid working:

Firstly, some scholars define hybrid working as a form of working at a range of locations, spending regular and significant amounts of time away from any office or home location (Bosch-Sijtsema et al. 2010, 183). It does not correspond with the understanding of hybrid working that is generally understood nowadays. Secondly, numerous articles use a different term for studying the same phenomenon: working partly at the office and partly remotely using ICT. Because of the abovementioned reasons, it was necessary to look through other concepts of hybrid telework and include them in the literature search. The concepts included in this literature review are:

Telework, telecommuting: The terms ‘telecommuting’ and ‘telework’ have been commonly used as a synonym (Sullivan, 2003, 160). There is a consensus that, generally, telework is remote work, requiring the use of information and communications technologies (ICTs) (Sullivan, 2003, 158). Telework became an everyday topic after organisations were forced to reorganise their work due to COVID-19 restrictions.

Remote work: Often used as a synonym of telework (e.g., Eurofound..., 2017), is defined by working from a remote place using information and communication technology (Miele & Tirabeni, 2020).

Virtual work: An advanced form of telework (Bailey & Kurland, 2002, 384), often referred to as a synonym of the telework (e.g., Gajendran and Harrison, 2007, Sardeshmukh et al., 2012, 194). **Blended working** refers to time-independent and location-independent working enabled through high-tech ICT software, devices, and infrastructure (Van Yperen et al., 2014).

New Ways of Working (NWW): There are several definitions of the NWW, yet, scholars agree on some facets: The flexibility in work time and place has been emphasised by almost all scholars; also, the use of ICT is widely agreed upon. A significant attribute of NWW pointed out by Baudewijns et al. (2015) is an open workplace where workers do not have allocated seating (Engelen et al., 2019, 468).

Conventional ways of working do not respond to technological advancement, business globalisation and changes in the needs of employees. This paper proposes implementing the umbrella term “hybrid telework” for future studies of working ways while employees work partly at the office and partly remotely using ICT. It would improve exploiting the research evidence for one of the most common ways of working in the post-pandemic era. The term “hybrid telework” distinguishes it from full-time telework when employees do not share their worktime between the office and remote location.

3 MATERIAL AND THE METHOD OF THE LITERATURE REVIEW

The search for this structural literature review was done in comprehensive research databases: EBSCO, Scopus, and Web of Science. In addition, references of relevant articles were looked through. For the search, two groups of different keywords based on the theoretical background above were used: (a) JD-R model, job resources, job demands, employee’ well-being; (b) telework, telecommuting, new ways of working, hybrid work, blended work, virtual work, remote work. The first search resulted in 2543 articles.

Inclusion criteria for articles to be analysed further were: (i) published in a peer-reviewed scholarly journal English, (ii) empirical study (e.g., cross-sectional study, intervention study), and/or qualitative research study of job demands and resources by a hybrid form of teleworking, (iii) studies full-time employees, not freelance, or self-employed workers (iv) period 2001-2019. This period was chosen because the JD-R model that is used for this literature review was introduced in 2001. Also, studies concerning telework during the pandemic were not included as the main purpose for this research is to employ the existing

body of knowledge for the post-pandemic era. Drastic measures during the COVID-19 will believably remain to the history, and job demands and resources are expectedly different by voluntary hybrid teleworking.

The title and abstract of each paper were examined, and the article was filed into the relevant group. Thirdly, all selected articles were checked according to employees' telework intensity to ensure that they represent research findings of employees working partly from the office and partly remotely. If the study did not specify the share of working remotely and just used the term, e.g., "teleworkers," to describe the sample, it was not included in this literature review. Finally, 45 articles met all criteria of this literature search.

The results of selected studies were included in the table (see Table 1.), and similar results of job demands and resources were combined. If the conclusion part of the revised study did not define outcomes clearly according to the JD-R concepts, the allocation was made based on the classification of Schaufeli & Taris (2014).

4 RESULTS AND THE CONCEPTUAL JD-R MODEL FOR HYBRID TELEWORKING

Thirteen job demands and nineteen resources were specified. This number is significantly smaller than the number for conventional ways of working: 30 job demands and 31 job resources (Schaufeli and Taris, 2014). It means that there are fewer research data for hybrid teleworking. There were slightly more papers in the 2010s (24 studies) as in the 2000s (21 studies).

According to Bakker & Demerouti (2007, 312), job resources may exist at the level of the organisation at large, the interpersonal and social relations, the organisation of work, and at the level of the task. Building on that, the job demands and resources found in academic research were organised into four main categories:

1. I Job demands and resources related to the nature and location of the hybrid telework. This category included job demands and resources characteristic of flexibility in time and space (e.g., job autonomy, work-life balance, less commuting, etc.) – 29 studies.
2. II Job demands and resources related to the management practices. These are resources and demands derived from the management ways and processes (e.g., supervisor support, workload, etc.) – 19 studies.
3. III Job demands and resources related to social relations (e.g., loneliness, support from colleagues, etc.) – 25 studies.
4. IV Job demands and resources related to the information and communications technology (ICT) (e.g., IT complexity, techno-invasion) – 7 studies.

Job demands and resources of hybrid teleworking derived from the literature review were systemised into Table 1. Similar results were combined, and contradictions were also included.

Table 1. Job demands and resources in the academic literature of the hybrid telework, elaboration of the authors

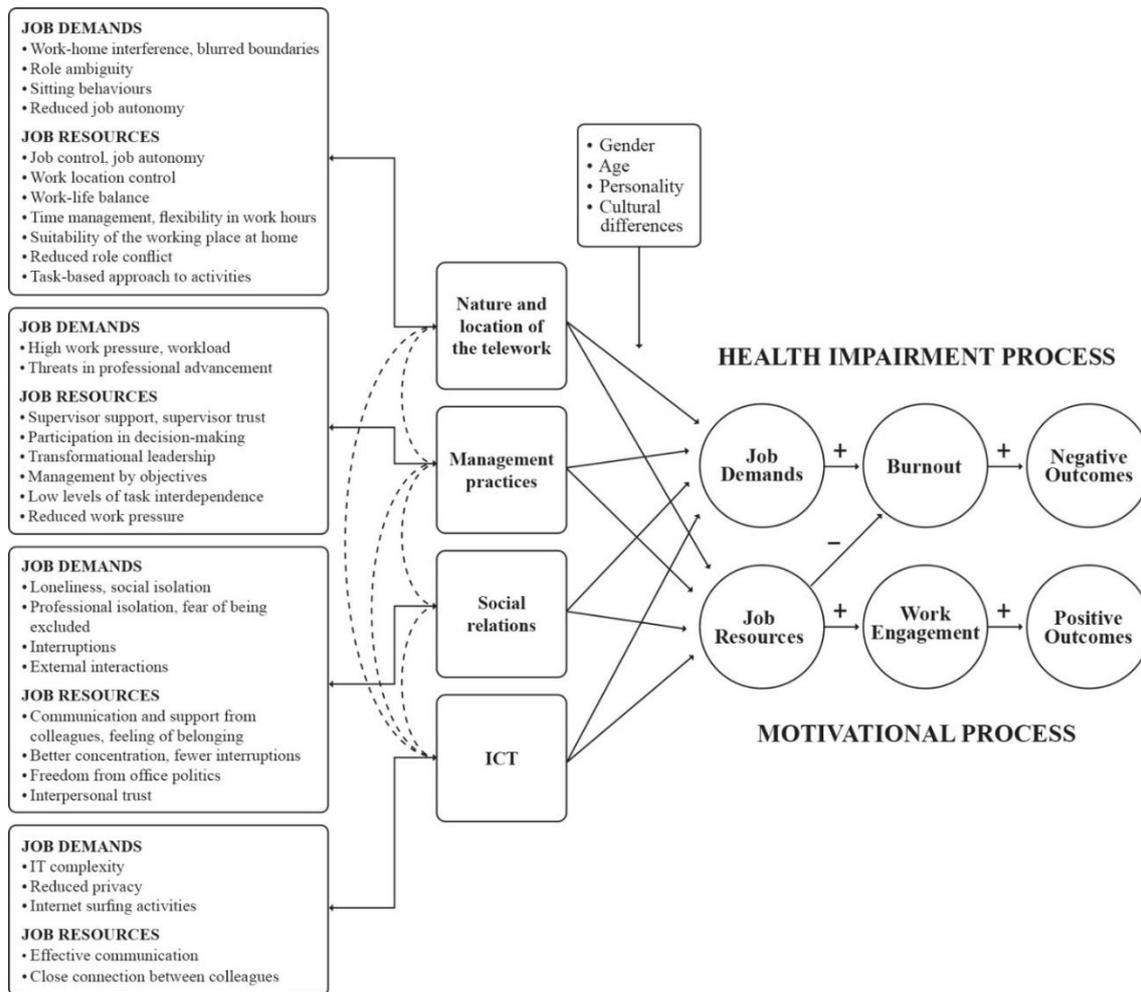
Job demands	Job resources
I Job demands (4) related to the nature and location of the hybrid work	I Job resources (7) related to the nature and location of the hybrid work
Work-home interference, blurred boundaries (Hartig et al., 2007, Troup & Rose, 2012, Grant et al., 2013), separating home and work apart (Tietze, Musson 2005), work-family conflict (Lautsch et al., 2009, Vander Elst et al., 2017))	Job control, job autonomy (Lundberg & Lindfors, 2002, Vittersø et al., 2003, Kossek et al., 2006, Kelliher, Anderson 2008, Sardeshmukh et al., 2012, Grant et al., 2013, Peters et al., 2014, Ter Hoeven, Van Zoonen 2015, Sewell, Taskin 2015, Gajendran et al., 2015, Suh, Lee 2017, Vander Elst et al., 2017, Müller & Niessen, 2019), job

	discretion (Golden, Veiga 2005, Kelliher & Anderson, 2010)
Role ambiguity (Tietze, Musson 2005, Sardeshmukh et al., 2012, Suh, Lee 2017)	Less stress with the commute (Vittersø et al., 2003, Grant et al., 2013), satisfaction with work location control (Nijp et al. 2016)
Sitting behaviours (Grant et al., 2013)	Work-life balance (Tietze, Musson 2005, Golden 2006, Peters et al., 2009, Kelliher & Anderson, 2010, Grant et al., 2013, Ter Hoeven, Van Zoonen 2015), less stress with child-care (Vittersø et al., 2003, Grant et al., 2013), lower work-family conflict (Madsen 2003, Madsen 2006, Leung, Zhang 2017), boundary management (Kelliher & Anderson, 2008, 2010), no change in work-home interference demands (Nijp et al. 2016)
Reduced autonomy (Van Steenbergen et al., 2018)	Time management, possibility to take time out (Tietze, Musson 2005), flexibility in work hours (Vittersø et al., 2003)
	Suitability of the working place at home (Grant et al., 2013; Nakrošienė et al., 2019), workspace management (Halford, 2005)
	Reduced role conflict (Fonner, Roloff 2010, Sardeshmukh et al., 2012)
	Task-based approach to activities (Tietze & Musson, 2003)
II Job demands (2) related to the management practices	II Job resources (6) related to the management practices
High work pressure, workload (Kelliher, Anderson 2008, Suh, Lee 2017), time pressure (Konradt et al., 2003), work intensification (Kelliher & Anderson, 2010)	Reduced work pressure (Sardeshmukh et al., 2012), reduced workload (Van Steenbergen et al., 2018)
Threats in professional advancement (Kurland, Cooper, 2002, Kelliher, Anderson 2008, Van Steenbergen et al., 2018)	Supervisor support, supervisor trust (Nakrošienė et al., 2019, Bentley et al., 2016, Peters et al., 2014, Grant et al., 2013), supervisory relationships (Golden, Veiga 2008, Lautsch et al., 2009), high quality leader-member exchange (de Vries et al., 2019; Gajendran et al., 2015; Golden, 2006)
	Participation in decision-making (Vander Elst et al., 2017)
	Management by outputs (Gerards et al., 2018)
	Transformational leadership (Gerards et al., 2018)
	Low levels of task interdependence (Golden, Veiga 2005, Suh & Lee, 2017)
III Job demands (4) related to the social relations	III Job resources (4) related to the social relations
Loneliness, social isolation (Grant et al., 2013), reduced support and feedback (Sardeshmukh et al., 2012), emotional distance from colleagues, anxiety about being forgotten (Richardson, McKenna, 2014). No damaging effects on the quality of workplace relationships/collegiality (Van Steenbergen et al., 2018, Ten Brummelhuis et al., 2010), no changes in social support (Nijp et al. 2016)	Communication and support from colleagues (Grant et al., 2013, Peters et al., 2014, Bentley et al., 2016, Vander Elst et al., 2017), feelings of social and physical belonging (Vittersø et al., 2003), social interactions (Gerards et al., 2018; Halford, 2005)

Professional isolation (Cooper, Kurland 2002, Kurland, Cooper, 2002, Golden et al., 2008), fear of being excluded and overlooked (Sewell, Taskin 2015), networking for career advancement (Richardson, McKenna, 2014)	Fewer interruptions from colleagues (Tietze, Musson 2005, Richardson, McKenna, 2014), better concentration (Biron & van Veldhoven, 2016, Vittersø et al., 2003), reduced time for communication with co-workers (Fonner, Roloff 2010, Nakrošienė et al., 2019), recovery from interpersonal interaction (Windeler et al., 2017)
Interruptions (Konradt et al., 2003, Fonner, Roloff 2012, Ten Brummelhuis et al., 2012, Ter Hoeven, Van Zoonen 2015)	Freedom from office politics (Fonner, Roloff 2010)
External interactions (Windeler et al., 2017)	Interpersonal trust (Raghuram & Wiesenfeld, 2004)
IV Job demands (3) related to the ICT	IV Job resources (2) related to the ICT
IT complexity (Suh, Lee 2017)	Effective communication (Ten Brummelhuis et al., 2012, Kelliher & Anderson, 2010, Ter Hoeven, Van Zoonen 2015)
Reduced privacy (Suh, Lee 2017), techno-invasion (Leung, Zhang 2017), constant access to technology (Grant et al., 2013)	Close connection between colleagues (Ten Brummelhuis et al., 2012)
Internet surfing activities (O'Neill, T.A., et al., 2009)	

Based on the results of defined job demands and resources and the JD-R model (Demerouti et al. 2001), the conceptual JD-R model for hybrid teleworking is composed as in figure 1. Future hybrid telework research will add new knowledge about job demands and resources into this conceptual model. Job demands and resources of hybrid telework derive from the nature and location of the hybrid telework, management practices, social relations (or lack of it), or issues related to the usage of information communication technology. The conceptual model also includes inter-category impacts. Management practices impact all other categories. The information and communication technology has potentially the same impact, although research is still scarce.

Figure 1. Conceptual JD-R model for hybrid telework. Authors compilation based on the JD-R model (Demerouti et al., 2001; Schaufeli & Taris, 2014)



The number of studies in categories varies. Most studies concerned topics related to the nature and location of the hybrid telework, social relations and loneliness. Management practices have been less studied, especially job demands stemming from deficient practices. Little research has been carried out about job demands and resources related to information and communication technology.

5 DISCUSSION AND CONCLUSION

The research question aimed to be answered in the current paper was: What are the job demands and resources of hybrid teleworking based on existing academic research? The first essential step in this review was to determine the concepts of hybrid teleworking found in academic literature. The use of different terms is extensive, and as a result, the valuable information gained from studies may remain unnoticed. This literature review included articles of various hybrid work concepts by which employees work partly from the office and partly remotely using ICT. This paper also offers to implement the umbrella term “hybrid telework” for future studies of the abovementioned way of working. More likely, this will be the most common way of working in the post-pandemic era and it would make the research evidence more coherent. Results of this study were compiled to conceptual JD-R model of hybrid forms of teleworking. Most attention from scholars has been paid to work characteristics related to the nature and location of the work and social relations. However, several gaps can be highlighted:

Firstly, issues related to information and communications technology usage have received much less attention in the context of job resources and job demands. While technology has

been a crucial component of teleworkers' work for decades, it is surprising that there is such limited knowledge about the impact on teleworkers' well-being of usage of ICT. The conceptual model presented in this paper addresses ICT usage as a specific domain, not as the mediating variable. For example, although technology is a tool for communication for teleworkers, use of it has its specificity, which is different from face-to-face communication, and therefore, its impact on communication and relationships is also different. Thus, problems with social isolation may arise not because of working outside of the office but may be related to the way of using ICT.

Furthermore, Bordi et al. (2018) argue that employees work with a variety of technologies simultaneously and need to integrate and combine them effectively. Hence, the volume of digital communication is one of the most demanding aspects which may affect the work-load, feelings of constant connectivity, and interruptions.

Secondly, job demands and resources related to management practices have also received less attention. It is known from the previous research that opportunities for professional development and innovative climate have been considered as a significant job resource (Schaufeli, Taris, 2014). When many organisations and teams have just short experience with remote work, more knowledge is needed on how to create the above-mentioned resources in hybrid teams. In addition, managers may face challenges in leading hybrid teleworking teams, and there is limited knowledge about job demands related to deficient management practices.

Thirdly, one aspect of social relations has remained unexplored with hybrid forms of telework: relations with clients. Client relationships could be demanding (Hakanen et.al., 2017), yet, positive relationships and appreciation from the client could be a vital job resource (Montreuil, Lippel, 2003). It can be assumed that hybrid employees rely more on ICT while communicating with clients and have fewer personal contacts. As client relationships are crucial for organisations' outcomes, it is crucial to determine how hybrid teleworkers experience client work and how to address that.

From the practical point of view, leaders and HR managers can use the conceptual JD-R model for hybrid teleworking to design and organise work to support the teleworkers' well-being. The model helps identify job demands and resources in four categories and be more aware of potential risk factors for burnout and possibilities to increase employee well-being. As well-being at work is shaped by the interaction of job resources and demands, it is necessary to assess and develop work characteristics in a way that helps to prevent job demands and increase job resources of hybrid telework.

REFERENCES

- Bailey, D. E., Kurland, N. B. (2002), "A Review of Telework Research: Findings, New Directions, and Lessons for the Study of Modern Work", *Journal of Organizational Behavior* 23, 4 383–400. <https://doi.org/10.1002/job.144>.
- Bakker, A. B., Demerouti, E. (2007), "The Job Demands-Resources Model: State of the Art", *Journal of Managerial Psychology* 22, 3 309–28. <https://doi.org/10.1108/02683940710733115>.
- Baruch, Y. (2001), "The Status of Research on Teleworking and an Agenda for Future Research", *International Journal of Management Reviews* 3, 2 113–29. <https://doi.org/10.1111/1468-2370.00058>.
- Baudewijns, C., Gerards, R., de Grip, A., (2015), "New ways of working and work engagement", ROA Research Memorandum 002, Maastricht University, Research Centre for Education and the Labour Market (ROA).

- Bentley, T. A., Teo, S. T. T., McLeod, L., Tan, F., Bosua, R., Gloet, M. (2016), The role of organisational support in teleworker wellbeing: A socio-technical systems approach. *Applied Ergonomics*, 52, 207–215. <https://doi.org/10.1016/j.apergo.2015.07.019>
- Biron, M., van Veldhoven, M. (2016), When control becomes a liability rather than an asset: Comparing home and office days among part-time teleworkers: Within-individual Study on Part-time Telework. *Journal of Organizational Behavior*, 37(8), 1317–1337. <https://doi.org/10.1002/job.2106>
- Boell, S. K., Campbell, J., Cecez-Kecmanovic, D., Cheng, J. “The Transformative Nature of Telework: A Review of the Literature”, s.a., 10.
- Bordi, L., Jussi O., Mäkinen J. P., Kirsi H. T. (2008), “Communication in the Digital Work Environment: Implications for Wellbeing at Work”. *Nordic Journal of Working Life Studies* 8, S3 <https://doi.org/10.18291/njwls.v8iS3.105275>.
- Bosch-Sijtsema, P. M., Ruohomäki, V., Vartiainen, M. (2010), Multi-locational knowledge workers in the office: Navigation, disturbances and effectiveness: Multi-locational knowledge workers in the office. *New Technology, Work and Employment*, 25(3), 183–195. <https://doi.org/10.1111/j.1468-005X.2010.00247.x>
- Collins, A. M., Hislop, D., Cartwright, S. (2019), “Social Support in the Workplace between Teleworkers, Office-Based Colleagues and Supervisors”, *New Technology, Work and Employment* 31, 2 161–75. <https://doi.org/10.1111/ntwe.12065>.
- Cooper, C. D., Kurland, N. B. (2002), “Telecommuting, Professional Isolation, and Employee Development in Public and Private Organizations”, *Journal of Organizational Behavior* 23, 4 511–32. <https://doi.org/10.1002/job.145>.
- Demerouti, E., Bakker, A. B. (2011), The Job Demands– Resources model: Challenges for future research. *SA Journal of Industrial Psychology/SA Tydskrif vir Bedryfsielkunde*, 37(2), 1-9
- Demerouti, E., Bakker, A. B., Nachreiner, F., Schaufeli, W. B. (2001), “The Job Demands– Resources Model of Burnout”, *Journal of Applied Psychology* 86, 3 499–512. <https://doi.org/10.1037/0021-9010.86.3.499>.
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, D. (2019), “Is Activity-Based Working Impacting Health, Work Performance and Perceptions? A Systematic Review”, *Building Research & Information* 47, 4 468–79. <https://doi.org/10.1080/09613218.2018.1440958>.
- Eurofound and the International Labour Office (2017), Working anytime, anywhere: The effects on the world of work. Publications Office of the European Union, Luxembourg, and the International Labour Office, Geneva https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1658en.pdf
- European Commission (2020), Telework in the EU before and after the COVID-19: where we were, where we head to. https://ec.europa.eu/jrc/sites/jrcsh/files/jrc120945_policy_brief_-_covid_and_telework_final.pdf (accessed 13.12.2021)
- Eurostat, https://ec.europa.eu/eurostat/databrowser/view/lfsa_19plwk26/default/table?lang=en (accessed 13.12.2021)
- Federal Reserve Bank of Atlanta (2020), Firms Expect Working from Home to Triple. <https://www.frbatlanta.org/blogs/macroblog/2020/05/28/firms-expect-working-from-home-to-triple> (accessed 14.10.2020)
- Fonner, K. L., Roloff, M. E. (2012), “Testing the Connectivity Paradox: Linking Teleworkers’ Communication Media Use to Social Presence, Stress from Interruptions, and Organizational Identification”, *Communication Monographs* 79, 2 205–31.

- Gajendran, R. S., Harrison, D. A. (2007), “The Good, the Bad, and the Unknown about Telecommuting: Meta-Analysis of Psychological Mediators and Individual Consequences”, *Journal of Applied Psychology* 92, 6 1524–41. <https://doi.org/10.1037/0021-9010.92.6.1524>.
- Golden, T. D. (2006), “The Role of Relationships in Understanding Telecommuter Satisfaction”, *Journal of Organizational Behavior* 27, 3 319–40.
- Golden, T. D., Eddleston, K. A. (2020), Is there a price telecommuters pay? Examining the relationship between telecommuting and objective career success. *Journal of Vocational Behavior*, 116, 103348. <https://doi.org/10.1016/j.jvb.2019.103348>
- Golden, T. D., Veiga, J. F. (2008), “The Impact of Superior–Subordinate Relationships on the Commitment, Job Satisfaction, and Performance of Virtual Workers”, *The Leadership Quarterly* 19, 1 77–88. <https://doi.org/10.1016/j.leaqua.2007.12.009>.
- Golden, T. D., Veiga, J. F., Dino, R. N. (2008), The impact of professional isolation on teleworker job performance and turnover intentions: Does time spent teleworking, interacting face-to-face, or having access to communication-enhancing technology matter? *Journal of Applied Psychology*, 93(6), 1412–1421. <https://doi.org/10.1037/a0012722>
- Grant, A. M., Christianson, M. K., Price, R. H. (2007), “Happiness, Health, or Relationships? Managerial Practices and Employee Well-Being Tradeoffs”, *Academy of Management Perspectives* 21, 3 51–63. <https://doi.org/10.5465/amp.2007.26421238>.
- Grant, C. A., Wallace, L. M., Spurgeon, P. C. (2013), An exploration of the psychological factors affecting remote e-worker’s job effectiveness, well-being and work-life balance. *Employee Relations*, 35(5), 527–546. <https://doi.org/10.1108/ER-08-2012-0059>
- Jari, H. J., Schaufeli, W. B., Ahola, K. (2008), “The Job Demands-Resources Model: A Three-Year Cross-Lagged Study of Burnout, Depression, Commitment, and Work Engagement”, *Work & Stress* 22, 3 224–41. <https://doi.org/10.1080/02678370802379432>.
- Hakanen, J. J., Seppälä, P., Peeters, M. C. W. (2017), High Job Demands, Still Engaged and Not Burned Out? The Role of Job Crafting. *International Journal of Behavioral Medicine*, 24(4), 619–627. <https://doi.org/10.1007/s12529-017-9638-3>
- Hartig, T., Kylin, C., Johansson, G., (2007), The telework tradeoff: stress mitigation vs. constrained restoration. *Appl. Psychol.* 56, 231e253.
- Hoeven, C. L., Zoonen, W. (2015), “Flexible Work Designs and Employee Well-being: Examining the Effects of Resources and Demands”, *New Technology, Work and Employment* 30, 3 237–55. <https://doi.org/10.1111/ntwe.12052>.
- Inceoglu, I., Geoff, T., Chu, C., Plans, D., Gerbasi, A. (2018), “Leadership Behavior and Employee Well-Being: An Integrated Review and a Future Research Agenda”, *The Leadership Quarterly* 29, 1 179–202. <https://doi.org/10.1016/j.leaqua.2017.12.006>.
- Kelliher, C., Deirdre, A. (2008), “For Better or for Worse? An Analysis of How Flexible Working Practices Influence Employees’ Perceptions of Job Quality”, *The International Journal of Human Resource Management* 19, 3 419–31.
- Udo, K., Hertel, G., Schmook, R. (2003), “Quality of Management by Objectives, Task-Related Stressors, and Non-Task-Related Stressors as Predictors of Stress and Job Satisfaction among Teleworkers”, *European Journal of Work and Organizational Psychology* 12, 1 61–79. <https://doi.org/10.1080/13594320344000020>.
- Kossek, E. E., Lautsch, B. A., Eaton, S.C. (2006), Telecommuting, control, and boundary management: Correlates of policy use and practice, job control, and work–family effectiveness. *Journal of Vocational Behavior*, 68(2), 347–367. <https://doi.org/10.1016/j.jvb.2005.07.002>

- Kurland, N. B., Cooper, C. D. (2002), Manager control and employee isolation in telecommuting environments. *The Journal of High Technology Management Research*, 13(1), 107–126. [https://doi.org/10.1016/S1047-8310\(01\)00051-7](https://doi.org/10.1016/S1047-8310(01)00051-7)
- Lautsch, B. A., Kossek, E.E., Eaton, S.C. (2009), Supervisory Approaches and Paradoxes in Managing Telecommuting Implementation“. *Human Relations* 62, 6 795–827. <https://doi.org/10.1177/0018726709104543>.
- Leung, L., Zhang, R. (2017), Mapping ICT use at home and telecommuting practices: A perspective from work/family border theory. *Telematics and Informatics*, 34(1), 385–396.
- Lundberg, U., Lindfors, P. (2002), Psychophysiological reactions to telework in female and male white-collar workers. *Journal of Occupational Health Psychology*, 7(4), 354–364.
- Mann, S., Holdsworth, L. (2003), “The Psychological Impact of Teleworking: Stress, Emotions and Health”, *New Technology, Work and Employment* 18, 3 196–211. <https://doi.org/10.1111/1468-005X.00121>.
- Maruyama, T., Tietze, S. (2012), From anxiety to assurance: Concerns and outcomes of telework, *Personnel Review*, 41(4), 450–469. <https://doi.org/10.1108/00483481211229375>
- McKinsey (2020), <https://www.mckinsey.com/featured-insights/future-of-work/what-800-executives-envision-for-the-postpandemic-workforce> (accessed 14.12.2021)
- Montreuil, S., Lippel, K. (2003), Telework and occupational health: A Quebec empirical study and regulatory implications. *Safety Science*, 41(4), 339–358.
- Mulki, J. P., Jaramillo F. (2011), “Workplace Isolation: Salespeople and Supervisors in USA”, *The International Journal of Human Resource Management* 22, 4 902–23.
- Müller, T., Niessen, C. (2019), Self-leadership in the context of part-time teleworking. *Journal of Organizational Behavior*, 40(8), 883–898. <https://doi.org/10.1002/job.2371>
- Nakrošienė, A., Bučiūnienė, I., Goštautaitė, B. (2019), “Working from Home: Characteristics and Outcomes of Telework”, *International Journal of Manpower* 40, 1 87–101.
- Nijp, H. H., Beckers, D. G. J., van de Voorde, K., Geurts, S. A. E., Kompier, M. A. J. (2016), Effects of new ways of working on work hours and work location, health and job-related outcomes. *Chronobiology International*, 33(6), 604–618.
- O’Neill, T.A., et al., (2009), Predicting teleworker success: an exploration of personality, motivational, situational, and job characteristics. *New Technology, Work and Employment*, 24 (2), 144–162.
- Peters, P., den Dulk, L., van der Lippe, T. (2009), The effects of time-spatial flexibility and new working conditions on employees’ work–life balance: The Dutch case. *Community, Work & Family*, 12(3), 279–297. <https://doi.org/10.1080/13668800902968907>
- Richardson, J., McKenna, S. (2014), “Reordering Spatial and Social Relations: A Case Study of Professional and Managerial Flexworkers: Reordering Spatial and Social Relations”, *British Journal of Management* 25, 4 724–36. <https://doi.org/10.1111/1467-8551.12017>
- Sardeshmukh, S.R., Sharma, D., Golden, T.D. (2012), Impact of telework on exhaustion and job engagement: a job demands and job resources model. *New Technology, Work and Employment*, Vol. 27(3).
- Schaufeli W.B., Taris T.W. (2014), A Critical Review of the Job Demands-Resources Model: Implications for Improving Work and Health in: Bridging Occupational, Organizational and Public Health.
- Schulte, P., Vainio, H. (2010), “Well-Being at Work – Overview and Perspective”, *Scandinavian Journal of Work, Environment & Health* 36, 5 422–29.
- Sewell, G., Taskin, L. (2015), “Out of Sight, Out of Mind in a New World of Work? Autonomy, Control, and Spatiotemporal Scaling in Telework”, *Organization Studies* 36, 11 1507–29.
- Suh, A., Jumin L. (2017), “Understanding Teleworkers’ Technostress and Its Influence on Job Satisfaction”, *Internet Research* 27, 1 140–59.

- Sullivan, C. (2003), What's in a name? Definitions and conceptualisations of teleworking and homeworking. *New Technology, Work and Employment*, 18(3), 158–165.
- Sullivan, C., Lewis, S. (2001), Home-based Telework, Gender, and the Synchronization of Work and Family: Perspectives of Teleworkers and their Co-residents. *Gender, Work & Organization*, 8(2), 123. <https://doi.org/10.1111/1468-0432.00125>
- Ten Brummelhuis, L. L., Haar, J. M., van der Lippe, T. (2010), Collegiality under pressure: The effects of family demands and flexible work arrangements in the Netherlands. *The International Journal of Human Resource Management*, 21, 2831–2847.
- Ter Hoeven, C. L., Van Zoonen, W. (2015), Flexible work designs and employee well-being: Examining the effects of resources and demands. *New Technology, Work and Employment*, 30, 237–255.
- European Parliament (2021), The Impact of teleworking and digital work on workers and society
[https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662904/IPOL_STU\(2021\)662904_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662904/IPOL_STU(2021)662904_EN.pdf)
- The Flexible Workspace Outlook Report 2019 EMEA, Colliers International
<http://flexiblespace.colliers.com> (accessed 15.12.2021).
- Tietze, S., Gill M. (2005), “Recasting the Home-Work Relationship: A Case of Mutual Adjustment?” *Organization Studies* 26 9 1331–52.
- Tremblay, D.-G., Paquet, R., Najem, E. (2006), Telework: A Way to Balance Work and Family or an Increase in Work--Family Conflict? *Canadian Journal of Communication*, 31(3), 715–731. <https://doi.org/10.22230/cjc.2006v31n3a1721>
- Troup, C., Rose, J. (2012), Working from home: Do formal or informal telework arrangements provide better work–family outcomes? *Community, Work & Family*, 15(4), 471–486. <https://doi.org/10.1080/13668803.2012.724220>
- Van Steenbergen, E. F., van der Ven, C., Peeters, M., Taris, T. (2018), “Transitioning Towards New Ways of Working: Do Job Demands, Job Resources, Burnout, and Engagement Change?” *Psychological Reports* 121, 4 736–66. <https://doi.org/10.1177/0033294117740134>.
- Vander Elst, Tinne, Ronny Verhoogen, Maarten Sercu, Anja Van den Broeck, Elfi Baillien, ja Lode Godderis. „Not Extent of Telecommuting, But Job Characteristics as Proximal Predictors of Work-Related Well-Being“. *Journal of Occupational & Environmental Medicine* 59, nr 10 (October 2017): e180–86.
- Van Yperen, N. W., Rietzschel, E. F., & De Jonge, K. M. M. (2014). Blended Working: For Whom It May (Not) Work. *PLoS ONE*, 9(7), e102921. <https://doi.org/10.1371/journal.pone.0102921>
- Well-being at work: creating a positive work environment, European Agency for Safety and Health at Work 2013. <file:///Users/macbook/Downloads/well-being-at-work-creating-a-positive-work-environment.pdf> (accessed 02.12.2021).
- WHO (2019). Mental health in the workplace. https://www.who.int/mental_health/in_the_workplace/en/ (accessed 02.12.2021)
- Vittersø, Joar, Sigmund Akselsen, Bente Evjemo, Tom Erik Julsrud, Birgitte Yttri, ja Svein Bergvik. „Impacts of Home-Based Telework on Quality of Life for Employees and Their Partners. Quantitative and Qualitative Results From a European Survey“, s.a., 33.
- Yoo, J., Jing C., Gary L. F. (2020), “Influence of Customer Participation from the Employee Perspective”, *International Journal of Bank Marketing* 39, 1 24–47. <https://doi.org/10.1108/IJBM-05-2020-0255>.

Deterritorialization of the Workspace: Is Representation a New Ideology of Offices in the Information Society?

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ABSTRACT

The characteristic of the modern way of working in the information age is the dispersion of work: the workspace becomes deterritorialized and new design guidelines are introduced through systems of communication, flows and virtual systems. The purpose of this paper is to theoretically answer the question of whether workspaces thus gain meaning, or there are some key *symbols* and *maps of meaning* of workspaces that, despite the necessary dispersion, will not change. The paper is based on the views of sociologist Manuel Castells on network society and Stuart Hall on representation, and the basic platform is based on Ernst Gombrich's view on perception saying "There is no innocent eye". The view propagated in this paper is that the change of the social context from post-industrialism to information society has conditioned the change of needs from *work space* to *representation space*, which becomes a kind of ideology. Representation that way directly enables the implementation of corporate culture. In this paper, the topic is analyzed through two filters - first through the presentation of transformation of the territory and the dispersion of workspace, then through the analysis of the concept of representation itself and adopted *maps of meaning* related to offices and workspaces. We conclude that we are shifting from the term *place* to the term *communication code*. The issue of workspace architecture is related to defining and recognizing flows. Architecture becomes a frame that *represents* the messages of new elites, and productivity as a goal is achieved by those users who have successfully implemented a set of tools from the industrial age in the tools of the information age – they transformed territories into flows. The value of the paper also lies in the fact that it can serve as a basis for further research into the architectural design guidelines of the workspace - how we can materialize communication codes in physical space.

Keywords

Workplace transformation, Deterritorialization, Representation, Ideology, Maps of meaning.

1 INTRODUCTION

1.1 The issue of workspace transformation

The transformation of work processes, which was primarily the result of the development of digital technologies in the last few decades, has conditioned the transformation of the physical territory of the workspace. Covid 19 only accelerated space dispersion and hybrid work, but transformations were certainly inevitable. The view propagated in this paper is that the workspace will be transformed, that the borders of the territory of work activity shall be erased, but the workplace shall not be left without space - the workspace becomes the *text* of work processes and success, it is transformed and acquires new meanings and *new readings of power and success* through *spatial representation*.

The analysis moves in the direction of investigating the impact of information flows on workplace architecture, and the impact of work process transformation on workspaces, seeking an answer to the question of forming new formats and modern organization of the physical framework of workspaces. One of the goals of the research is to define guidelines for designing workspaces in the information age, because practice shows the application of "traditional"

organizations, taken from the post-industrial era whose work processes have been obsolete. Basing the views on Manuel Castells' theory of flow, we argue that a network society has a key influence on workspace transformation and that transformation occurs by division into spaces of place and spaces of flows.

This paper analyzes the process of transformation of the work territory and the influence of a network society on one hand, and the concept of representation, on the other. The issue is analyzed through two filters - first through the analysis of workspace transformation and then through the analysis of representation (concept, mental and spatial representation) and the adopted "map of meaning" related to business facilities. The construction of a new map of meaning is allowed by the loss of territory, and new systems are introduced into new design guidelines - communication, flows and virtual systems.

2 TRANSFORMATION OF TERRITORIES INTO FLOWS

2.1 Deterritorialization of the workspace

The structure and dynamics of our society was conceptualized by sociologist Manuel Castells (Castells, 1996) who named it a network society. The transformation of work in the information paradigm follows a historical perspective, and implies above all the individualization of work, which creates potentially fragmentary societies.

It explains the information process of work: creating additional value by innovation of processes and products, deals with the working class restructuring and the creation of *flexible personalities* - employed people without workplaces⁴¹. Castells presents the theory of urbanism in the information age based on the distinction between the space of place and the space of flows. This is exactly the basis for the restructuring of workspaces, because the territory of workplaces, which was firmly defined by the space of place, is today reconstructed into spaces of flows and spaces of (different) places. Historically speaking, it was the territory that defined workspaces. From the 19th century and linear production processes, through the specialization of jobs and their individualization into cells, through an open plan that was also territorially predefined. Now we come to a turning point. The key change in the understanding of the concept and transformation of the workplace today is precisely in the transformation of its **territory** - the workplace has become flexible, work processes are networked and virtual, and the territory developed dual characteristics - physical and virtual.

A new platform for interpreting the meaning and transformation of the workspace is created. If the territory of the workplace in the information age loses its previous meaning and significance, and work processes can be performed non-territorially, what new meaning and priorities will the workspace gain?

3 MAPS OF MEANING

The basis for the interpretation of meaning can be found in Ernst Gombrich's 1960 work *Art and Illusion*, famous for conceptualizing this idea of perception. His statement "There is no innocent eye" refers to the existence of already formed maps of the mind, which represents the adopted platform of this paper. Will the imprinted workspace symbols remain the same, despite deterritorialization? Certain maps of meaning of the workspace are imprinted in our mind through the symbols of success, work, profit, innovation and progress, which represent certain messages and communication codes.

3.1 Representation and communication codes

According to the *Shorter Oxford English Dictionary* the meaning of representation is:

⁴¹ According to Castells, the transformation to flexible work patterns involves four elements: working time - not fixed, task orientation, location - mobile, contractual obligation - no loyalty and corporate rules

1. To represent something means to describe or present, to recall in the mind by description or representation or imagination; to present to us the image before us in our mind or in our feelings.

2. To represent also means to symbolize, represent, be a model or be a substitute.

The way in which the concept of representation connects the meaning and language is interpreted differently by different theories. *Reflective (mimetic, reflective approach)* is explained by the simple and direct reflection that already exists in the world of objects, people and events, between words (signs) and things. *Intentional (deliberate)* - the meaning is that given by the author, which he intends to convey and communicate with intent, or the *constructionist approach* - that the meaning is complex and construed through language and concepts. Constructivist theory can be viewed through the semiotic approach, largely influenced by the Swiss linguist Ferdinand de Saussure, or the discursive approach associated with the work of the French philosopher Michel Foucault.

The semiotic and discursive approach to representation have certain similarities, but also differ significantly in the interpretation of reading. The semiotic approach involves the question of how language forms meaning, while the discursive approach focuses on the effects and consequences of representation (and its policy) - how it is associated to the production and constructs of power, identity and defines uses through time and practice.

Conceptualists believe that we use signs in representation that are organized in different types of languages. Language uses symbols and signs to describe and represent reference objects from the “real” world. Furthermore, virtual things and things from imagination, fantasy, have their references. However, according to Hall, the language is not a “mirror” of reality and imagination, meaning is produced by language through various representational systems, which we call “languages” for easier understanding (Hall, 1997).

Language as a system of representation can be understood not as written or spoken, but as a representative of a certain meaning, communication of a thought, concept or idea. Its elements are sound, gesture, expression, thought, word, and their importance lies in the construction of a certain meaning and its conveyance. These are the media of conveying the meaning, which function as *signs* / symbols - which represent a concept, feeling or idea, which is read, decoded, interpreted in the same way.

“Signs represent or describe our concept, idea, or feeling in a way that allows others to “read”, decode or interpret the meaning in the same way we do.” (Hall,1997).

Italian semiologist and writer Umberto Eco also conducted semiological research of cultural phenomena and in his book “Culture, Information, Communication” he stressed that “semiological research is not only a way in which information messages renew the codes of ideologies, but at the same time they show us continuous movement through which information changes codes and ideologies and turns into a new code and a new ideology”. *Code* as a model of a group of communication conventions serves to explain the possibility of communicating certain messages. Collective acceptance of messages as a time-changing pattern, in the context of changing the territory and meaning of the workspace, confirms the possibilities of interpreting new ideologies of workspaces. By using the *code* as a process of communication through a series of messages or systems of meaning that affect people, it is possible to establish new systems of value of the relationship between workspaces and their users in the information age. Verbal and visual language as a means of construing meaning between the relationships of people, objects, ideas, i.e. the process of constructing a new map of meaning of business facilities in the information society, can be also defined by new architecture. Accepted systems and adopted “maps of meaning” related to offices are being redefined, new systems are being introduced - communication and flows, success and virtual systems. Hall in his work “*The Work of Representation*” explains the way of forming a constructionist approach to the

formation of representation - the first system that is formed in the mind, and works according to the principle of mental representation that classifies the world into familiar categories that are logical. **If we know the concept of something, we will know its meaning.** However, through language, we communicate meaning with signs adopted by the convention, and only if there are codes that allow us to translate concepts into language and signs. These signs do not exist in nature, but are the result of social conventions, part of our cultures, our common “map of meaning” that we adopt as members of a community. The idea that meaning provides the similarity between mental representations and representation is the oldest theory and it is the essence of the simplest theory of the relationship between representation and what it signifies. The concept of mental representation is primarily a theoretical construct of cognitive science and is related to the development of Theory of Mind and the main concept of the Computational Theory of Mind ⁴² according to which cognitive states and processes are constituted by the appearance, transformation and storage (in the mind / brain) of information structures (representations) of different types (Stanford Encyclopedia of Philosophy). If representation is an object with semantic properties (content, reference, truth), mental representation can be interpreted as a mental object. On the other hand, according to the naturalistic theory, mental representations acquire content thanks to their evolutionary history (Millikan, 1984), which also has a theologically significant feature, and some theories argue that the mental content of representation has been determined by the content of other concepts.⁴³ Mental representation means the representation of things that we experience with our senses, and in addition to the perception of space, imprint representations and perceptions of success, satisfaction and happiness in life are also important and should be also identified in planning the development of the workspace. If we identify business facilities and workspaces as places where success, income and work are created, it will take a long time for that perception to change, regardless of the fact that the territory of the workplace itself has become flexible. Even if workplaces are transformed to the point of complete non-territoriality, a perceptual impression remains, a mental representation of space as a place of work, creation, profit and success.

“Atmosphere is a comprehensive perceptual, sensory and emotional imprint of the environment or emotional situation” (Pallasmaa, 2017).

4 DISCUSSION AND SYNTHESIS

Considering the fact that the code of work, success and profit is written in our “maps of meaning”, when it comes to offices, the question arises whether in the modern challenges of dispersion and dislocation of work, the codes of presentation of success and work remain as “written”. Applying Hall's views on systems of representation, the concept of physical offices can be interpreted as a set of images, which by using visual and verbal language summarizes a set of characteristics that evoke an image in the mind's eye - a complex system of representation. Offices = working, successful and powerful, and opposite the lack of offices is automatically read as unsuccessful, poor and non-working. This concept generates a certain

⁴² Theory of Mind is the ability to attribute mental states (beliefs, desires, intentions, and emotions) to oneself and others, in order to predict and explain perceived behaviour (Givens, 2009). It requires understanding that the mental states of others may differ from our own, and that the behaviour of others is a consequence of those mental states. Computational Theory of Mind is a kind of modern Representational Theory of Mind (which has been developed since Aristotle), and compares the human brain with a computer, and the mind with a program (algorithm).

⁴³ In order not to get too involved in psychological and conceptual theories related to representation, we will just give a brief explanation: today it is usually considered that there are two types of representations - conceptual and constitutional (mental states such as thoughts, beliefs, desires are constituted)

type of knowledge about space and the user, and a certain attitude towards it. In fact, it functions as an ideology. Therefore, although the territory of work becomes dispersive, companies and offices will strive to maintain codes of success and power by representation of their spaces. The workspace, although experiencing the dispersion of the territory, will not be reduced, but will change the structure of presentation and meaning, and vice versa - it will strive to remain a representative of success, profit and power, while flows replace work territories.

5 CONCLUSION

The dispersion of work enabled by the digital transformation of business, transforms the territory of the workplace and puts flows in the foreground. The implementation of information technologies also serves as a catalyst for change and new reading and use of workspace - from the term *place* we shift to the term *communication code* - through representation. The focus is on recognizing flows and networking with spaces of place - physical territories, and architecture becomes a *hub* that represents and communicates users' messages. In practice, or in next research paper, it will be challenging to identify elements of architecture that can be materialized *maps of meaning* in physical space. Not to be abandoned - with wellbeing elements included, in person communication, team work and all psychological elements, because we are all (different) humans, we need holistic approach to future workspace. One of approaches, marked in this paper, is that physical deterritorialization is inevitable but communication codes remain the same: although the structure of the spaces themselves is changing - in the information age the issue of architecture is related to defining and recognizing flows, while architecture becomes a frame that represents the messages of (new) business elites.

REFERENCES

- Bruner, J. S. (1990), *Acts of meaning*, Harvard University Press, Cambridge.
- Castells, M. (1996), *The Rise of the Network Society*, Blackwell, Oxford.
- Castells, M. (1998), *End of Millennium*, Blackwell, Oxford.
- Eco, U. (1973), *Culture, Information, Communication*, Nolit, Belgrade.
- Gombrich, E. H. (1961), *Art and Illusion*, Pantheon Books, New York.
- Hall, S. (1997), "Work of Representation", ed. Hall, S. *Representation: Cultural Representations and Signifying Practices*, Sage, London, 13-74.
- Pallasmaa, J. (2017), *The Space of Time*, Faculty of Architecture, Belgrade.
- Millikan, R. G. (1984), *Language, thought, and other biological categories: New foundations for realism*, MIT press, Cambridge.

Resilient Organizations and Emerging Infrastructural Relations: The Making of Digital Resilience

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ABSTRACT

Exogenous shocks propel organizations to pursue resilience to absorb strain, adapt to disruption, and continue performing their work. While prior research has offered insights into how resilience is activated to bounce back in the light of a shock, we turn our attention to how digital resilience is practiced and how its bouncing forward potential manifests. Building on an emerging body of research highlighting the critical role that digital technology may play in dealing with external adversity and in affording resilient responses with a bouncing forward potential, we focus on the notion of digital resilience. We define digital resilience as the sociotechnical process through which organizations cope with adversity, maintain operations despite unprecedented uncertainty, and ultimately pursue transformative activities by deploying and engaging with digital technologies. We conducted a 2-years longitudinal qualitative study of how Greek primary school teachers practiced digital resilience in the face of COVID-19. Data collection was conducted from March 2020 to January 2022 and took place in three waves, in which we relied on multiple data sources and gathered empirical material through an amalgam of shadowing, observations, interviews and archival data. Our study uncovers the intricate workings of digital resilience and the component parts within each mechanism. We show that digital resilience is practiced by setting three interrelated mechanisms in motion, namely reappraising collective suffering, improvising based on tools at hand, and conducting reflective interventions and show how these mechanisms cultivate the emergence of settled or contested infrastructural relations. Our study extends theory on the emerging field of digital resilience by highlighting its processual, sociotechnical, and generative nature and offers a relational view on digital infrastructure evolution.

Keywords

Digital resilience, Infrastructural relations, Digital transformation.

1 INTRODUCTION

No dimension of human everyday life has been left untouched from the COVID-19 global pandemic. Organizational life has been severely disrupted and the smooth functioning, continuation, and existence of a plethora of organizations have been threatened. Such unprecedented exogenous shocks require organizations to practice resilience (Gittell et al., 2006; Meyer, 1982; Powley, 2009) and “effectively absorb, develop situation-specific responses to and ultimately engage in transformative activities to capitalize on disruptive

surprises that potentially threaten organizational survival” (Lengnick-Hall, Beck, & Lengnick-Hall, 2011). While prior research has offered insights into how resilience is activated to maintain functions or quickly recover from an external shock (Powley, 2009), our theorizing turns attention to whether and how a unique form of resilience, which arises through the engagement with digital technologies, unleashes a new improved trajectory for organizations and enables them to transform into a more adaptable state. Building on an emerging body of research highlighting the critical role that digital technology may play in dealing with external adversity (Wittbold et al., 2020; Ågerfalk et al., 2020) and in affording resilient responses with a bouncing forward potential (Fletcher & Griffiths, 2020; Heeks & Ospina, 2019a; Sakurai & Chughtai, 2020), we focus on the notion of digital resilience (Boh et al., 2020). We define digital resilience as the sociotechnical process through which organizations cope with adversity, maintain operations despite unprecedented uncertainty, and ultimately pursue transformative activities by deploying and engaging with digital technologies. The notion of digital resilience questions prior IS research focusing either on organizational resilience and its impact on IT system implementation (Cho et al., 2007) or on the resilience of the IT system itself (Wang et al., 2010). Rooted in the argument that possibilities for absorbing strain, adapting to disruption, and transforming into a new state emerge in the imbrication between digital technologies and the organizations that utilize such technologies (Heeks & Ospina, 2019a), digital resilience better captures that resilient responses emerge via the socio-technical links between the organizational members’ demands and the digital technologies’ affordances. Additionally, given that digital technologies are also malleable, flexible, and combinable in myriads of ways enabling continued innovation and transformation (Kallinikos et al., 2013; Yoo et al., 2010), digital resilience is marked by an inherent bouncing-forward potential which can manifest in the aftermath of organizational members’ engagement with digital technologies to develop situation-specific responses to adversity. Advancing understanding of how digital resilience is practiced and providing insights into whether and when digital resilience has a bouncing forward potential can be valuable for organizations confronted with an exogenous shock and need to ensure continuity of operations by engaging in a rapid digital transformation journey. While digital first organizations or even for organizations whose work always included partial reliance on digital technologies, digital resilience could be practiced by utilizing slack resources (Meyer, 1982), several organizations do not fall in this category and have been even more vulnerable and fragile. Thus, the puzzle we focus on is particularly important for organizations who have not been in the process of becoming digital first and lack sufficient digital resources and infrastructure to pursue such a challenging endeavor. Against the above background, we ask: *How do organizations practice digital resilience in the face of an external shock? How does the bouncing forward role of digital resilience unfold?*

2 BACKGROUND

Prior research highlights that exogenous shocks require organizations to practice resilience (Sutcliffe & Vogus, 2003). Resilience equips organizations with the possibility not only to absorb strain, resume operations, and bounce back to the original state unaffected by a shock (Holling, 1973; Van der Vegt, 2015), but also to learn from these shocks, transform, and bounce forward to a new state (Walker et al., 2004), characterized by enhanced preparedness for future shocks (Sakurai & Chughtai, 2020) and by altered processes, boundaries, and goals (Folke et al., 2010; Ortiz-de-Mandojana, 2016; Weick & Sutcliffe, 2001). The processes via which resilience emerges have been studied from several research streams. First, resilience has been discussed as a latent, learnable capacity of organizations to rebound and resume operations in the wake of unsettling events, which is built and activated through social interactions among organizational members (Powley, 2009). In this view, resilience is rooted in positive individual

relationships, relational reserves (Gittell et al., 2006) and employee strengths to improvise (Weick, 1993) and cope with adversity (Coutu, 2002; Luthans, 2002). A second stream of research views resilience as “positive adjustment under challenging conditions” (Sutcliffe and Vogus, 2003), which can emerge via loosening of control and novel use of slack resources (Gittell et al., 2006). While both research streams shed light on organizational resilience and various social mechanisms and enabling conditions that allow for such resilience to occur, they leave open questions regarding the role of digital technology and the sociotechnical processes giving rise to resilient responses. In the extant IS literature devoted to resilience, in which the role of technology is expected to be more pronounced, resilience tends to refer to robustness and an ability to cope with changes in the external environment and apply to the users of a system, the information system itself, as well as the outcome of the system (Heeks & Ospina, 2019a; Ignatidis & Nadhakumar, 2006). Acknowledging the role that human systems, information systems, and output or enterprise systems play for the resilience of organizations calls for an approach to information systems well-understood and established and usually referred to as socio-technical (Bostrom & Heinein, 1977). A recent review on resilience in information systems research (Weber et al., 2021) captured existing work from a socio-technical perspective, which appreciates the role of technology users and how processes of resilience unfold over time. Their insights call for more work on the mechanisms of resilience and how organizations can “resist and withstand, recover to the original state in the sense of bouncing back, or recover to a new state in the sense of adaptation (Weber et al., 2021).” First identification of empirical characteristics or markers of resilience points to the need to uncover emerging mechanisms of resilience that involve the use of information systems, denoted as e-resilience (Heeks & Ospina, 2019b) or as we refer to it here, digital resilience. More specifically, our exploration aims at understanding the conditions under which digital resilience allows for a bouncing forward for an organization that may include elements of digital transformation or a continuity of practice using digital tools instead of focusing on non-digital practices. To shed light on whether and how digital resilience propels transformation, we track the evolution of digital infrastructure and how previously underused or disregarded IT tools become regular fixtures in practice in the aftermath of the pandemic. Thus, we connect to prior research on the processes through which digital infrastructure evolves (Henfridsson & Bygstad, 2013) and draw on an emerging research stream highlighting the need to acknowledge the multiple roles that context and organizational members play and adequately capture the complex dynamics of digital infrastructure evolution (Karasti & Blomberg, 2018; Pipek & Wulf, 2009). Infrastructures are “built networks that facilitate the flow of goods, people, or ideas and allow for their exchange over space” (Larkin, 2013). The digital infrastructure literature focuses on “the basic information technologies and organizational structures, along with the related services and facilities necessary for an enterprise or industry to function” (Tilson et al., 2010). The term infrastructure is intended to encompass “interconnected system collectives,” moving the field away from studies of single-site IS (Henfridsson & Bygstad, 2013). Tilson et al. (2010) argue that as distributed, emergent, and relational phenomena, digital infrastructures are paradoxical in having to contend with logics of both change and control across infrastructural layers. A critical concern in infrastructural research has thus focused on the tensions arising from managing opposing logics in interconnected systems. Existing research has focused on three fundamental ways in which these tensions evolve, namely through innovation, adoption, or scaling (Henfridsson & Bygstad, 2013; Kaniadakis & Constantinides, 2014). Arguably, all three are shorthands for complex processes involving multiple actors and systems. The long-recognized complexity of the processes of infrastructure change led to the term “infrastructuring” as a verb (Pipek & Wulf, 2009), acknowledging the

multiple roles that context and users play and the challenges in adequately capturing these dynamics (Karasti & Blomberg, 2018).

3 METHODS

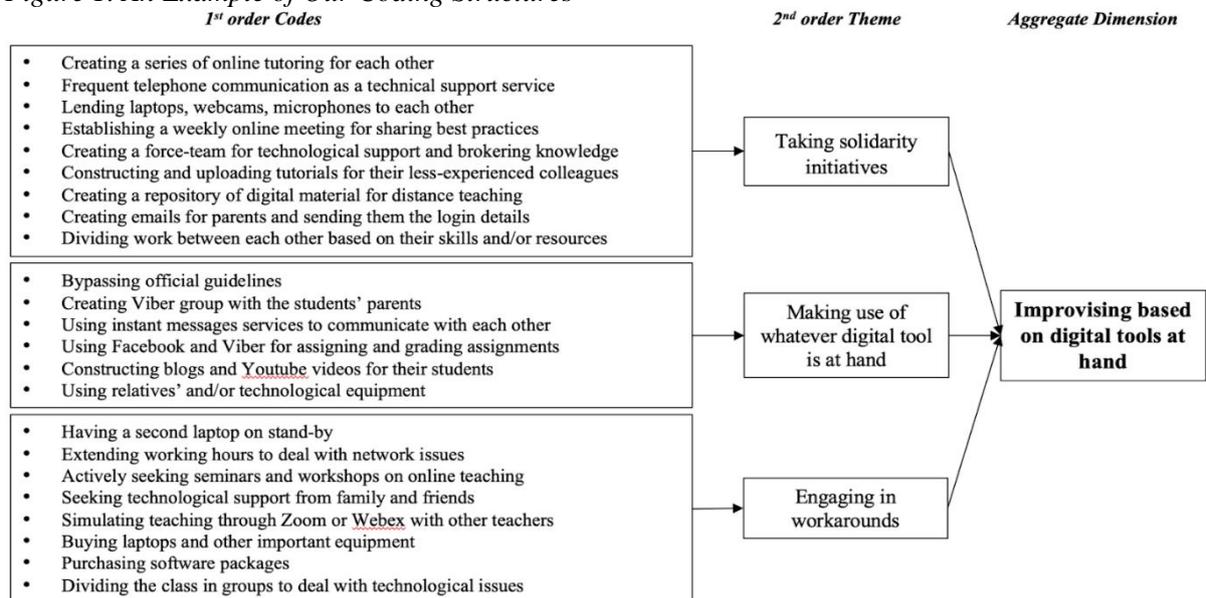
In seeking to answer our research question, we conducted a longitudinal qualitative study of digital resilience in a cumbersome public organization whose core work fundamentally relies on physical contact. To study digital resilience, we explore a setting where digital transformation stands at a beginning and where an external shock truly impacts work and routines on all levels. Over a 2-years period, we explored how Greek primary school teachers developed situation-specific responses to the severe disruption triggered by COVID-19 and the subsequent national lockdowns by engaging with digital technologies in novel ways and pursuing a rapid digital transformation journey. Greek primary schools' work has traditionally been fundamentally dependent on physical meetings, their resources have been highly constrained, their digital infrastructure at a minimum, and in the light of the COVID-19 pandemic, there was absence of knowledge and even of the desire to engage with digital technologies to perform their work. Greek primary schools not only used to neglect the importance of digital technologies to their processes in the past, but also were just healing from a previous external shock that impeded investments in digital infrastructure; the 2008 Eurozone economic crisis. Data collection was conducted from March 2020 to January 2022 and took place in three waves. We relied on multiple data sources and gathered empirical material through an amalgam of shadowing, observations, interviews and archival data. Table 1 presents the main data sources and the data types gathered in the three waves of data collection.

Table 1. Data Collection and Data Types

	First Wave of Data Collection (Mar 2020-May 2020)	Second Wave of Data Collection (Oct 2020-Apr 2021)	Third Wave of Data Collection (Sep 2021-Jan 2022)
Observations	- 34 consecutive days of observations of a teacher using a shadowing method - 6 staff meetings that took place on Zoom and Webex in March and April 2020 (avg length 1h30m)	- 33 consecutive days of observations of a teacher, using a shadowing method	-
Interviews	-	- 24 semi-structured interviews with teachers from different schools on the same Greek island with our shadowee partaking too	- 12 Interviews via Zoom
Focus Groups	-	- 12 focus groups with teams of teachers who collaborated with each other during the first lockdown (32 teachers from 5 different schools) while the shadowee was also present	-
Archival Data	✓	✓	✓

Similar to our data collection, our analysis was built on methodological diversity and involved a wide variety of analytical moves. To establish a deeper connection with our data and provide richer and more contextual answers to our research question, we engaged in methodological bricolage (Pratt et al., 2020) and utilized multiple methods of analysis. In particular, we constructed a timeline of key events and changes over time, summarized important observations in vignettes of teachers' experiences and responses to adversity with the use of digital tools (Feldman, 2000) and coded our interviews (Figure 1) by relying on grounded theory techniques (Locke, 2001) and the so-called "Gioia method" (Gioia et al., 2013). Further, based on the extensive observational data, fieldnotes, and interviews, we constructed two distinct narratives (c.f. Sonenshein, 2010) of how digital resilience has influenced the relations between the users and the digital tools and conducted multiple member checks with key informants.

Figure 1. An Example of Our Coding Structures



4 FINDINGS

4.1 Digital resilience mechanisms

Our findings suggest that digital resilience is a sociotechnical process occurring in the organizational actors' interactions with each other and with digital tools at hand. In such sociotechnical interactions, organizational actors demonstrate resourcefulness and exercise digital resilience by setting three interrelated mechanisms in motion, namely reappraising collective suffering, improvising based on tools at hand, and conducting reflective interventions. By paying attention to the underlying mechanisms of the digital resilience process, we show the intricate workings of digital resilience and the component parts within each mechanism.

4.1.1 Reappraising collective suffering

Our analysis revealed that reappraising collective suffering is the first mechanism through which digital resilience took place. Reappraising collective suffering refers to the process in which organizational actors handle ambiguity triggered by an exogenous shock by expressing their concerns regarding the possibility of sustaining operations with the existing digital infrastructure, by channeling such concerns into productive work, and by collectively bolstering a rejection to be resource-constrained. Based on our analysis, we suggest three

interrelated sub-components of this mechanism: emphasizing occupational duty, embracing new boundary relations, and mobilizing users' vulnerabilities.

4.1.2 Improvising based on digital tools at hand

Our analysis revealed that an additional mechanism through which digital resilience occurred is what we call improvising based on the digital tools at hand. This mechanism refers to the process in which organizational actors cope with resource scarcity and engage in improvisation by supporting each other and 'making do' on the spur of the moment with the use and novel recombination of digital tools at hand for new purposes. We identified three interrelated sub-components of this mechanism: making use of whatever digital tool is at hand, engaging in workarounds and undertaking solidarity initiatives.

4.1.3 Conducting reflective interventions

The third mechanism through which digital resilience occurred is what we call conducting reflective interventions to teachers' ongoing improvisation to deliver situation-specific solutions to emerging challenges. Through this mechanism, users intervene in their ongoing improvisation and explore new ways of engaging with digital tools by reflecting in the midst of using the digital tools and retrospectively on the use of such tools ex-post, by leveraging the digital tools' backtalk, and by reconnecting with the organization's revised infrastructure. This mechanism was critical in producing resilient responses since its three interrelated sub-components made the users experiment with a variety of digital technologies, narrow down the list of effective tools and practices, and get an understanding of how such tools can be used in novel ways. Yet, this could also trigger another cycle of collective suffering when encountering problems.

5 DISCUSSION

After identifying the mechanisms through which organizational actors practiced digital resilience during the unfolding of the exogenous shock, our analysis focused on the second part of our purpose: whether and how digital resilience mechanisms enable leapfrogging and bouncing forward to a new stable state in the aftermath of the shock. In seeking to address this, we unpacked the relational nature of "infrastructuring" and identified that exercising digital resilience may cultivate two distinct infrastructural relations between organizational actors and digital technologies: contested or settled ones. The emergence of these infrastructural relations echoes whether or not the digital technologies, with which organizational actors engage to cope with an exogenous shock, become a permanent fixture in the actors' core work. In doing so, we provide an explanation of digital infrastructure evolution in the post-shock period, which occurs via the manifestation of digital resilience mechanisms.

5.1 Digital Resilience Mechanisms and Emerging Infrastructural Relations

Building on our findings, we suggest that contested infrastructural relations take place when a mobilizing pathway is taken, whereas settled infrastructural relations occur when users progress through a transformation path.

5.1.1 Mobilizing pathway: Emergence of contested infrastructural relations

First, digital resilience mechanisms influence digital infrastructure through what we call the mobilizing pathway. Organizational actors mobilize and accumulate a repertoire of digital technologies to provide situation-specific and short-term responses to an exogenous shock. The mobilizing pathway entails that while improvisation and uncoordinated accumulation of independent digital technologies enable organizational actors to respond to the shock's particularities and achieve a temporal fix, the infrastructural relations remain contested after the shock. The notion of contested infrastructural relations explains that digital technologies do not become a permanent fixture in organizational actors' core work in the aftermath of practicing digital resilience. Although organizational actors mobilize their own digital devices

and tools to secure continuation of work, there is resistance to reconnect with the official digital technologies provided by the top management and to keep engaging with them in their work activities and interactions in the post-shock period. An explanation of why infrastructural relations become contested may lie in the organizational actors' experiences and emotions of the external shock and the coping process (Dwyer et al., 2021). In particular, in the third wave of data collection, several of our respondents described that the anxiety, the overwhelming pressure, and the vulnerability they experienced, due to the need to engage with digital technologies to continue performing their work, discouraged them to keep using digital technologies when the schools reopened. This suggests that while the digital resilience mechanisms we identified can propel the construction of a pool of slack resources, the presence of contested infrastructural relations testifies to a view of digital technologies as merely an emergency toolkit.

5.1.2 Transforming pathway: Emergence of settled infrastructural relations

Second, digital resilience mechanisms influence digital infrastructure through what we call the transforming pathway. By practicing digital resilience, organizational actors not only achieve a temporal fix, but also trigger transformation as some of the independent digital technologies are continuously and reliably used and can be relied upon even after the exogenous shock. This means that new infrastructural relations between digital technologies and organizational actors become settled. In other words, users establish stable and new patterns of use of digital technologies beyond their short-term responses to adversity. Settled infrastructural relations are developed as organizational actors' positive experiences and emotions lead them to continue using the digital technologies even after measures of physical presence suspension are lifted. The organizational actors' accumulation of experiences and acclimatization to the use of digital technologies encourage them to keep engaging with these technologies in their post-shock work activities and interactions (e.g., staff meetings, interactions with students' parents, immersion of online repositories for educational material). In each wave of practicing digital resilience, users accumulate experiences that support overcoming barriers to immersing digital technologies in routines and work activities taking place in the aftermath of the exogenous shock.

5.2 Contributions and Implications

Our findings contribute to two distinct and until now unconnected bodies of literature, namely digital resilience and digital infrastructure evolution. On the one hand, we extend theory on digital resilience (Boh et al., 2021; Weber et al., 2021, Heeks & Ospina, 2019a) (i) by uncovering the inner workings of digital resilience as exercised by unprepared and less digitally mature organizations and thereby deciphering the processuality and ambiguity of digital resilience where organizational members "make do" and cope with upsetting environmental changes despite lack of support or coordinated action, (ii) by establishing that the improvisational nature of digital resilience can be a double edged sword leading to digital transformation and to an enriched yet fragmented digital infrastructure, and (iii) by questioning prior research solely focusing on recovery and bouncing back as digital resilience is portrayed here as a sociotechnical practice inducing changes in and configurations of the digital infrastructure. On the other hand, we also contribute to the research stream devoted to digital infrastructure evolution (Henfridsson & Bygstad, 2013; Kaniadakis & Constantinides, 2014) (i) by including the initial friction and the inertia triggered by the limitations of the existing digital tools to satisfy its organizational members' needs as constitutive elements of the process of digital infrastructure evolution and (ii) by arguing that digital infrastructure can evolve due to digital resilience when new infrastructural relations between the organizational member and the tools take place (Karasti & Blomberg, 2018; Pipek & Wulf, 2009). Our focus on the level of practice for the emergence of digital resilience generates important lessons for management.

The mechanisms of digital resilience uncovered here are largely bottom-up dynamics that resourceful individuals and teams create in order to cope with the mission and keep up the performance of the organization. Surprisingly, this can occur, in the case studied, despite an absent top management. One managerial take-away is the self-regulatory potential of small teams and groups in practice. This insight can be seen as an opportunity for management to lead by supporting practice and step away from imposing the use of certain systems early on when a shock hits. Rather, our findings suggest that the evolving infrastructure requires managerial oversight, which is more long-term than the immediate resilience in the face of a shock. More work is needed to differentiate types of external shocks and the adequate organizational reaction when it comes to the resilient improvisation and adoption of existing and novel information technology.

REFERENCES

- Ågerfalk, P. J., Conboy, K., Myers, M. D. (2020), "Information Systems in the Age of Pandemics: COVID-19 and Beyond," *European Journal of Information Systems* (29:3), Taylor & Francis, 203–207.
- Boh, W., Constantinides, P., Padmanabhan, B., Viswanathan, S., Henfridsson, O., Rai, A., Sen, S. (2021), "Panel: Digital Resilience During Covid: Fleeting or Enduring". *ICIS 2021 Proceedings*.
- Bostrom, R. P., Heinen, J. S. (1977), MIS problems and failures: A socio-technical perspective. Part I: The causes. *MIS Quarterly*, 17-32.
- Cho, S., Mathiassen, L., Robey, D. (2007), Dialectics of resilience: A multi-level analysis of a telehealth innovation. *Journal of Information Technology*, 22(1), 24–35.
- Coutu, D. L. (2002), How resilience works. *Harvard business review*, 80(5), 46-56.
- Dwyer, G., Hardy, C., Tsoukas, H. (2021), Struggling to make sense of it all: The emotional process of sensemaking following an extreme incident. *Human Relations*.
- Feldman, M. S. (2000), Organizational routines as a source of continuous change. *Organization science*, 11(6), 611-629.
- Fletcher, G., Griffiths, M. (2020), Digital transformation during a lockdown. *International Journal of Information Management*, 55, 102185.
- Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., Rockström, J. (2010), Resilience thinking: integrating resilience, adaptability and transformability. *Ecology and society*, 15(4).
- Gittell, J. H., Cameron, K., Lim, S., Rivas, V. (2006), Relationships, layoffs, and organizational resilience: Airline industry responses to September 11. *The Journal of Applied Behavioral Science*, 42(3), 300-329.
- Gioia, D. A., Corley, K. G., Hamilton, A. L. (2013), Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods*, 16(1), 15-31.
- Heeks, R., Ospina, A. V. (2019), Conceptualising the link between information systems and resilience: A developing country field study. *Information Systems Journal*, 29(1), 70-96.
- Henfridsson, O., Bygstad, B. (2013), The generative mechanisms of digital infrastructure evolution. *MIS quarterly*, 907-931.
- Holling, C. S. (1973), Resilience and stability of ecological systems. *Annual review of ecology and systematics*, 4(1), 1-23.
- Ignatiadis, I., Nandhakumar, J. (2006), The impact of enterprise systems on organizational resilience. In *IFIP International Working Conference on the Transfer and Diffusion of Information Technology for Organizational Resilience*, 259-274, Springer, Boston.
- Kallinikos, J., Aaltonen, A., Marton, A. (2013), The ambivalent ontology of digital artifacts. *MIS Quarterly*, 37(2), 357-370.

- Kaniadakis, A., Constantinides, P. (2014), Innovating financial information infrastructures: The transition of legacy assets to the securitization market. *Journal of the Association for Information Systems*.
- Karasti, H., Blomberg, J. (2018), Studying infrastructuring ethnographically. *Computer Supported Cooperative Work (CSCW)*, 27(2), 233-265.
- Larkin, B. (2013), The politics and poetics of infrastructure. *Annual review of anthropology*, 42, 327-343.
- Lengnick-Hall, C. A., Beck, T. E., Lengnick-Hall, M. L. (2011), Developing a capacity for organizational resilience through strategic human resource management. *Human resource management review*, 21(3), 243-255.
- Locke, K. (2001), *Grounded theory in management research*. Sage.
- Meyer, A. D. (1982), Adapting to environmental jolts. *Administrative science quarterly*, 515-537.
- Ortiz-de-Mandojana, N., Bansal, P. (2016), The long-term benefits of organizational resilience through sustainable business practices. *Strategic Management Journal*, 37(8), 1615-1631.
- Pipek, V., Wulf, V. (2009), Infrastructuring: Toward an integrated perspective on the design and use of information technology. *Journal of the Association for Information Systems*, 10(5), 1.
- Powley, E. H. (2009), Reclaiming resilience and safety: Resilience activation in the critical period of crisis. *Human relations*, 62(9), 1289-1326.
- Pratt, M. G., Sonenshein, S., Feldman, M. S. (2020), Moving beyond templates: A bricolage approach to conducting trustworthy qualitative research. *Organizational Research Methods*.
- Sakurai, M., Chughtai, H. (2020), Resilience against crises: COVID-19 and lessons from natural disasters. *European Journal of Information Systems*, 29(5), 585-594.
- Sutcliffe, K. M., Vogus, T. (2003), Organizing for resilience. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship*: 94-110, Berrett-Koehler.
- Tilson, D., Lyytinen, K., Sørensen, C. (2010), Research commentary-Digital infrastructures: The missing IS research agenda. *Information systems research*, 21(4), 748-759.
- Van Der Vegt, G. S., Essens, P., Wahlström, M., George, G. (2015), Managing risk and resilience. *Academy of Management Journal*, 58(4), 971-980.
- Walker, B., Holling, C. S., Carpenter, S. R., Kinzig, A. (2004), Resilience, adaptability and transformability in social-ecological systems. *Ecology and society*, 9(2).
- Wang, J. W., Gao, F., Ip, W. H. (2010), Measurement of resilience and its application to enterprise information systems. *Enterprise information systems*, 4(2), 215-223.
- Weber, M., Hacker, J., vom Brocke, J. (2021), Resilience in Information Systems Research-A Literature Review from a Socio-Technical and Temporal Perspective. *ICIS 2021 Proceedings*.
- Weick, K. E. (1993), The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative science quarterly*, 628-652.
- Weick, K. E., Sutcliffe, K. M. (2001), *Managing the unexpected* (Vol. 9). San Francisco: Jossey-Bass.
- Wittbold, K. A., Carroll, C., Iansiti, M., Zhang, H. M., Landman, A. B. (2020), How hospitals are using AI to battle COVID-19. *Harvard Business Review*, 3(04).
- Yoo, Y., Henfridsson, O., Lyytinen, K. (2010), Research commentary—the new organizing logic of digital innovation: an agenda for information systems research. *Information systems research*, 21(4), 724-735.

**SESSION 7B: WORKING ENVIRONMENTS: INTERDISCIPLINARITY BETWEEN
RESEARCH AND EDUCATION**

In search of bridging knowledge between disciplines: About spatial solutions to environmental satisfaction in knowledge work

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ABSTRACT

The purpose of this conceptual paper is to discuss our interdisciplinary knowledge production process, which seeks ways to bridge knowledge between disciplines to produce more coherent knowledge about the impact of spatial solutions on environmental satisfaction. The workplace intervention study on work environmental satisfaction and well-being brought up novel needs to broaden interdisciplinary knowledge production to avoid a fragmentation of knowledge. We are a group of researchers working with intervention-based research aiming to produce interdisciplinary knowledge to better understand the impact of spatial solutions on work environmental satisfaction and well-being. Our expertise extends from the knowledge of work and organisational psychology, environmental psychology and psychophysiology to architectural design and human-computer interaction. A spatial intervention built for running company premises provided the framework for reflecting all the research activities conducted

before and during the design intervention. While using a broad variety of quantitative and qualitative methods, we found out the need to advance our understanding of the interdisciplinary knowledge production mechanisms to do our share of preventing a fragmentation of knowledge. This conceptual paper reports our remarks of the interdisciplinary knowledge production in the context of an intervention-based research project. We see value in reporting the recognized needs for seeking convergence between methods and concepts. In our temporary research project, we recognised the possibilities to bring each other's disciplines closer together and to customise common methods and broaden meanings of used concepts together with the relevant stakeholders. Discussing the bridging knowledge production process is, as such, valuable, making visible the variety of boundaries in between disciplines and approaches which are overshadowed when reporting the narrow field-specific outcomes.

Keywords

Interdisciplinary workplace research, Workplace design, Workplace satisfaction, Workplace intervention research, Knowledge management.

1 RATIONALE

Activity-based office design is a contemporary way of building space-efficient offices, both in cases of new and renovated office premises. Therefore, the investigation of the functionality of this work environment has a significant societal and scientific importance. However, under the pressures of designing today's workspaces, it remains difficult to design offices that are compatible with the people working in them. While there is already some scientific knowledge on the functionality of and environmental satisfaction with activity-based offices (Engelen et al., 2019), research about design solutions supporting the well-being and work engagement of users is very limited. The causal relationship between physical office environments and employee outcomes is seen as being systemically complex and often challenging to explain (e.g., Van der Voordt, 2004; Ruohomäki et al., 2015; Appel-Meulenbroek, et al. 2018) and, therefore, cooperation between disciplines is needed. As well as disciplines working solo, the multidisciplinary way of working, where disciplines work in parallel but not together (Stokols et al. 2003a, 2003b; Wagner et al. 2011) most likely leads to knowledge fragmentation. This reflects the present situation in work environment research where knowledge is produced by various disciplines (e.g., Colenberg et al. 2020). Our choice was the interdisciplinary way of working to advance our understanding especially of the complex causal relationships concerning the spatial solutions in activity-based office environments. With interdisciplinarity, we refer to the interdisciplinary scientific research (IDR) requiring an integration of concepts, techniques, and/or data from different fields of established research (Porter et al. 2006), also considering integrating different bodies of knowledge (Rafols and Meyer, 2010) and, thereby, presuming the presence of teaming (Wagner et al. 2011). Our way of working is presently close to instrumental interdisciplinarity (Klein 1996, Aboelela et al., 2006, Klein 2010) in bridge building between fields by problem-solving activities, seeking, but not (yet fully) achieving a synthesis or fusion of different perspectives. The context of our interdisciplinary cooperation was a workplace design intervention study, which was closer to combi-office (de Been and Beijer, 2014; Vos and van der Voordt, 2002) in its office typology, but considered as belonging, in this paper, to the broader category of activity-based offices. With intervention, we refer to the general definition of interfering with an outcome or course, especially of a condition or process (as to prevent harm or improve functioning) (Intervention, 2020). In our case, when the research focus was on spatial solutions, intervention referred to a study of the real-world environment through change to capture a holistic overview to find better solutions for users and a working theory applicable for the design profession (Markkanen et al., 2022, Herneoja

et al., 2022). A spatial intervention built for running company premises provided the framework for all the research conducted before and during the design intervention by all involved disciplines. In this paper, we are not reporting the outcome of the intervention study but focusing on discussing challenges and learnings in interdisciplinary interactions.

We used a variety of methods fitting to the epistemic approach of each discipline from quantitative to qualitative methods. Work and organisational psychology and environmental psychology was in charge of validated questionnaires. Architectural design research used semi-structured interviews and participatory design workshops to be able to create the changed office interior. Both architectural design research and computer science was needed when using the experience sampling method (ESM) supported by indoor positioning (see also Markkanen et al. in this issue). Psychophysiology was in charge of stress level and heart rate variability measurements integrated into indoor positioning with the aid of computer scientists.

In addition to learning each other's field-specific approaches, we identified the necessity to clarify the used concepts. Albeit applying the same vocabulary, the meanings of the concepts varied between disciplines. In this paper, we focus on the person-environment fit theory (Edwards et al., 1998) and the need–supply fit model (Kristof-Brown et al., 2005) originating from the person-environment fit, are the key models indicating compatibility between a worker and one's work environment. Some of us were familiar with person-environment fit and need–supply fit or were (to some extent) able to integrate the key contents into the ontological framework of one's discipline. In both person-environment fit and need–supply fit, the physical work environment is discussed too generically, causing, at least to architectural design researchers, challenges when aiming to contribute to the interdisciplinary discussion. Therefore, sharing was needed on the field-specific ways of understanding the concepts referring to spatial contents. The qualities of knowledge management brought into discussion the challenge of adherence to *transferring knowledge* (e.g., Carlile 2004) from one discipline to another within the entire research group. However, in bilateral cases, knowledge transfer across disciplinary boundaries was relevant when knowledge interests or used methodology were either shared or familiar to each other. Still, the clarifying discussions within the entire research group supported interdisciplinary teaming (Wagner et al. 2011) by learning about each other's disciplinary specificities to support producing translating knowledge (e.g., Nonaka 1994; Carlile 2004). Considering our workplace design intervention as a concrete boundary object (Star and Griesemer, 1989; Carlile, 2002) advances design management thinking. Originally *boundary objects were considered to have different meanings in different social worlds, but their structure is common enough to more than one world to make them recognisable, a means of translation* (Star and Griesemer, 1989). Instead of translation, Carlile (2004) discusses transforming knowledge at the pragmatic boundary to create common interests to share and assess knowledge (Carlile 2004). In a work environment context, social worlds may be considered as researchers from different disciplines, professionals (e.g., designers) from different fields and users engaged in the design or research processes as participants (Herneoja et al., 2022). Workplace design intervention as a boundary object provides the *common interests to develop that allow actors to address the consequences, differences, and dependencies of each other's domain specific knowledge* (Carlile 2004). And recognise the designers of the physical office environments as an end-user group of the produced bridging knowledge. The designers' viewpoint, inbuilt also to architectural design researchers' way of working (Markkanen et al., 2022), was important in mitigating the discontinuity in knowledge transfer of the work environment research outcomes to (e.g.) the architectural design practice to improve physical office spaces.

2 IDENTIFYING OUR MANY WAYS OF APPROACHING SPATIAL CONTENTS

2.1 Physical environment in the larger psycho-social and organisational context

To understand the relations between the physical environment and outcomes such as satisfaction and well-being, it is necessary to distinguish and study effects related to physical versus psychosocial factors. On one hand, it is important to distinguish the effects of the physical environment from those of the psychosocial factors as employee well-being, for example, is affected more by the latter (Herbig et al., 2016). On the other hand, the physical environment contributes to some aspects of the psychosocial environment, such as interpersonal relations (Haapakangas et al., 2019). Ruohomäki et al. (2015) have suggested a salutogenic and user-centred approach for workplace design, one that promotes users' health and well-being in buildings, and supports users' needs. Their framework focuses on functional, psychological and social dimensions of the workspace. A workplace that promotes well-being supports work tasks and work processes; is ergonomic and accessible to all; respects privacy and the personal need for space; strengthens a sense of control; enhances workflow and engagement; and promotes communication and learning (Ruohomäki et al. 2015). A case study by Ruohomäki et al. (2021) showed that employees' satisfaction with the work environment following a transition to an activity-based office was positively related to job satisfaction, well-being at work and work performance; and the work environment plays an important role in work performance, satisfaction and well-being.

2.2 Basic spatial concepts in work environment research

We are aware of the common concepts in work environment research referring to spatial contents: workplace, workstation or desk, workspace, and work environment. Workplace is used as a generic concept referring to the employer's premises or a place where people work. Workstation usually refers to a setup for an individual user; workspace refers to an open, half-open or enclosed part of an office with single or multiple workstations; and work environment refers to a setting, such as an office, consisting of multiple workspaces. For example, when defining activity-based offices, they are described as open-office environments with additional half-open and enclosed workspaces, where workers choose workstations or workspaces that best suit their current work tasks and subjective preferences (Appel-Meulenbroek et al., 2011, Bodin Danielsson et al., 2014; Wohlers and Hertel, 2017). However, the used terminology is not always uniform, and the meaning of the used concepts may vary (Colenberg et al. 2021). A few work environment research reports also include some visual documentation: a floor plan where furnishing indicates the placement and grouping of workstations or workspaces or, additionally, some photographs may be provided. This level of visual documentation is presently considered sufficient in the production of generalizable knowledge of a specific work environment.

2.3 Architectural ways of approaching spatial design

In architecture the spatial design as an end product is characterised by thinking of it as an experienced physical space, in addition to fulfilling the set functional needs (e.g., Ching & Binggeli, 2018). The conceptual content and the concrete, material content are intertwined, and inseparable. The designer has an idea of the experience the physical space could provide the user; however, this presumption needs to have a physical framework. The first concern, although the focus is on designing the inside space, is the geographical location of the office building and where the space is located inside the building. Points of the compass and floor level affect, for example, the nature of the natural light entering the space and the views available, in addition to the size, shape, and location of the window openings (e.g. Ching & Binggeli, 2018). In other words, the outside factors have consequences on how a worker experiences one's work environment, in addition to the qualities and details of the interior as a whole. The creation of this three-dimensional physical space, in general, is intertwined with

physical and technical contents, such as solutions and systems, and their documentation. (Herneoja et al., 2022) In this process, established and well organised cooperation with other designers beyond architecture is already business as usual (e.g., designers of interior, and lighting, acoustic and HVAC systems (e.g. BS ISO 17772-1:2017)). From a design point of view, the physical circumstance as a materialised entity, together with the perceived space by the worker, form an inseparable pair to understand a physical workplace as a whole.

2.4 Potential workplace design process points to support knowledge transfer between disciplines

To overcome previously recognised challenges in communicating the workplace design outcomes and their relationship to work environment research, such as understanding the need-supply fit formation and workplace satisfaction, we divided the design process into three phases - design aims, affordance design, and site-specific design (Markkanen et al. 2022). The design phases communicate the design outcome on different levels: for example, the design aims phase conveys the employees' needs for privacy, interaction, and the preferred atmosphere of the space, while the affordance design phase indicates how the spaces can be used (Markkanen et al. 2022). For the site-specific design, constituting the comprehensive design, we have applied the multidimensional design framework of instrumental, symbolic and aesthetic dimensions (Rafaeli and Vilnai-Yavetz, 2004) to describe the spatial qualities.

2.5 Human-computer interaction (HCI) and multiple ways of understanding place

In the application areas of Computer-Supported Collaborative Work (CSCW), places have been brought up as a useful frame of analysis for understanding collaborative work (Dourish et al. 2016). Similarly, the physical space and different ways to experience it are relevant for developing technology (Lentini and Decortis, 2010, Paananen et al. 2021). However, geometric understanding is the prevailing approach, e.g., in the case of mobile tracking where GPS-coordinates are used as a numerical way to differentiate places. This could also be considered as a baseline for discussing place in a physical context in interdisciplinary communication. Tracking workers in office environments requires a suitable technology to be used, for instance, when using ESM approaches (see e.g., Markkanen et al. in this issue). Despite the good accuracy of current indoor positioning systems, location does not include any qualitative information, for example, about the direction of the worker's gaze or their orientation. A place as a locational coordinate is, as such, empty of qualitative contents. The spatial context of the work environment and the realistic documentation of the floorplan furnishing, combined with the tracking data, provides the information on which side of the table the worker is seated, thereby providing a hint on where the person is looking. In addition to reference to a specific place, mobile tracking data may include a time dimension. Thereby, it is possible to know not only where, but also when the worker has been seated in a specific place.

3 WORKER - WORK ENVIRONMENT RELATED CONCEPTS AND METHOD-BASED COOPERATION

Worker's environmental satisfaction is an indicator of user experience. It reflects how well the environment meets worker's wishes and needs concerning work itself, social working environment, physical working environment or interactions between these aspects (Van der Voordt, 2004). During the workplace design intervention, the employees' experiences and perception of the spaces were inquired through multiple research methods, such as semi-structured interviews on site, questionnaire survey, experience sampling questionnaire, stress level measurements, and evaluation workshops. The methods were designed to gain a more detailed understanding of user needs in relation to their activities and used spaces, in addition to perceived spatial satisfaction and support. We have previously used a design research approach in combination with participatory design methodology to enable more detailed

understanding of how workplace design is linked to need-supply fit formation and work environment satisfaction (Markkanen et al., 2022). In addition to need-supply fit linked requirements of privacy and interaction, our design research approach explored how spatial aesthetics and atmosphere affected the employees' work environment satisfaction and spatial support.

Surveys are a traditional research instrument for obtaining quantitative data on the worker-work environment relations, including perceptions of the environment, user's characteristics and behaviour, and responses to the environment. In this case, a Work environment and well-being survey (Ruohomäki et al. 2013, 2021) was used to gather relevant background information (concerning e.g., demographic characteristics, work content, office presence and multilocal working), evaluate satisfaction with the physical work environment both generally and in terms of specific indoor environmental and design factors, gain information on the psychosocial context and assess users' well-being. This survey was used with a before-after intervention study, to statistically test the effects of the intervention on work environmental perceptions and well-being.

Combining experience sampling method (ESM) applied in work environment research with collecting tracking data as a broadly applied method in HCI is a fine example of value-added with methodological cooperation. We used the ESM before and during the intervention to gain insight on task complexity, needs for privacy, interaction and atmosphere, and experienced spatial support (see also Markkanen et al. in this issue). The reported data included information on the location and nature of the activity. Using indoor location tracking, we could use the real-time location of participants to trigger desired events. In our system, the two-dimensional location data was used to send notifications to the participants' smartphones. The location positioning software was configured to trigger a function, when the participants left certain predetermined workplace areas. Detailed understanding of employee experiences in relation to their location and activity, such as individual work, collaboration or recovery, enables understanding how different spaces support work and if the work environment provides fitting spaces.

Another novel approach was to combine two established methods, the measured physiological stress level and heart rate interval measurements (Järvelin-Pasanen et al., 2018) widely used in the field of work environment research with time-location specific data often used in HCI methodology. From a data analysis point of view, the timestamps of these data sources serve to connect physiological measures to a specific space. This brings more context behind the stress measurements results and helps to compare how different spaces affect human physiology. However, pure location-based data remained limited in its capability to contextualise different situations. Knowing a person's location and level of stress is not able to clarify what aspects of the space affect them. For instance, the type of work being done, presence of other people, or the quality of the space need qualitative approaches described above, to complement this time-space -based location data.

However, the interdisciplinary cooperation within this specific workplace design intervention was an interesting process, the partial realisation of high risks led to an insufficient amount and quality of the gathered data. Firstly, to support the interdisciplinary approach, we recruited workers to participate in each research phase and used various data collection methods. Secondly, the optimal number of participants is different for the used qualitative and quantitative research methods: e.g. the participatory design workshops cannot be organized with an equal number needed for survey or ESM methods. Thirdly, the focus associated with the spatial solution of the workplace required participants to work primarily onsite during the research periods to find out aspects about their environmental satisfaction related to the spatial solution. However, during all our research periods the COVID-19 based strong remote working

recommendations by the local authorities was in force and, therefore, the participants' activity at the company premises was low. The gathered quantitative data has fallen short, and the remote way of working also disturbed the gathering of the quantitative data. And finally, because of the realisation of depicted risks, one of the most interesting phases to analyse disciplinary-specific findings and reflect them together to advance our shared interdisciplinary understanding about impact of spatial solutions to environmental satisfaction was not fulfilled in this case study.

4 CONCLUSION AND FURTHER THOUGHTS

The purpose of this conceptual paper was to discuss our interdisciplinary knowledge production process, which seeks the ways to produce more coherent knowledge about the impact of spatial solutions on workers' environmental satisfaction. Our interest to search for bridging knowledge(s) emerged of a particular shared workplace design intervention study. The versatile interdisciplinary expertise provided a unique opportunity to learn about each other's ways of working or even combine each other's methods. We also realised that finding methods for knowledge production fulfilling prerequisites of all involved disciplines was not realistic. Our diverse approaches aimed to produce generalisable knowledge of workplace satisfaction: this extended from survey study to workspace-specific understanding of aesthetic and atmospheric qualities of space. Our interest was also on the detailed location-specific knowledge production about the office interior, which affect the employees' work environment satisfaction, and is an essential part of the spatial designers' (e.g., architects') location-based design work. The often-used expression *mixed-methods* was in our case as such empty to only describe the methods used within the research group, but not to indicate the shared methods used by all researchers.

The used concepts referring to the spatial contents raised interesting and necessary discussions about their diverse discipline-specific meanings. When focusing on the impact of spatial solutions on workers' environmental satisfaction, we found out different discipline-based emphases in understanding the content of the concept environment, affecting how environmental satisfaction should be approached. For architectural design, the researchers' environment raised mainly connotations referring to the built environment as the physical environment. Instead, the work environment research environment was identified as the perceived physical environment in the larger psycho-social and organisational context. This kind of qualitatively enriched way of discussing the physical environment was, at times, challenging, at least for architect researchers, since the physical representations involved were discussed in a generic way. On the other hand, design knowledge production aimed to reflect on the physical qualities of a specific work environment, and only the design research outcomes concerning design methods were generalizable.

We applied the boundary object theory's *common enough* approach when clarifying the meanings of the used concepts in our shared communication. We decided to apply the very basic concepts of spatial solution, place and space, as an analogy related to physical reality. We recognised a place as a combination of concrete and conceptual contents: a physical space as a design target aiming to fulfil worker's functional needs and provide affordances, a physical space perceived by a worker and a place as a physical environment in the larger psycho-social and organisational context. The most basic way of understanding a place as a location or place in a time-location context has raised interest for further development of interdisciplinary methodological cooperation, also demonstrated in this paper. A locationally understood place at a precise moment may be considered as a mathematical anchor to all qualitative and quantitative data concerning a specific circumstance that may be placed to a time-location based grid.

We also identified how conventional practices in some disciplines may raise novel question settings in an interdisciplinary research consortium. The raised questions about practicalities also led to interesting discussions about broader content-wise and methodological issues. We recognised that our interdisciplinary process brought up multiplicity of interaction between disciplines varying from transforming knowledge across disciplinary borders to a more translative approach through shared learning process. Also, the need for relevant and informative knowledge for the architectural design practice to improve the physical office spaces brought into discussion the demand for transforming knowledge at the pragmatic boundary. However, interdisciplinarity emerged as a diverse and demanding way of working, it also brought up the importance of having the pursuit of a common understanding.

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REFERENCES

- Aboelela, S.W., Larson, E., Bakken, S., Carrasquillo, O., Formicola, A., Glied, S.A., Haas, J., Gebbie, K.M. (2007), Defining Interdisciplinary Research: Conclusions from a Critical Review of the Literature. *Health Services Research*, 42: 329-346. <https://doi.org/10.1111/j.1475-6773.2006.00621.x>
- Appel-Meulenbroek, R., Clippard, M., Pfnür, A. (2018), The effectiveness of physical office environments for employee outcomes. An interdisciplinary perspective of research efforts. *Journal of Corporate Real Estate*, Vol. 20, No. 1, pp. 56-80. <https://doi.org/10.1108/JCRE-04-2017-0012>
- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), An end-user's perspective on activity-based office concepts. *Journal of Corporate Real Estate*, 13(2), 122-135. <https://doi.org/10.1108/14630011111136830>
- Bodin Danielsson, C., Chungkham, H. S., Wulff, C., Westerlund, H. (2014), Office design's impact on sick leave rates. *Ergonomics*, 57(2), 139-147. <https://doi.org/10.1080/00140139.2013.871064>
- BS ISO 17772-1:2017 (2017), Energy Performance of Buildings – Indoor Environmental Quality – Part 1: Indoor Environmental Input Parameters for the Design and Assessment of Energy Performance of Buildings, International Organization for Standardization, Geneva, Switzerland.
- Carlile, P. R., Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge across Boundaries. *Organ. Sci.* 2004, 15, 555–568
- Carlile, P. R., A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. *Organ. Sci.* 2002, 13, 442–455.
- Ching, F. D. K., Binggeli, C. (2018), *Interior Design Illustrated*, (4th ed.), Wiley and Sons, Hoboken, NJ.

- Colenberg, S., Jylhä, T., Arkesteijn, M. (2020), "The relationship between interior office space and employee health and well-being – a literature review." *Building Research & Information*, <https://doi.org/10.1080/09613218.2019.1710098>
- de Been, I., Beijer, M. (2014), "The influence of office type on satisfaction and perceived productivity support." *Journal of Facilities Management*, 12(2), 142–157. <https://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216>
- Dourish, P. (2006), Re-space-ing place: "place" and "space" ten years on. *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*, 299–308. <https://doi.org/10.1145/1180875.1180921>
- Edwards, J.R., Caplan, R.D., Harrison, R.V. (1998), "Person-environment fit theory: conceptual foundations, empirical evidence, and directions for future research", in Cooper, C.L. (Ed.), *Theories of Organizational Stress*, Oxford University Press, Oxford, pp. 28-67.
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, A. (2019), Is activity-based working impacting health, work performance and perceptions? A systematic review. *Building Research & Information*, 47(4), 468-479.
- Haapakangas, A., Hallman, D. M., Mathiassen, S. E., Jahncke, H. (2019), The effects of moving into an activity-based office on communication, social relations and work demands—a controlled intervention with repeated follow-up. *Journal of Environmental Psychology*, 66, 101341.
- Herbig, B., Schneider, A., Nowak, D. (2016), Does office space occupation matter? The role of the number of persons per enclosed office space, psychosocial work characteristics, and environmental satisfaction in the physical and mental health of employees. *Indoor Air*, 26(5), 755-767.
- Herneoja, A., Markkanen, P., Juuti, E. (2022), "An architectural viewpoint to user-centred work environment research to support spatial understanding in a transdisciplinary context through ecosystem-based approach", *Journal of Corporate Real Estate*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/JCRE-12-2020-0070>
- Intervention (2022), In Merriam-Webster.com, available at: www.merriam-webster.com/dictionary/intervention (accessed 24 June 2022).
- Järvelin-Pasanen, S., Sinikallio, S., Tarvainen, M. (2018), "Heart rate variability and occupational stress – systematic review", *Industrial Health* 2018, 56, 500-511.
- Klein, TJ (2010), A taxonomy of interdisciplinarity. In Robert Frodeman, Julie Thompson Klein, J. Britt Holbrook, Carl Mitcham (Eds.). *An Oxford Handbook of Interdisciplinarity* (15-30). New York: Oxford University Press.
- Klein, J. T. (1996), *Crossing boundaries: Knowledge, disciplinaries, and interdisciplinaries*. Charlottesville, VA: University Press of Virginia.
- Kristof-Brown, A. L., Zimmerman, R. D., Johnson, E. C. (2005), "Consequences of individuals' fit at work: a meta-analysis of person–job, person–organization, person–group, and person–supervisor fit." *Personnel Psychology*, 58, 2, 281-342.
- Lentini, L., Decortis, F. (2010), Space and places: When interacting with and in physical space becomes a meaningful experience. *Personal and Ubiquitous Computing*, 14(5), 407–415. <https://doi.org/10.1007/s00779-009-0267-y>
- Markkanen, P., Juuti, E., Herneoja, A. (2022), "Exploring ways to study the workplace design in a small knowledge work company", *Journal of Corporate Real Estate*, <https://doi.org/10.1108/JCRE-01-2021-0006>
- Nonaka, I. A Dynamic Theory of Organizational Knowledge Creation. *Organ. Sci.* 1994, 5, 14–37.

- Paananen, V., Oppenlaender, J., Goncalves, J., Hettiachchi, D., Hosio, S. (2021), Investigating Human Scale Spatial Experience. *Proc. ACM Hum.-Comput. Interact.* 5, ISS, Article 496 (November 2021), 18 pages. <https://doi.org/10.1145/3488541>
- Porter, A.L., Roessner, J. D., Cohen, A. S., Perreault, M. (2006), Interdisciplinary research: meaning, metrics and nurture, *Research Evaluation*, Volume 15, Issue 3, Pages 187–195, <https://doi.org/10.3152/147154406781775841>
- Rafaeli, A., Vilnai-Yavetz, I. (2004), “Instrumentality, aesthetics and symbolism of physical artifacts as triggers of emotion”, *Theoretical Issues in Ergonomics Science*, Vol. 5 No. 1, pp. 91-112, <https://doi.org/10.1080/1463922031000086735>
- Rafols, I., Meyer, M. (2010), Diversity measures and network centralities as indicators of interdisciplinarity: Case studies in bionanoscience. *Scientometrics*, 82, 263–287.
- Ruohomäki, V., Haapakangas, A., Lahtinen, M. (2013), Tilat työn mukaisiksi: Työn analyysi ja koettu sisäympäristö yliopistossa. *Sisäilmastoseminaari 2013*. Sisäilmayhdistys ry, SIY raportti nro 31, 135-140.
- Ruohomäki, V., Lahtinen, M., Reijula, K. (2015), ”Salutogenic and user-centred approach for workplace design.” *Intelligent Buildings International*, Vol. 7, No. 4, pp. 184-197. <https://doi.org/10.1080/17508975.2015.1007911>
- Ruohomäki, V., Sirola, P., Lahtinen, M. (2021), Työn sujuminen, tyytyväisyys työympäristöön ja hyvinvointi monitilatoimistossa. *Psykologia* 56(04), 433–453.
- Star, S.; Griesemer, J. *Institutional Ecology, Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39*. *Soc. Stud. Sci.* 1989, 19, 387–420.
- Stokols, D., Fuqua, J., Gress, J., Harvey, R., Phillips, K., Baezconde-Garbanati, L., Unger, J., Palmer, P., Clark, M. A., Colby, S. M., Morgan, G., Trochim, W. (2003), Evaluating transdisciplinary science. *Nicotine & Tobacco Research*, 5, S21–S39. <https://doi.org/10.1080/14622200310001625555>
- Stokols, D., Fuqua, J., Gress, J., Harvey, R., Phillips, K., Baezconde-Garbanati, L., Unger, J., Palmer, P., Clark, M. A., Colby, S. M., Morgan, G., Trochim, W. (2003), Evaluating transdisciplinary science. *Nicotine & Tobacco Research*, 5 (Suppl. 1), S21–S39.
- Van der Voordt, T. (2004), ”Productivity and employee satisfaction in flexible workplaces.” *Journal of Corporate Real Estate*, Vol. 6, No. 2, pp. 133–148.
- Vos, P., van der Voordt, T. (2002), “Tomorrow’s offices through today’s eyes: Effects of innovation in the working environment.” *Journal of Corporate Real Estate*, 4(1), 48–65. <https://doi.org/10.1108/14630010210811778>
- Wagner, C. S., Roessner, J. D., Bobb, K., Klein, J. T., Boyack, K. W., Keyton, J., Rafols, I., Börner, K. (2011), Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature, *Journal of Informetrics*, 5, 1, 14-26. <https://doi.org/10.1016/j.joi.2010.06.004>
- Wohlers C., Hartner-Tiefenthaler, M., Hertel, G. (2017), The Relation Between Activity-Based Work Environments and Office Workers’ Job Attitudes and Vitality. *Environment and Behavior*, Sage Journals. <https://doi.org/10.1177/0013916517738078>

Interdisciplinarity in light of Actor-Network Theory

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ABSTRACT

The Norwegian University of Science and Technology has begun a major campus development project with ambitious goals such as promoting innovation, collaboration, and knowledge development. Interdisciplinarity is seen as an important approach to achieve these goals. There are multiple factors that might influence interdisciplinary work, such as organisational, cultural, technological, and physical factors, and there is a need for an approach to discuss all these factors in context. This paper will examine the concept of interdisciplinarity and whether Actor-Network Theory (ANT) can be a useful approach when it comes to shaping an academic community. A literature study was performed to investigate what existing literature says about interdisciplinarity and the different factors influencing such work. Further, it investigates if interdisciplinarity can be discussed towards ANT and if this can help expand the discussion on interdisciplinary work further. The findings in this paper show that multiple factors might influence interdisciplinary work. Actor-Network Theory is an interesting approach since it looks at how both tangible and intangible factors interact. Organisational, cultural, and technological factors and the physical space must be seen in relation to each other to get the full effect of the different factors to achieve interdisciplinarity. The findings in this paper can be helpful to further develop the discussion and understanding of interdisciplinarity. Putting the different factors influencing interdisciplinarity in a context it might help planners and designers to get a more holistic picture of how to promote innovation in for instance campus development projects.

Keywords

Interdisciplinarity, Interdisciplinary, Actor-network theory, ANT, Campus development.

1 INTRODUCTION

The Norwegian University of Science and Technology, NTNU, has begun a large campus development project. The project has ambitious goals such as promoting innovation, collaboration, and knowledge development to contribute to solving the challenges our society is facing, like the climate crisis, poverty, health, pandemics, and issues regarding all three dimensions of sustainability. These issues are viewed as too complex to be solved by one discipline alone, and therefore academics and researchers must work together across disciplines. Interdisciplinarity is a term that already is widely used in academia, as well as in other sectors. It is often understood as equal to collaboration which is a quite limited understanding. Interdisciplinarity is often mentioned as an important part of innovation and creativity and provides opportunities to generate new ideas or develop new approaches and solutions.

How can traditional academic practice, working mainly in their disciplinary silos, be changed to shape new academic communities and networks across disciplines? There are multiple factors, e.g., organisational, cultural, technological, and physical that play a role in achieving these goals. Therefore, there is a need for an approach that makes it possible to discuss all these aspects in context. This paper will elaborate on the concept of interdisciplinarity, and factors that might influence interdisciplinary work. Further, the paper aims to investigate whether

Actor-Network Theory can be a useful approach to examine the concept of interdisciplinarity when shaping an academic community.

2 THEORETICAL FRAMEWORK

This section will present the theoretical framework regarding interdisciplinarity, factors influencing interdisciplinary work and actor-network theory.

2.1 Interdisciplinarity

Stember (1991) stated that the influence of academic disciplines is dominant in universities. Colleagues are organised by departments of separate disciplines, identity and career development of faculty are enhanced by disciplinary guilds and professional associations, and students are expected to specialise in one discipline. Today, more than thirty years later, universities are still structured into faculties and departments, and employees and students are still strongly related to their own academic disciplines. Even while disciplines serve a useful purpose, the academic disciplines create barriers to the university's sole purpose (Stember, 1991). The world is facing challenges that are too complex or too broad to be handled by one discipline alone, and therefore researchers need to work together across disciplines. These challenges include comprehensive topics such as the climate crisis, energy crisis, pandemics, poverty, and issues regarding all three dimensions of sustainability etc. Interdisciplinarity is often understood as equal to collaboration, which is a fairly simplified interpretation of the term, but the heightened interest in teamwork to solve complex problems has helped to reinforce connections between disciplines (Klein, 2010). Working across academic disciplines can help facilitate the development of new, creative, and innovative approaches, which can provide opportunities to e.g., generate new ideas, develop new approaches and methods, as well as eliminate oversight and errors in monodisciplinary practice (Reich & Reich, 2006). Since the 1960s, interdisciplinarity has been a major topic in academic and policy-oriented discourse on knowledge production and research funding (Huutoniemi et al., 2010). The first major set of terminology was developed in the 1970s. In a report published in 1972 by the Organization for Economic Cooperation and Development (OECD), they classified interactions of disciplines into multi-, pluri-, inter-, and trans-disciplinarity (Klein, 2017). There are many nuances to interdisciplinary work, and the categories mentioned above involve various steps of cooperation and coordination between disciplines (Jantsch, 1972). Disciplinarity is specialisation in isolation, a mono-discipline, it describes that someone can study something within a discipline, without needing knowledge about another discipline. Multidisciplinarity describes a situation where a problem is approached from a variety of disciplines, but with no cooperation or integration (Max-Neef, 2005). Pluridisciplinarity is when there is cooperation between a variety of disciplines that are assumed to be more or less related, but with no coordination between them (OECD, 1982). OECD (1982, p. 23) described interdisciplinarity as:

An adjective describing the interaction among two or more different disciplines. This interaction may range from simple communication of ideas to the mutual integration of organising concepts, methodology, procedures, epistemology, terminology, data and organisation of research and education in a fairly large field. An interdisciplinary group consists of persons trained in different fields of knowledge (disciplines) with different concepts, methods, and data and terms organised into a common effort on a common problem with a continuous intercommunication among the participants from the different disciplines. Right off the bat, interdisciplinarity seems like a no-brainer. Coordinated collaboration across disciplines to further develop knowledge sounds easy enough, but it is not as easy as it sounds. Interdisciplinarity has multiple challenges, and such work is more complicated than it seems. There are many reasons for working interdisciplinary, but there are some issues that cannot be

resolved just by adding disciplines together, or just by placing specialists from different disciplines together, and the greatest barrier to interdisciplinarity is often methodological (Lindauer, 1998). Some academic disciplines might be more interdisciplinary than others by the nature of their academic practice, and to cross e.g., the humanities and the sciences can pose a greater challenge than crossing internally within the humanities or the sciences (Stember, 1991).

Stember (1991) suggested some strategies to consider before embarking on an interdisciplinary project, to help make interdisciplinary work a little easier to handle. The first step is to select the appropriate members and leaders for the project, commitment and a common interest in the project are crucial to the success of an interdisciplinary project. Second, it is important to establish some ground rules, such as scheduling meetings, publication arrangements etc. To uncover and discuss differences in methodology participants should present how they can contribute and their discipline's viewpoint early in the project, this also helps the different contributors to recognise and appreciate that different disciplines have different ways of working. Lastly, there is a need for infrastructural support. Interdisciplinary projects might need an allocated space, and this might vary from just a dedicated room, a laboratory, or a larger structure where researchers and students from different disciplines can work together.

2.2 Factors influencing interdisciplinary work

Several factors need to be present to facilitate interdisciplinarity in universities, e.g., organisational, cultural, technological, and physical factors. Organisational factors regard how the organisation is organised and financed and how it facilitates the core activities that are being carried out, as well as the organisation's infrastructure. These factors are important because it sets both the limitations and the possibilities for what the researcher can do, and the frameworks put up here will decide how easy or difficult it can be to work interdisciplinary (Stember, 1991). "Individual researchers involved in interdisciplinary research (IDR) require a supportive environment that permits them to work in multiple disciplines and departments and to be fairly evaluated and rewarded for both their interdisciplinary and their disciplinary work." (National Academy of Sciences et al., 2005, p. 61).

Cultural factors are important as they represent the values and ideologies of a group. Commitment to a common interest including some ground rules is crucial for a project to succeed (Stember, 1991). Many researchers are closely linked to their academic discipline, and in a university, it can be cultural factors within a study program, research group, departments and so on. Cultural factors also include the language and methodological approach of the disciplines, which is natural from their discipline's research traditions (Reich and Reich, 2006). To uncover and discuss differences in methodology is crucial to help the different contributors recognise and appreciate that different disciplines have different ways of working (Stember, 1991).

The fast development in technology in the last decades has made employees more mobile, and now it is possible to work anywhere at any time (Weijs-Perrée et al., 2018). This has also made it possible to communicate with colleagues all around the world (Blakstad, 2015). Hence, technological factors provide great opportunities to increase the amount of interdisciplinary work. Since the outbreak of COVID-19 in March 2020 researchers all over the world have had to occasionally work from home, and technology made it possible to keep up much of the research activities from employees' home offices. Technological factors include everything from specialised laboratories, 3D technology, the internet, whiteboard, phones, computers etc. Physical factors such as buildings, space, and physical artefacts can either support or hinder what an organisation wants to achieve (Blakstad et al., 2008). The need for infrastructural support is important to recognise. One should not underestimate the scope and costs of a project, especially when it comes to interdisciplinarity. Such projects might need different

kinds of allocated space such as laboratories or rooms dedicated to a certain purpose (Stember, 1991). Having colleagues nearby and with a short distance to travel to discuss new ideas face to face with colleagues is important for sharing knowledge (Weijs-Perrée et al, 2019). However, organisational, cultural, and technological factors and the physical space must be seen in relation to each other to get the full effect of the different means to achieve interdisciplinarity (Blakstad, 2015).

2.3 Actor-Network Theory

Actor-Network Theory, hereafter ANT, was developed during the 1980s, and the sociologists Bruno Latour and Michel Callon was in the forefront of this development. An actor-network seeks to define and describe the relational ties between both human and non-human elements, and in line with its semiotic origin, ANT grants all entities in a heterogeneous network the same explanatory status (Monteiro, 2000). Who are the actors, and what are the networks? According to Latour, the term actor should be understood in the same way as the term actant is used in semiotic (Latour, 1996, p. 7): An “actor” in ANT is a semiotic definition – an actant – that is, something that acts or to which activity is granted by others. It implies no special motivation of human individual actors, nor of humans in general. An actant can literally be anything provided it is granted to be the source of an action.

By this definition, Latour explains that the term actor does not only apply to human actors, as it usually is in the traditional understanding of the term. It also applies to non-human actors, which can include everything that is made to act (Fallan, 2008). ANT prescribes agency to objects, and thereby claims that human actants and technological actants have the same amount of agency, and therefore they are equally important to the network they are in (Fallan, 2008). Thereby, the term can include concepts, objects, technology etc.

When two or more actors are connected, they will create an actor-network. According to Fallan (2008, p. 83) “Networks are made up by associations and constituted by the effects of the enrolled actors.”. Latour (2005, p. 131) specifies that “Network is a concept, not a thing out there. It is a tool to help describe something, not what is being described”.

Monteiro (2000, p. 75) describes how an actor-network works: [...] All of these factors are related or connected to how you act. You go about your business not in a total vacuum but rather under the influence of a wide range of surrounding factors. This act you are carrying out and all of these influencing factors should be considered together. This is exactly what the term ‘actor network’ accomplishes. An actor network, then, is the act linked together with all of its influencing factors (which again are linked), producing a network.

Translation, or Sociology of translation, was introduced by Michel Callon in 1986. Its purpose is to align objects or the networks in which the objects are in towards a certain target. To use translation is appropriate when analysing how actor networks are created and how they are developed and maintained (Callon, 1986). Latour (1994, p. 32) wrote: “[...] I use translation to mean displacement, drift, invention, mediation, the creation of a link that did not exist before and that to some degree modifies two elements or agents.”. Callon (1986) describes translation as a process of four phases, or ‘moments’, which can overlap: problematization, interessement, enrolment and mobilization. Problematization is when an actor offers a problem statement and seeks to engage other actors to find the solution. This problem must be interesting for the other actors to create a collective interest. Interessement is when researchers, or other actors, try to impose and stabilise the identity of the other actors it defines through its problematization. If interessement is successful it will lead to enrolment, which is about designating a set of interrelated roles and attributing them to the actors who accept them. It is in the enrolment phase that the definition and distribution of roles are being tested, and it is crucial to have clear roles and motives to who is doing what, so that the actors accept the roles, and join the network. Mobilization is the last phase in the translation process and defines who speaks in the name of

whom. Who is the speaker of the network, and who is writing the scientific articles on behalf of the group? (Callon, 1986). The spokesperson must act according to the network's interests, and this is a test of how strong the network is (Wæraas and Nielsen, 2016).

3 METHODOLOGICAL APPROACH

This paper is mainly a theoretical paper based on a literature study looking at the main topics "Interdisciplinarity" and "Actor-Network Theory". The search engine Google Scholar was used and search the terms used were "interdisciplinary", "interdisciplinarity", "transdisciplinarity", "actor-network theory", and "ANT". Much of the literature can be perceived as old since it is from the 1970-80s. When reading newer literature these sources were used in them as well, therefore old literature was not perceived as an issue. More recent literature has also been used for this paper. For the author's PhD-project 10 interviews with academic staff from different departments at NTNU were conducted. Some of the questions regarded interdisciplinarity and the informants' experiences and thoughts about it. The interviews are presented in the findings to illustrate some of the challenges with interdisciplinarity in practice, and which factors they brought forward that support or hinder such work. The interviews were semi-structured, so it offered the informants the ability to speak freely about their experiences.

4 FINDINGS FROM INTERVIEWS

From interviews conducted with academic staff from different departments at NTNU, it became clear that one of the greatest barriers to interdisciplinary work is organisational. According to all informants, there are many systems to go through to be able to work with colleagues outside their own department. These systems are bureaucratic and related to for instance financing, where should the hours be billed, who is getting the points for publications etc. These administrative tasks take up valuable time of the researcher's day, and many researchers thereby view the costs as larger than the outcome of the project. Some informants also mentioned large differences in methodological, and theoretical approaches, as well as differences in the department's professional language as challenging. This was especially prominent between the humanities and the sciences. Multiple informants explained that their disciplines are interdisciplinary by nature and that they can work interdisciplinary with almost all disciplines, while other informants describe their practice as too specialised, so it is challenging to work interdisciplinary. One informant from the sciences could not ever imagine working interdisciplinary with someone from the humanities, because they, according to the informant, did not have anything in common at all. This is a culture that has been set in the informants' discipline and thereby excludes many great opportunities for interdisciplinary work. This is an example of how cultural factors influence interdisciplinary work. Other informants mentioned the physical distance between the university's campuses as a barrier to interdisciplinarity and hopes that the co-location of the two largest campuses will help facilitate more interdisciplinary work. The informants that already are working on interdisciplinary projects explained that few of the projects took place internally at the university, but rather with industry or other universities outside Norway. The latter is made possible by technology that helps them communicate across borders.

5 DISCUSSION

This section will discuss the concept of Interdisciplinarity in light of Actor-Network Theory to investigate if ANT can help organise the different factors influencing such work, in an attempt to understand the process of interdisciplinarity in a better way.

The literature explained that interdisciplinarity is an important approach to solving complex problems and working together across academic disciplines provides opportunities to generate new ideas and develop new approaches and methods (Reich & Reich, 2005; Klein, 2010). The jungle of terms and nuances regarding interdisciplinarity might seem confusing, both for researchers who are working with interdisciplinarity as a concept and for the researchers who are trying to work interdisciplinary. ANT is developed to methodologically analyse connections between social and technological elements. The actors might be human or non-human, and ANT seeks to define and describe relational ties between these elements (Monteiro, 2000).

Callon's (1986) method of Translation and Stember's (1991) strategies for interdisciplinary work can be helpful to get a systematic approach to the analysis of the different factors influencing interdisciplinarity, as well as working systematically with problematization, interessement, enrolment, and mobilization. As stated, many factors influence interdisciplinary work, and this paper addressed the physical, technological, organisational, and cultural factors. An analysis of how these factors connect to and interact with each other can help facilitate interdisciplinarity. The interviews found that one of the greatest barriers to interdisciplinarity is organisational, and often related to financial systems within the organisation. Second, there are cultural differences between the disciplines, often related to methodological and theoretical approaches, as well as language, which Lindauer (1998) mentioned as the greatest barrier to interdisciplinarity. There are variations across the disciplines and some disciplines are interdisciplinary by nature, while others are more monodisciplinary, which is natural because of their disciplines' research traditions.

Attitudes towards different academic disciplines can be linked to the discipline's culture. Stember (1991) mentioned the two "opposites" (humanities and sciences) as examples of disciplines that might struggle to work together, most likely because of the large methodological differences between them. One informant said in their interview that they would rather work with other disciplines within technology, even outside national borders, rather than work with someone from the humanities. This is not because of the people, but because of their methodological approaches and the large differences between their theoretical perspectives. These are just two examples, but both should be more manageable if the organisation is aware of these challenges. The organisation should have systems in place to make it easier to work across disciplines and departments without all the bureaucracy, and time spent on unnecessary administration to figure out e.g., where to bill the hours.

Both the theory and the findings from the interviews illustrate that interdisciplinary work is dependent on a long list of factors that need to interact with each other, and it might be challenging to identify all of them. ANT is an interesting approach since it looks at how both tangible and intangible factors interact. The act linked together with all influencing factors creates the actor-network (Monteiro, 2000). In a campus development process, the focus tends to be on the physical design of buildings and the infrastructure, while the other less concrete or visible factors like social relations or values are not always as easy to recognise and thereby, they are easier to forget or ignore, and not be systematically attended to during the process (Blakstad et al., 2008). ANT can be useful to identify and organise which factors must be present to facilitate interdisciplinarity. These factors might vary from discipline to discipline.

6 CONCLUSION

Interdisciplinarity is important and working together across disciplines increases the opportunities to e.g., generate new ideas and methods and to help innovation. To make it easier for researchers to engage in interdisciplinary activities the location and design of campus buildings will be important. To facilitate more interdisciplinarity, physical, organisational,

cultural, and technological factors must be present and understood, such as financing and administrative systems, which needs to be less rigid.

Actor-Network Theory might be useful to understand the processes of interdisciplinary work, and to illustrate which actors, both human and non-human, are engaged in such activities. Analysing successful interdisciplinary projects and looking at the connections between the actors in the project, or network, can uncover elements or success factors in the process which can contribute to forming a model or description of the processes in an interdisciplinary project. On the other hand, no projects are alike, so making it general enough to be applied to multiple projects poses a challenge.

ANT can be a helpful approach for planners, architects, and designers, as well as organisations, to see how the process of interdisciplinarity unfolds, and to identify factors that need to be present and/or influence interdisciplinary work. And by knowing this, being able to design buildings and spaces that encourage this type of work for both researchers and students, and if the facilities are inviting and facilitate interdisciplinary activities, we are one step further in shaping an academic community.

REFERENCES

- Blakstad, S. H., Hansen, G. K., Knudsen, W. (2008), Methods & tools for evaluation of usability in buildings. In: *Usability of Workplaces, Phase 2*, Edited by: Alexander, K. Rotterdam: International Council for Research and Innovation in Building and Construction. CIB W111 Research Report
- Blakstad, S. H. (2015), Work isn't where it used to be, in Ropo, A., Salovaara, P., Sauser, E., De Paoli, D. (Eds), *Leadership in Spaces and Places*, Elgar Cheltenham.
- Callon, M. (1986), Some elements of a sociology of translation domestication of the scallops and the fishermen of St. Brieuc Bay, *The Sociological Review*, 32(1), pp. 196-223. doi: <https://doi.org/10.1111/j.1467-954X.1984.tb00113.x>
- Fallan, K. (2008), Architecture in Action: Traveling with actor-network theory in the land of architectural research, *Architectural Theory Review*, 13(1), pp. 80-96. doi: <https://doi.org/10.1080/1326482080918306>
- Huutoniemi, K., Klein, J. T. Bruun, H., Hukkinen, J. (2010), Analyzing Interdisciplinarity: Typology and Indicators, *Research Policy*, 39(1), pp. 79-88. doi: <https://doi.org/10.1016/j.respol.2009.09.011>
- Jantsch, E. (1972), Inter- and transdisciplinary university: A systems approach to education and innovation, *Higher Education*, 1(1), pp. 7-37. doi: <https://doi.org/10.1007/BF01956879>
- Klein, J. T. (2010), *A taxonomy of interdisciplinarity*, in Frodeman, R., Klein, J. T. & Pacheco, R. C. S. (Eds.) *The Oxford Handbook of Interdisciplinarity*. Oxford: Oxford University Press, pp. 15-30.
- Klein, J. T. (2017), Typologies of Interdisciplinarity, the Boundary Work of Definition, in Frodeman, R. Klein, J. T., and Pacheco, R. C. S. (Eds.) *The Oxford Handbook of Interdisciplinarity*. Second edition. Oxford: Oxford University Press, pp. 21-34.
- Latour, B. (1994), On technical mediation: Philosophy, sociology, genealogy, *Common knowledge*, 3(2), pp. 29-64.
- Latour, B. (1996), On actor-network theory: A few clarifications, *Soziale Welt*, 47(4), pp. 369-381. Retrieved from: <http://www.bruno-latour.fr/sites/default/files/P-67%20ACTOR-NETWORK.pdf>
- Latour, B. (2005), *Reassembling the Social. An Introduction to Actor-Network Theory*. Oxford: Oxford University Press.

- Lindauer, M. S. (1998), Interdisciplinarity, the psychology of art, and creativity: an Introduction, *Creativity Research Journal*, 11(1), pp. 1-10. doi: https://doi.org/10.1207/s15326934crj1101_1
- Max-Neef, M. A. (2005), Foundations of transdisciplinarity, *Ecological Economics*, 53(1), pp. 5-16. doi: <https://doi.org/10.1016/j.ecolecon.2005.01.014>
- Monteiro, E. (2000), Actor-network theory and information infrastructure. In *From control to drift: The dynamics of corporate information infrastructures* (pp. 71-83). Oxford: Oxford University Press.
- National Academy of Sciences, National Academy of Engineering, and Institute of Medicine (2005), *Facilitating Interdisciplinary Research*. Washington DC: The National Academies Press. DOI: <https://doi.org/10.17226/11153>
- OECD (1982), *The university and the community: the problems of changing relationships*. Paris: Organisation for Economic Co-operation and Development.
- Reich, S. M., Reich, J. A. (2006), Cultural Competence in Interdisciplinary Collaborations: A Method for Respecting Diversity in Research Partnerships, *American Journal of Community Psychology*, 38(1), pp. 51-62. doi: <https://doi.org/10.1007/s10464-006-9064-1>
- Stember, M. (1991), Advancing the social sciences through the interdisciplinary enterprise, *The Social Science Journal*, 28(1), pp. 1-14. doi: [https://doi.org/10.1016/0362-3319\(91\)90040-B](https://doi.org/10.1016/0362-3319(91)90040-B)
- Weijs-Perrée, M., van de Koeving, J., Appel-Meulenbroek, R., Arentze, T. (2018), Analysing user preferences for co-working space characteristics. *Building Research & Information*, 47(5), pp. 534-548, doi: <http://doi.org/10.1080/09613218.2018.1463750>
- Weijs-Perrée, M., Buck, L., Appel-Meulenbroek, R., Arentze, T. (2019), Location choices of face-to-face interactions in academic buildings: an experience sampling approach. *Ergonomics*, 62(12), pp. 1499-1514. doi: <http://doi.org/10.1080.00140139.2019.1660419>
- Wæraas, A., Nielsen, J. A. (2016), Translation Theory ‘Translated’: Three Perspectives on Translation in Organizational Research, *International Journal of Management Reviews*, 18(3), pp. 236-270.

Behaviour Settings Facilitating the Interdisciplinary Research and Design of Work Environments

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ABSTRACT

The design and research of contemporary work environments is ideally interdisciplinary – considering technical, personal, organisational, behavioural, and spatial aspects in an integrated manner. In the scope of his dissertation, the author came across an entity which could facilitate this interdisciplinary discourse: the “behaviour setting” according to Barker (1963). This entity is defined by both spatial and temporal boundaries and structures. It can be described in terms of the people involved and their characteristics, their behaviour (including its timing and objects involved), and the environment surrounding. Such entities are repeatedly observable in an organisational context as “standing patterns of behaviour”. This paper describes how this concept can be extended by the activity theories of Leontjew (1977) and Engeström (1987), with transactional activities as the connecting element between people and their environment. The resulting joint concept is illustrated with an example of applied practice. In the context of re-designing and optimising a typical activity-based, non-territorial office space, this entity is suggested as an interdisciplinary approach. Based on this, a specific behaviour setting is described in detail, and possible aspects resp. contributions of four disciplines are presented, which are usually involved in activity-based workplace design and research. Based on the insights of this practical example, advantages and disadvantages of behaviour settings for the interdisciplinary approach in designing and researching current office environments are discussed. It is shown that this concept is difficult to apply due to its openness and conceptual vagueness. But on the other hand, it offers great potential for a successful interdisciplinary discourse and a deeper understanding of the fit between persons and their built environment.

Keywords

Behavior settings, Interdisciplinary approach, Workplace design.

1 INTRODUCTION

The design of contemporary office environments for spatially mobile and temporally flexible knowledge work is often follow a human centered paradigm, the activity-based workplace design (ABWD, e.g., Babapour, 2019, or Van Meel, 2019). In this paradigm, architectural and technical design decisions are based on the office users’ work activities resp. their needs resulting from these activities. In the search for a suitable observation and description grid for such office and knowledge work environments (Steffen, 2022), one of the questions that arose was, which entity could prove to be useful for both the design and research of such environments. This is relevant because ABWD involves an interdisciplinary approach, which is often described with the keywords “people, place, technology”, emphasising the various interactions of human, environmental and technical components in a modern office work environment (Oseland, 1999; Visher, 2008). Human components (“People”) of an ABDW are typically the topic of behavioural and organisational sciences. They are concerned with e.g., personal characteristics, work activities, or organisational structures. Spatial aspects (“Place”) are typically the domain of disciplines like interior design, architecture, or facility management. Their typical entities are spatial surfaces, furniture, colouring, but also maintenance. The

“Technology” includes technical aspects of the buildings themselves (e.g., power distribution, heating, air-conditioning, ventilation, etc.) and is a typical topic of engineering sciences. In addition, information and communication technology (ICT, e.g., infrastructure, networks, hard- and software) is essential in ABWD offices. The research question is therefore: can an entity be found that is able to include these different aspects and disciplines (as well as additional ones that are not listed here)?

At first, this question seems rather theoretical. However, it becomes very practical as soon as a concrete research or practice project is to be implemented in an interdisciplinary way. The professionals or researchers involved need a “boundary object” (Star & Griesemer, 1989) for their interdisciplinary discourse. This object needs to contain the most important elements of the three main ABDW aspects mentioned above and needs to be compatible with the central approaches and concepts of the disciplines involved.

2 CONNECTING BEHAVIOR SETTING APPROACH AND ACTIVITY THEORIES

Such a boundary object could be the “behaviour settings” as they were originally conceptualised by Barker (1963) – who studied as one of the first behavioural scientists the interaction between humans and their built environment. He and his students analysed the daily life in villages and cities. They found it structured by larger scale episodes like church services, choir rehearsals or school lessons which occur in a similar form repeatedly over weeks and years. These cyclically recurring patterns of behaviour can be described with the characteristics shown in Table 1.

Table 1: Typical characteristics of behaviour settings (Barker, 1963; Kaminski 1986; Wicker, 1987).

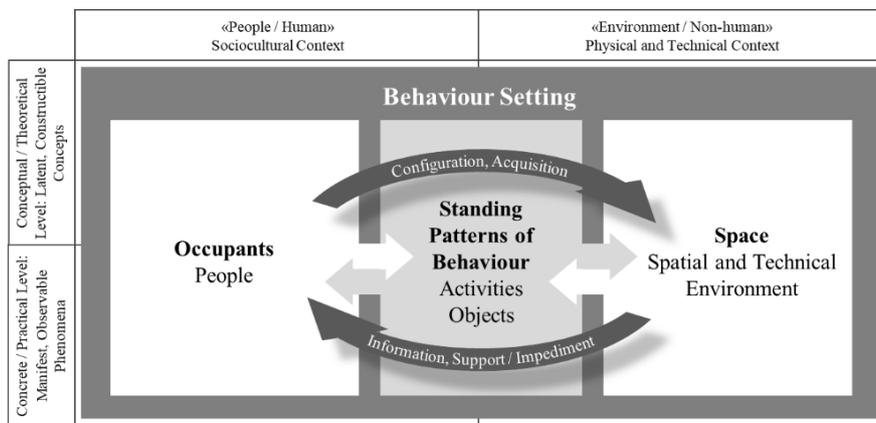
Characteristic	Description
Occupants	The people acting in the setting: their number, their role, their intentions and motives in it – as well as their age, gender, education, job profile, number of years in the organisation, hierarchy level, etc.
Activities	Specific behavioural patterns resp. work activities, their aim or function (both for the occupants and the organisation), as well as their content.
Objects	Artefacts and materials used in or required for the activities, but also spatial components such as furniture the occupants use actively.
Space	The geographical location and the built environment, including the interior design, furnishing, choice of colours and materials, as well as building technology (lighting, heating, ventilation, air-conditioning etc.)
Time	The temporal location (e.g. day of the week) and temporal structure of the episodes (especially duration, frequency and rhythm), as well as the sequence of the activities and the actions within (“scripts” according to Schank & Abelson, 1977).
Connections to other settings	The extent to which a behaviour setting is linked to others regarding the features described above, or in terms of supply and demand, e.g., if an object or action is needed from or of another setting.

In the ABWD context, the episodes of interest would be of a smaller scale like team meetings, phone calls, coffee breaks or individual focused work (within the larger behaviour setting “organisational working day”). A more systematic list is provided below in section 3.

The behaviour setting approach provides an encompassing descriptive framework, but it has some shortcomings in explaining the interaction of the different human and non-human components within the settings (Steffen, 2022). To overcome these restrictions, Barker’s approach can be combined with the activity theories of Leontjew (1977) and Engeström (1987).

They point out – among other aspects – that (a) the transactional relationship between people and their environment is formed and enacted by the activities carried out, and (b) is performed in cyclical repetitions (similar to Barker). Engeström (1987) introduces the social aspect of activities, which reflects the different roles in Barker’s behaviour settings. Activities are usually carried out in an organisational or even social context, following certain rules resp. socially agreed conventions. Furthermore, they often include a division of labour and the use of instruments (of any kind). They involve the production, exchange, distribution, and consumption (of goods material or immaterial). All these elements serve the pursuit of certain goals, towards intended results. Especially the role of the instruments as central element within the human-environment transaction is explained more explicitly in the activity theories than in the approach of Barker and his scholars. Engeström (1987) also emphasises the “symbolic content” of activity elements, especially of tools and the physical environment. All the single elements – and probably the entire behaviour setting – often have a socially and individually constructed value or meaning (in addition to their objective physical properties). An office chair, for example, can therefore not only be a piece of furniture made of wood, metal, fabric, etc. It can also be the proverbial “executive chair” – with all the interindividually shared cognitions, emotions and controversies associated with this term (like being an expression of status, hierarchy, masculinity etc). Behaviour settings thus always have two levels: an objective physical and a socially constructed immaterial one. This applies for the human components of the settings (“People”, see above), as well as for the non-human components (“Place” and “Technology”) – although different principles are prevalent, e.g., physics and mechanics for non-human vs. psychological and social processes for human components (Cairns, 2012). Figure 1 schematically illustrates this extended concept of behaviour settings (adapted from Steffen, 2022). During repetitive episodes, the interaction between people and the surrounding spatial-technical environment takes place through similar (i.e. setting-typical) behaviour patterns (i.e. activities, including the use of tools of all kinds). By performing these activities, the occupants appropriate and shape the environment, while the occupants themselves are specifically influenced by the environment. For example, the experience it as informative, supportive and/or hindering. All these elements can be described, analysed, and (if resources are available) designed on an objective-physical and a constructed-symbolic level.

Figure 1: Schematic framework for behaviour settings of activity-based office environments (cf. Steffen, 2022).



3 A PRACTICAL EXAMPLE

This rather theoretical model is best illustrated by a practical example. In any ABWD use case, the experts involved (researchers and/or practitioners) could reflect on these three questions:

- (a) Which behaviour settings can be identified in the everyday life of the organisation concerned?
- (b) What characteristics can be observed within each of the identified settings (and how are these characteristics interrelated)?
- (c) How the identified settings interrelated to each other?

The experts could make these reflections based on the office usability method, as it is suggested by Blakstad, Olsson, Hansen and Knudsen (2010), by assessing relevant spots within the office space during an on-site walkthrough and discussing their findings in a subsequent workshop. Hereby – by answering question (a) above – the experts would have a significant chance to identify various behaviour settings for individual work, formal meetings, and informal interaction (Haynes, 2007). By reflecting the questions (b) and (c) above, the experts may also conclude that the identified informal settings are not yet supported ideally by current office infrastructure (as in the case of Steffen & Schulze, 2017). According the ABWD paradigm, a “free-standing meeting bay” (cf. Figure 2) could be suggested as an improvement.

Figure 2. A typical “free-standing meeting bay” (source: www.resaleinternational.de).



In consequence, the experts in this example could reflect on the questions (b) and (c) not only for the actual situation, but also for the desired future behaviour settings to be performed in this meeting bay. The exemplary result of such a consideration is shown in Table 2.

Table 2. Characteristics of a prototypic (desired) behaviour setting for informal interaction in a free-standing meeting bay.

Characteristic	Description
Occupants	On site: 2 to 4 persons of any kind (independent of organisational affiliation, hierarchical level, educational level, work experience, age, gender etc.). Additional persons can be added via video call. Bystanders (outside of the setting) can also participate (but only for rather short interactions).
Activities	Spontaneous conversations, both about professional and private content (i.e., both work and recreational behaviour). Virtual content can also be shown using a laptop or tablet computer.
Objects	For taking notes: a paper notebook, laptop tablet computer. For presentations and/or video calls: laptop or tablet computer connected with permanently installed screen (incl. loudspeaker) and/or camera. Therefore, a power supply, an interface for laptops and the screen, as well as a network access (e.g., via wifi) is required.

Space	This setting should be located close to the individual work settings nearby, but with sufficient acoustic privacy to them (especially as concentrated individual work is prevalent performed there). As furniture, a component like shown in Figure 2 can be provided.
Time	Typical duration: 30 to 60 minutes. Occurring several times a day in random and spontaneous patterns (depending on the density of staff presence in the office).
Connections to other settings	This behaviour setting is intended to complement (a) the nearby settings for short spontaneous conversations at bistro-style tables, and (b) the planned, formal meetings in the (closed) meeting rooms located a bit further on the same floor. Most important is the easiest possible change from the individual work zone to the meeting bay. Another interconnected setting is the home office (or other office spaces) as additional participants can be connected via video call from elsewhere.
Organisational context	This setting cannot be reserved or booked in any way, in order to support spontaneous talks. Planned meetings can be held there as well, but only with restriction. After each meeting, the setting is to be released tidy (clean desk policy). This form of informal communication needs to be accepted by the organisation (e.g., valued as productive work as well). Spontaneously adding people via video call to this setting requires a certain degree of (informal) consensus, when and in what form this is considered appropriate.

To reach the full potential of the behaviour setting as an entity for interdisciplinary ABWD, it is essential that all disciplines involved would integrate their relevant aspects, concepts and/or methods. In the practical example, the experts of the specific disciplines could make the following consecutive considerations:

- Architecture, interior design:
Is the model in Figure 2 suitable for the interior design context (in terms of colour, choice of material, style, price range, etc.)? What are the users' expectations regarding the comfort or the representative value of the setting furniture? Which locations within the office space are suitable for this setting?
- Facility management, building services engineering:
What is the expected frequency of use of this setting? How many of these settings are needed? How costly or easy is it to add/remove some if needed? Is the use of the space by this setting cost-effective? What are its requirements in terms of ventilation, lighting, power supply, etc.? What maintenance procedures does this setting and its use require and what are their costs?
- Human resources / organisational sciences:
Is it necessary to address this form of informal communication specifically in the organisation, e.g., in team meetings? Should the supervisors be addressed in order to act as role models with their conscious use of the settings? Are explicitly communicated guidelines required (e.g., no booking, clean desk policy, etc.)? Do the users need an extra training on how to use the video conferencing tools installed?
- Computer science, information and communication technology (ICT):
What equipment (screen, camera, speakers, video conferencing system, interface, etc.) is appropriate? How is this equipment integrated into the overall ICT strategy of the organisation? How far has digitisation already evolved in the organisation (e.g., equipment with mobile devices, digitisation of files and data) to facilitate a spontaneous change between settings (e.g., from individual work to informal communication)? What (additional) costs would the equipment entail?

These questions are not only practice-related in the design and implementation of such behaviour settings in specific organisations. Addressing them could also generate scientific insights in applied (interdisciplinary) research projects (e.g., as case studies or by cross-organisational comparisons).

4 CONCLUSION

This rather simple, but practice-related example in the ABWD context suggests that such an integrated holistic use of behaviour settings as entities (i.e., activity focussed, recurring episodes in the temporal and spatial everyday life of an organisation) can integrate numerous aspects of different disciplines. This approach seems to provide a great conceptual openness. Although it is not (yet) able to model and predict the mechanisms of behaviour and work activities accurately within a specific behaviour setting for mobile-flexible knowledge work – this approach can facilitate interdisciplinary discussion on this, as the example suggests. Even very hands-on methods like the office usability walkthrough and workshop (as illustrated in the section above, reflecting the questions a to c) during the planning phase, important causalities and connections within and between settings can be identified, analysed and discussed. However, the integration capacity of behaviour setting as a boundary object in interdisciplinary practice and/or research projects needs furthermore to be scrutinised and discussed. An encompassing evaluation study of the behaviour settings as an interdisciplinary method for analysing and designing ABWD environments still needs to be conducted, as well as more use experiences from practitioners to be collected and shared.

Another advantage of behaviour settings as an entity of both research and design seems to be the inclusion of time as a factor. Knowledge of occurrence (duration, frequency, and rhythm) of settings provides important quantitative information for designing office spaces, like determining the required number of furnishing components (e.g., work desks, meeting rooms, informal communication areas, kitchenettes, etc.) including the space required. Knowledge of the temporal structure of behavioural sequences (not yet specified in the practical example in Table 2) helps to understand better the work activities themselves and therefore the user needs. This quantitative assessment could be made more appropriate by including other concepts such as user typologies (like user personas). The expected duration of a behaviour setting also suggests indications for its design. Towards a setting with a short duration of stay, users may have lower demands on comfort, ergonomics, or indoor climate quality. If users would agree on a “short use time” of a specific behaviour setting, they might accept compromises in the design quality (freeing up resources for an enhanced design of other settings). On this, further research is requested as well.

Behaviour settings as an entity provide a third advantage when designing and/or researching activity-based work environments. With every occurrence, setting can be adapted and developed stepwise. Depending on intervention, spatial factors (e.g., additional chairs) can be adapted as well as technical factors (e.g., different hardware or software), or human factors (e.g., different activity patterns, roles or competences). Especially in ABWD environments, continuous optimisation and adaptation to changing user needs was identified as a key success factor (Babapour, 2019).

The author’s experience from various ABWD projects suggest, that behaviour settings and their daily routine do not necessarily turn out as intended (in the planning phase). This applies especially to those new or unfamiliar to the office users. A regular occurrence of such episodes in everyday organisational life usually requires a process of appropriation and familiarisation among the users. It seems recommendable to support this process as needed, e.g., through additional information, training, role models, etc. It would also be advisable to clarify whether

spatial, technical, organisational, or cultural phenomena might hinder this appropriation process – again in the sense of an interdisciplinary analysis.

To sum up:

- Behaviour settings as an entity of both research and design appear to have a substantial potential fostering the interdisciplinary discourse. Further research and exploration in practice therefore seems worthwhile.
- Behaviour settings include time as a factor for the use of ABWD environments. This is particularly beneficial in the quantitative planning of such office environments.
- Due to their episodic and recurring character, behaviour settings appear as suitable entities for an ongoing (or step-by-step) optimisation and adaptation of ABWD environments.
- The establishment of an episodic and recurring occurrence of individual behaviour settings requires an appropriation and familiarisation process among the users. If necessary, this process can be specifically supported and fostered.

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REFERENCES

- Blakstad, S. H., Olsson, N., Hansen, G. K., Knudsen, W. (2010), Usability mapping tool. In K. Alexander (Ed.), *Usability of Workplaces - Phase 3*. Rotterdam: International Council for Research and Innovation in Building and Construction.
- Babapour, M. (2019), *The Quest for the Room of Requirement: Why Some Activity-Based Flexible Offices Work While Others do Not*. PhD Thesis. Gothenburg: Chalmers Tekniska Hogskola.
- Barker, R. G. (1963), The Stream of Behavior as an Empirical Problem. In R. G. Barker (Ed.), *The Stream of Behavior*. New York: Appleton-Century-Crofts.
- Cairns, G. (2012), Philosophical Contradictions in FM. In K. Alexander & I. Price (Eds.), *Managing Organizational Ecologies: Space, Management, and Organizations* (pp. 94-105). New York: Routledge.
- Engeström, Y. (1987), *Learning by expanding*. Cambridge: Cambridge University Press.
- Haynes, B. P. (2007), Office productivity: a theoretical framework. *Journal of Corporate Real Estate*, 9(2), 97-110.
- Kaminski, G. (Ed.) (1986), *Ordnung und Variabilität im Alltagsgeschehen*. Göttingen: Hogrefe.
- Leontiev, A. N. (1977), *Activity and consciousness*. Progress Publishers.
- Oseland, N. (1999), *Environmental Factors Affecting Office Worker Performance: A Review of Evidence*. London: The Chartered Institution of Building Services Engineers.
- Schank, R. C., Abelson, R. P. (1977), *Scripts: Plans, Goals and Understanding*. Hillsdale: Erlbaum.
- Star, S. L., Griesemer, J. R. (1989), Institutional ecology, translations and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social studies of science*, 19(3), 387-420.
- Steffen, M., Schulze, H. (2017), Multispace funktioniert nur, wenn es ständig optimiert wird. *FMPPro*, 3, 20-22.
- Steffen, M. (2022), *Bürraumsettings für Wissensarbeit: Entwicklung eines Orientierungsmodells*. Doctoral Thesis. Magdeburg: Fakultät für Humanwissenschaften der OVGU.
- Van Meel, J. (2019), *Activity-Based Working. The Purenet Practice Guide*. Available at: <http://www.pure-net.org> (accessed 3 September 2021).

- Vischer, J. C. (2008), Towards a user-centred theory of the built environment. *Building Research & Information*, 36(3), 231-240.
- Wicker, A. W. (1987), Behavior settings reconsidered: Temporal stages, resources, internal dynamics, context. In D. Stokols & I. Altman (Eds.), *Handbook of environmental psychology* (Vol. 2, pp. 613-653). New York: Wiley.

Robotisation in workplace and facility management: threat or opportunity? A q-study into future visions on the labour market and its implications for higher education

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ABSTRACT

Robotisation and automation are transforming the demand of employee skills in many different labour markets. Thus, higher education institutions potentially need to adapt their curricula to this change as well. To date no studies have been done into the impact of robotisation on the labour market in workplace and facility management. Physical robots are however more and more visible in office environments, for instance in facility services such as cleaning, maintenance, and catering. Whereas, interactive virtual robots are seen in workplace management, security and service desks. But are these robots replacing or creating jobs? And what does this mean for competency development in higher education programs in workplace and facility management? This study has adopted Q-methodology to explore expert opinions on the impact of robotisation on workplace and facility management, in order to understand how higher education should prepare talent for the future labour market. Q-methodology is a mixed methods methodology that allows for the systemic exploration and comparison of the construction of stakeholders' viewpoints (Boom et al., 2021). In line with the guidelines of Webler et al. (2009) this study developed 48 statements through a literature review and semi-structured expert interviews. Subsequently, 13 participants were asked to rank these statements in a Q-grid. Through rotated factor analysis three typical viewpoints were extracted from the data. This paper provides a contribution both to practice and higher education by structuring the potential impacts of robotisation on workplace and facility management in three distinct viewpoints. Additionally, Q-methodology is introduced as a tool for systemic exploration of the construction of stakeholders' viewpoints and can benefit workplace researchers.

Keywords

Robotisation, Labour market, Facility management, Q-methodology, Higher education.

1 INTRODUCTION AND BACKGROUND

We are currently in the middle of the fourth industrial revolution, in which a new range of technological innovations is emerging that combine the physical, digital and biological world (Marr, 2016; Penprase, 2018). An example of such innovations are robots. Robotisation and related automation are expected to have a big impact on a wide variety of labour markets. By definition robotisation refers to the automation of human tasks in a system or process through introducing (semi-) autonomous robotic devices. According to studies by Oxford Economics

(2019) and McKinsey (2018) up to 400 million jobs could be replaced worldwide by robots by 2030. Other studies indicate that this possible loss of jobs is likely to be compensated by creation of new types of jobs (e.g. Klenert et al., 2020). Especially in manufacturing the job landscape has already changed dramatically due to increasingly effective and efficient robotics and automated systems. This development is especially visible in countries such as South-Korea, Singapore and China where robot development and adoption are pushed as part of economic development programs (Atkinson, 2018). Robots are also increasingly ‘employed’ in physically demanding, repetitive or dangerous jobs such as construction and offshore maintenance. De Vries et al. (2020) point out that also in other industries routinized labour-intensive tasks and jobs can lead the replacement of workers or changes in job profiles towards more creative tasks. Similarly, automated systems have replaced many administrative and analytic roles in organizations (Marr, 2018; Freese and Dekker, 2018). Higher education programs for these fields have already emerged, changed and disappeared (Gleason, 2018). More recently robotics and automated systems have been combined in a new generation of so-called semi-autonomous smart or data-driven (interactive) physical and virtual robots. It is these types of robots and systems that are increasingly visible in office environments, for instance in facility services such as cleaning, maintenance and catering but also in all kinds of (semi-autonomous) interactive virtual assistants related to workplace management, security and service desks. To date no studies have been done into the impact of robotisation on the labour market in workplace and facility management, nor into what this means for competency development in higher education programs in workplace and facility management.

This study aims to develop an understanding of the (potential) impacts of robotization on the current FM labour market and the skillset needed to be successful in the FM labour market of the upcoming decade(s). This information is needed to adjust the curricula of higher education programs in workplace and facility management where needed. As this study explores future visions it is likely that there is not one straight answer to the question. However by exploring and comparing the arguments for different visions on robotisation, it is possible to understand these visions better and their complementarity or incompatibility. Therefore, this paper reports on a study focussing on establishing generic worldviews of relevant experts from FM practice and education on the future impact of robotisation on the FM labour market through applying Q-methodology.

2 METHODOLOGY

Q-methodology is a mixed methods methodology that allows for the systemic exploration and comparison of the construction of stakeholders’ viewpoints (Hutson & Montgomery, 2010) in order to develop representative worldviews that are shared between stakeholders. Goldman (1999, p.589) refers to Q-methodology as a ‘scientific study of human subjectivity’. It was originally developed to appreciate how different viewpoints are constructed from different beliefs and values in governance issues (e.g. Ellis et al., 2007; Addams and Proops, 2000) without claiming generalisable results beyond the stakeholders (Steelman & Maguire, 1999). Consequently, this makes Q-methodology very useful for the exploration of how visions on the future in a particular context are constructed.

The strength of Q-methodology lies in the combination of mathematical rigour of quantitative methods and the interpretive nature of qualitative methods (Robbins and Krueger, 2000). Typically the process is executed in five steps (Stergiou and Airey, 2011; Webler et al., 2009). First, a so-called “concourse”, a set of items and statements about the topic at hand is developed based on for instance a systematic review of literature and expert interviews (Newman & Ramlo, 2010). For this study this was done through a review of academic and professional literature and thematic analysis of semi-structured interviews with 6 experts. Hypothetically

this leads to an infinite number of statements, however in this study the concourse consisted of 109 statements. In the second step the set of statements in the concourse is therefore narrowed down to 30 to 60 statements for a study with a limited number of participants (Brown et al., 2008), the so-called Q-sample. To ensure that the Q-sample represents the diversity of perspectives about the topic under investigation, the sampling of statements for this study was done by adopting a stratified sampling strategy similar to Boom et al. (2021) to avoid under- or overrepresentation of a particular category. This resulted in a list of 48 statements. These statements were then reviewed by two independent other researchers to ensure content validity. The final part of step two is to refine and randomise the statements and prepare the Q-grid. As data for this study was collected during the 2021 COVID-19 lockdown in the Netherlands, the Q-grid was prepared using online software (qmethodsoftware.com). A Q-grid, is typically a bell-curve shape grid with an uneven scale (11 points in this study), ranging from strongly agree to strongly disagree (see figure 1).

The third step focusses on recruiting participants, the so-called P-sample. For this study on the implications of robotisation for the FM labour market and higher education, four types of stakeholders (n=13) were selected to be part of the study: experts in applying robots in the service sector; entrepreneurs; educators; and students. According to Webler et al. (2009) capturing the range of opinions present in the concourse is important in selecting participants. Purposive sampling of opinion leaders and decision-makers is therefore accepted. Depending on the number of worldviews expected, a sample size between 12 and 36 participants is sufficient in a Q-study (Webler et al., 2009), as the purpose is to establish the construction of worldviews rather than analysing which percentage of the population is represented by a particular worldview. The fourth step puts the participants to work with the Q-sample and grid. The software records their responses. In this study respondents were asked to rank the 48 statements in a forced grid in a way that represents their view on the impact of robotisation on FM employment and employability. The forced grid was chosen to support respondents in making choices between statements.

Figure 1: example of a Q-sort grid

most disagree						most agree				
-5	-4	-3	-2	-1	0	1	2	3	4	5

In the final and fifth step, focusses on the data analysis process of calculating correlations, factor analysis and factor scores, the online software supported this process. First, correlations between respondent grids are calculated, to establish the “degree of (dis-)agreement in points of view among stakeholders” (Stergiou & Airey, 2011, p.316). This correlation matrix is then entered into centroid factor analysis to identify how many actually different and similar Q-sorts there are in the data set. Contrary to many other types of factor analysis, centroid factor analysis focusses on clustering similar grids (respondents with similar views) rather than individual statements, through maximising the sum of absolute loadings. As a rule of thumb, at least three respondents need to load on an (expected) worldview for it to be accepted. Through this process, three distinct worldviews were extracted from the data through this process, although

four were expected. Through oblimin rotation the statements were identified that formed the basis for defining, differentiating and describing each of the worldviews of different groups of respondents (Stergiou & Airey, 2011).

3 RESULTS

As indicated above, the data analysis revealed three distinct worldviews on the impact of robotisation on the FM labour market. Each of these is shortly introduced below.

3.1 Worldview 1: human interaction is key, robots will have a minor impact

This worldview represents people that put emphasis on human interaction needed in FM and FM services. These respondents acknowledge the potential added value of robotisation but not as replacement of human interaction. In the view of these respondents robot are useful for executing repetitive standardised tasks that would allow staff to invest more time in personal attention and relationship management with users and guests through the emphatic and creative skills robots don't have. According to these respondents, robots could also add value by extending opening hours of buildings and services such as catering. Consequently, these respondents do not believe robots will replace jobs or lead to a growth in jobs, especially in organisations where hospitality and workplace experience are essential. In their view higher education programs in facility management should focus on developing creative, social, digital and communication skills.

3.2 Worldview 2: focus on efficiency and productivity with major impact on the labour market

For these respondents, robotisation presents a big opportunity for increasing productivity, efficiency and effectiveness at a lower cost. They believe that robotisation will replace jobs in the FM labour market at different levels of education. Through for instance data-driven cleaning, maintenance and cleaning robots many operational jobs, including their management will disappear. Simultaneously, there will be many new job opportunities in organisations developing, programming, maintaining and selling these robotised services especially for talent that combines technical knowhow with knowledge and experience in FM services. The business case for robotisation in this worldview is built on reducing human error and increased speed in production processes, increased productivity and availability of robotised services as robots do not get tired and are not bound by labour law. FM organisations are preparing for these developments by developing new services, partnering with and/or acquiring technology partners. According to these respondents higher education programs in facility management should change significantly and have more attention for technology and data science in their programs and less attention for more traditional business administration knowledge and skills.

3.3 Worldview 3: co-working and co-botting, balanced impact on the labour market

Respondents with this worldview believe robotising will have an added value for both FM staff as well as customers and clients. Clients will see costs go down as a result of increased efficiency and productivity, while staff will have more time for building users and benefit from increased sustainable employability because repetitive, hard or dangerous tasks that lead to human error, illness, stress and other physical problems are taken over by robots. Moreover smart data systems will support staff in providing customised services and personal attention for instance through logging preferences and complaints. According to these respondents staff will not be replaced but rather collaborate with robots (or cobot) as robots cannot do every task yet, nor can one robot do multiple different types of tasks like to their human co-workers. For instance, cleaning robots are able to clean large floor surfaces efficiently, while cleaning staff does specialised tasks or identifies new and next tasks through interpreting smart building data. Similarly, smart security systems can detect potential problems effectively and alert security staff to assess the situation. In this vision the role of higher education is to prepare talent to

engage with technology and develop new service innovations through smart combinations of hardware, software and humanware, while simultaneously paying attention to the role of change management in technology adoption processes.

4 CONCLUSION AND DISCUSSION

The worldviews found and presented in this study are not mutually exclusive but rather seem to focus on different ways of adopting robotisation in different types and sizes of organisations. The future does not unfold itself as a single and linear process in the same way for all organisations. Therefore there is no right or wrong, or even a ranked likelihood to be given for these worldviews. They seem to be unfolding simultaneously as elements of the worldviews presented above are already visible in different organisations. Semi-autonomous cleaning robots have been around for years. Data scientists provide us with better dashboards and data-driven services using building data every month. Robots are replacing jobs in food service production sites and other places where quantity, productivity and minimal human error are important because robots are never tired and are at their best in repetitive tasks. Sensor data and machine learning support smart installations to provide us with healthier workplaces with enough oxygen, light and the right temperature while using less energy. Machine learning also improves interactions with service desk chatbots every day so they can be more helpful the next day. Simultaneously, soft skills such as human empathy, flexibility, collaboration and creativity are increasingly important in many jobs both in hard and soft FM, next to the ability to engage with technology and integrate insights from data in decision-making (Low et al., 2019; IFMA, 2014). Therefore, it is safe to say that some of these perspectives on the future seem to be here already.

The question remains however, to what extent do the current FM programs in higher education reflect the reality and implications of the fourth industrial revolution. Simultaneously, there are also other important developments talent should be prepared for, for instance contributing to sustainable development (Melissen et al., 2022). Because more and more non-core activities are added to the responsibility of FM departments, they run the risk of turning into a jack of all traits but master of none. Obviously, there are limitations to what a single facility manager can do and learn over the course of his or her (school) career and how educators can prepare talent for this lifelong learning while also receiving training on other topics and skills. The answer might be that higher education programs should allow for more diversification and differentiation rather than standardisation so that talent can craft their own development trajectory more while developing the meta-cognitive competence needed to stay agile learners in a world that is changing faster than ever.

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REFERENCES

- Addams, H., Proops, J. L. (Eds.) (2000), *Social discourse and environmental policy: An application of Q methodology*. Edward Elgar Publishing.
- Atkinson, R. (2018), *Which Nations Really Lead in Industrial Robot Adoption?* Washington: Information Technology & Innovation Foundation.
- Boom, S., Weijsschede, J., Melissen, F., Koens, K., Mayer, I. (2021), Identifying stakeholder perspectives and worldviews on sustainable urban tourism development using a Q-sort methodology. *Current Issues in Tourism*, 24(4), 520-535.
- Brown, S. R., Durning, D. W., Selden, S. C. (2008), *Q methodology*. New York: Public administration and public policy.

- Ellis, G., Barry, J., Robinson, C. (2007), Many ways to say 'no', different ways to say 'yes': applying Q-methodology to understand public acceptance of wind farm proposals. *Journal of environmental planning and management*, 50(4), 517-551.
- Freese, C., Dekker, R. (2018), *Samen werken met robots*. Amsterdam: De Burcht, Wetenschappelijk Bureau voor de Vakbeweging.
- Gleason N. (2018), *Higher Education in the Era of the Fourth Industrial Revolution*. Singapore, Springer.
- Goldman, I. (1999), Q methodology as process and context in interpretivism, communication, and psychoanalytic psychotherapy and psychotherapy research. *The Psychological Record*, 49(4), 589–604. doi:10.1007/BF03395329
- Hutson, G., Montgomery, D. (2010), Stakeholder views of place meanings along the Niagara Escarpment: An exploratory Q methodological inquiry. *Leisure/Loisir*, 34(4), 421–442. doi:10.1080/14927713.2010.544121.
- IFMA (2014), IFMA's 11 Core Competences. IFMA.org. <http://cdn.ifma.org/sfcdn/knowledge-base/ifmas-11-core-competencies.pdf?sfvrsn=0> (Accessed 19 March 2022)
- Klenert, D., Fernandez-Macias, E., Antón, J. I. (2020), Do robots really destroy jobs? Evidence from Europe. *Economic and Industrial Democracy*, doi:10.1177/0143831X211068891
- Low, S. P., Gao, S., Ng, E. W. L. (2021), Future-ready project and facility management graduates in Singapore for industry 4.0: Transforming mindsets and competencies. *Engineering, Construction and Architectural Management*. 28(1) doi:ECAM-08-2018-0322
- Marr, B. (2016), Why Everyone Must Get Ready For The 4th Industrial Revolution. *Forbes*.
- Melissen, F., Smit, B., Danivska, V., Mzembe, A. (2022), *Rethinking Sustainability in Facilities Management*. London : Sage.
- Newman, I., Ramlo, S. (2010), Using Q methodology and Q factor analysis in mixed methods research. In Tashakkori A., Teddlie C. (Eds.), *SAGE handbook of mixed methods in social & behavioral research* (2nd ed., pp. 505–530). Thousand Oaks, CA: Sage Publications.
- Marr, B. (2016), Why everyone must get ready for the 4th industrial revolution. *Forbes Tech*, 5.1
- Manyika, J., Sneider, K. (2018), *AI, automation, and the future of work: Ten things to solve for*. McKinsey & Company.
- Oxford Economics (2019), *How robots change the world*. Oxford: Oxford Economics.
- Penprase, B. E. (2018), The fourth industrial revolution and higher education. *Higher education in the era of the fourth industrial revolution*, 10, 978-981.
- Robbins, P., Krueger, R. (2000), Beyond bias? The promise and limits of Q method in human geography. *The Professional Geographer*, 52(4), 636-648.
- Stainton Rogers, R. (1995), 'Q Methodology', pp. 178–92 in J.A. Smith, R. Harré and L. Van Langenhove (eds) *Rethinking Methods in Psychology*. London: Sage.
- Steelman, T. A., Maguire, L. A. (1999), Understanding participant perspectives: Q-methodology in national forest management. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, 18(3), 361-388.
- Stergiou, D., Airey, D. (2011), Q-methodology and tourism research. *Current Issues in Tourism*, 14(4), 311-322.
- De Vries, G. J., Gentile, E., Miroudot, S., Wacker, K. M. (2020), The rise of robots and the fall of routine jobs. *Labour Economics*, 66, 101885.
- Webler, T., Danielson, S., Tuler, S. (2009), *Using Q method to reveal social perspectives in environmental research*. Greenfield MA: Social and Environmental Research Institute.

SESSION 7C: ACTIVITY-BASED WORKING: THEORY AND PRACTICE

Success factors and challenges in implementing Activity-based Flexible Offices – A qualitative process evaluation with key stakeholders

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ABSTRACT

This paper identifies success factors and challenges in planning Activity-based Flexible Offices (AFOs) from perspectives of practitioners involved in the process and staff managers. Data was collected in a public service organisation that had launched AFOs in two newly built offices (approximately 2000 employees). Data collection took place one year after relocation and involved interviews and focus group discussions with a total of 35 participants. The primary challenge in early planning phases was to navigate the boundaries of the project, particularly due to limited knowledge and resources within the organisation. Due to the large scale of the project, close collaboration with senior management was seen as a key success factor. The project suffered from insufficient analysis and late involvement of occupational health experts. The interior designers had minimal interaction with the work units and strived for a standardised solution according to the clients' requirements. Involvement of employees and managers in the planning was minimal, except for those managers who had decision-making roles in the process. Instead, representatives were appointed to play an intermediary role between the work units and the project. This led to reliance on individual representatives' interest, engagement, and negotiation capacity, with implication for design customisations and readiness for change within the units. Despite extensive communication material and appointing of representative roles, the information did not reach the units as intended. Reliance on managers to conduct internal change activities led to additional differences between units' acceptance of AFOs. New interdependencies emerged in the organisation due to the shift to a centralised and standardised workplace solution: high service expectations; demands for post-relocation customisations; and a necessity to create new roles and forums to make AFO work.

Keywords

Activity-based working, Planning process, Workplace design, Stakeholder involvement.

1 INTRODUCTION

Research findings about impacts of Activity-based Flexible Offices (AFOs) on employees' wellbeing and performance is mixed (Engelen, et al., 2019). There is also a gap between intended New Ways of Working (NWOW) and employees' actual ways of working in AFOs (Hoendervanger et al., 2016; Häne & Windlinger, 2021). Studies show that perception of AFO planning processes influence implementation outcomes (Brunia et al., 2016; Rolfö, 2018;

Sirola et al., 2021), specifically that a meaningful involvement and participation of employees in planning process is instrumental for achieving positive outcomes. While employees, as users of workplaces, are the most important stakeholders in design processes, there are other actors who influence a design change. Implementing AFOs can be seen as Human Factors-related design change characterised as top-down macro-ergonomics systems approach to design of work systems (Hendrick, 2007). Therefore, it is important to understand perspectives of different stakeholders.

This paper aims to identify success factors and challenges in planning Activity-based Flexible Offices from perspectives of practitioners and staff managers in a case organisation.

2 METHODOLOGY

A case study approach was selected for in-depth exploration of a planning process in a public service organisation that had launched AFOs in two new buildings (approximately 2000 employees). The descriptive and contextual nature of the topic calls for a qualitative case study. The study was approved by the Swedish Ethical Review Board (Ref. 768-18).

The planning process for launching the AFOs was approximately four years. The data was collected in February 2020 (approximately one year post-relocation), involving a total of 35 participants (Table 1):

- **Focus group discussions with the project team held** during a full-day process evaluation workshop with the practitioners (n=11). The workshop involved discussions for mapping events, resources, success factors and challenges.
- **Semi-structured interviews with architects: the two architects** responsible for interior design were interviewed about the process and intents behind workspaces. The interviews took approximately two hours.
- **Interviews with managers:** All managers (approximately 200) who had relocated to AFOs were invited to participate in focus group interviews. In total, 22 managers volunteered, of which some (n=5) did not attend the focus groups and were instead interviewed individually. The interviews covered different topics about AFOs. In this paper, questions about planning are included for analysis.

Table 1. Participants.

Data collection	Roles	Number
Focus group with project team	Project manager (1); Communication officer (1); ICT development/digitalisation expert (1); OHS experts (2); Real Estate owner/building (1); Tenant representative (1); Facility management/Service (4)	11
Individual interviews	Architects/interior designers	2
Group/individual interviews	Managers: line- (16), middle- (5), and senior (1) management	22

All data were recorded and transcribed. The analysis involved:

- **An evaluation coding strategy** to identify success factors and challenges, reflecting participants' descriptions of what happened and why. This strategy is appropriate for process evaluations, assigning judgements about merits or significance of different events and actions in a process (Miles et al., 2020., p. 68).
- **Second cycle codes** that grouped the evaluation codes into a smaller number of themes to condense the material (ibid., p.79). These were concepts such as *navigating project boundaries or stakeholder involvement*.

- **A priori coding strategy** to arrange the previously identified codes as chronological events (ibid., p. 192). These pre-defined codes describe phases of AFO implementation adapted from van Meel (2020) and van Koetsveld and Kamperman (2011): *general planning; requirement specification; design and development; building and change management; moving; and making it work in practice.*
- **Visual displays** to illustrate the process.

3 RESULTS

The results from (1) project team's and architects', and (2) managers' viewpoints are presented in two sections.

3.1 Project team's perspective

The findings are presented for each phase and categorised into four concepts: *Navigating project boundaries; Stakeholder involvement; Identification of needs and customisation; and communication with employees and managers* (Figure 1a-b). Each concept includes a range of themes describing success factors and challenges. Here, we elaborate on themes that were unanimous, clearly conflicting, or emphasised.

Phase One. General planning

Implementing AFOs was a new type of project for the organisation and the project team. This required navigating boundaries of the project and clarifying ambiguities about roles and responsibilities despite an initial lack of knowledge and resources. A success factor was recurrent meetings with the steering group and the support they provided from senior management. This was critical, as work units to be relocated were moving from facilities with unit-specific pricing for rent, facility services and de-centralised IT-equipment. The relocation involved changing the de-centralised billing model to a centralised one with bundled pricing per employee, and relocation from 27 smaller offices to two larger and standardised AFOs. Senior management had also specified sustainability goals for building standards and re-use of furniture.

During an initial planning, four sub-projects were created that worked in separate streams but got together frequently: IT, Facility management, Building/real estate, and Change management. A critical step was then to identify and involve key stakeholders (such as tenant and union representatives). While the multi-disciplinary collaboration was appreciated, the timing, extent and scope of stakeholder involvement was debated. For instance, it was agreed that HR and OHS experts should have been involved earlier, to provide guidelines and facilitate change. However, timing and scope of TRs' (tenant representatives) involvement was a subject of disagreement. This was critical, as TRs played an intermediary role between work units and project team: they were expected to voice the concerns of colleagues and communicate project information. According to some, TRs should have been involved earlier while others mentioned that the relative early involvement of TRs led to diversions from the project: "*it is difficult to find a balance between stakeholder involvement and moving forward*". Nonetheless, there was consensus about TRs' individual differences in fulfilling their responsibilities.

From a communication perspective, motives behind implementation were not clearly and sufficiently conveyed. This was believed to influence employees' acceptance.

Phase Two. Requirement specification

Requirements for IT-equipment and services were successfully specified, leading to a resource-efficient and well-functioning solution. A major challenge was insufficient needs analysis for building and facility services: (1) analyses were conducted 'too early' with neither iterations nor attention to parallel organisational changes; (2) focused on generic individual needs, instead of future needs of work units. Nonetheless, requirement specifications, invitation to tender, selection of contractors, and building design were based on insufficient analyses.

Participation of TRs, employees, and managers in specifying requirements was a topic of debate: while some mentioned TRs should have helped identify unit-specific needs, others defended the generic and top-down requirement specification for its convenience. TR's individual drive, persistence in voicing units' needs, and negotiation capacity led to some unit-specific considerations-

The project's novelty for facility management required internal organisational development: *"we should have appointed a project leader for our organisational development. We didn't have time to map our own needs as a service organisation. What we should deliver now and in future. No one knew what the requirements were. It took several years until we understood"*. Several new roles were appointed in this sub-project: (a) an expert for creating furniture inventories as the organisation aimed for a large-scale re-use of their furniture; and (b) a move coordinator to support the logistics of relocation. Other overlooked challenges were interdependencies between sub-projects, particularly imposed by upcycling of furniture. With the participants suggested that thorough risk analyses may help identify and address these risks.

Phase Three. Design & development

The collaboration between the project team/client and interior designers was facilitated with a *'transparent communication strategy with living documentation of design decisions'* – a successful strategy according to the designers. Nonetheless, closer collaboration between designers, FM and OHS experts was desired to better meet needs of tenants and service providers. The interior design decisions were based on the specifications provided by the client: *"a building for all without unit-specific customisations"*. Variety of work units and large number of employees did not allow for tailoring: *"It is difficult to make compromises, if you want to go all in with activity-based working"*. AFO was understood by the client and the architects as an open floor divided into zones, with collaboration zones being the largest to encourage collaboration, and prevent isolation and territorial behaviours. This understanding was influenced by architectural or consultancy firms that set certain design standards for AFOs: *"They [a firm] say 2,5-3 seats per person and have these zones with behavioural rules. I didn't come up with it but put together what other firms do and recommend"*. Establishing a new workplace concept with IT-equipment and services was seen as a success factor. Pilot tests were conducted in some of the previous offices to help understanding the new concept. While the pilots were found useful for developing the services, their low fidelity was raised as an issue: being far from reality, the pilots were *"difficult to understand, created many false truths and set wrong expectations, it would be better with a real test environment"*. In general, employees were not involved in the design process, and little effort was made to make unit-specific customisations.

Phase Four. Building and change management

Discussions about phase four mainly concerned change management's success factors: (1) a close collaboration with OHS experts, (2) extensive communication material, and (3) workshops with employees and managers. These workshops created a context for employees to be *heard and seen*, pose questions and voice concerns. The project team perceived these dialogues as 'negative complaints' rooted in fear of change, triggering worries about work environment in AFOs. Some mentioned that these activities were not tailored to needs and maturity levels of different units. Since the goal behind participatory activities were not clearly communicated; false interpretations were made *"they thought they could decide things"* that were challenging as design decisions had been made. Despite extensive communication material: *"information was not conveyed to managers, it stayed with tenant representatives and communication officers"*. The project team expected a higher level of participation in central change activities, and unit-specific activities organised by managers. Limited focus on and ambiguities about NWOW was another issue.

Re-using furniture continued to pose challenges, specifically for installing IT-equipment, some of which was delayed as old furniture had to be re-purposed.

Phases Five-Six. Moving and making it work

A smooth moving process and provision of IT- and ergonomic support was mentioned as a major success factors. However, limited involvement of HR remained an issue, for example some were not listed and were assigned lockers. Other issues concerned digital applications for occupancy measurements and to allow employees locate each other in the facilities. The project team lacked support from HR to develop or procure such solutions which employees expected in the new offices.

Handover to maintenance was experienced as ambiguous by facility management (with unclear roles, responsibilities, and billing structure). Other issues were high service expectations, customisation requests, no error handling system and limited post-relocation exchange with contractors for addressing faults and delivery delays. The interior designers also mentioned a need for continued exchange with the project team to learn and understand how the solution worked.

The project team discussed a disregard for NWOW due to limited preparations and involvement in change activities. More engagement was expected from managers and employee representatives to ensure compliance with NWOW. To address this and challenges with maintenance and post-relocation customisations, new work groups were created, consisting of panels of managers and facility management. The organisation was exploring ways to manage and make AFOs work.

Figure 2a. Success factors (green) and challenges (grey) according to the project team: Project management (PM); Communication (CO); Tenants (TR); IT development (ICT); Facility management (FM); Real estate/building (RE); Interior architecture (IA); Occupational health and safety (OHS)

Figure 1b. Success factors (green) and challenges (grey) according to the project team: Project management (PM); Communication (CO); Tenants (TR); IT development (ICT); Facility management (FM); Real estate/building (RE); Interior architecture (IA); Occupational health and safety (OHS)

1. General planning	2. Requirement specification	3. Design & development	4. Building & change management	5-6. Moving & making it work
Initial ambiguity in process, scope, sub-projects, roles & responsibilities (PM; TR; FM; OHS; RE; ICT)	Risk analysis was only conducted with respect to building and construction (PM; TR) Increased interdependencies (due to logistics of re-used furniture) required expertise and a new form of collaboration with IA; creating challenges for timely development and delivery of IT-solutions (ICT; FM; IA)			
A new project type without prior examples and experiences to rely on (FM; RE; IA)				
Navigating project boundaries	Learning about AFOs and collecting inspirational examples (TR; OHS; CO) Appointing service roles: move coordinator and furniture expert for inventory and re-use (FM) Organisational development and a positive social environment in FM team (FM)		Managing high service expectations and billing ambiguities (FM)	Handover ambiguities from project to maintenance & emergent needs of a service organisation (PM; FM; ICT; RE)
Status reports and regular meetings with the steering group, allowing for updating budgets and making changes (TR; RE; ICT)				
Stakeholder involvement				
Creating different groups: tenant representatives (TR); HR & union representatives (FM); building and design council (RE)	Establishment of a communication strategy to facilitate close collaboration with the client and work with the requirement specification (IA) Workshops with tenant representatives (TR; CO)	Workshops with contractors to address challenges with different phases of the project and reach consensus for courses of action (RE)		Establishing new work groups for participation of managers in overall building maintenance decisions (PM)
Loss of time and resource due to late involvement of stakeholders and disregard for existing guidelines (PM; TR; OHS; RE)				Tight collaboration with OHS experts to address issues concerning ergonomics, change management and work environment (OHS; PM)
Finding a balance between involving many stakeholders and leading the project forward (PM)	Limited collaboration and communication between interior design consultants and other experts e.g. IT, lighting designer, TRs and OHS experts (OHS; ICT; IA)			Limited exchange and follow-ups with contractors for addressing post-relocation problems (RE; IA; FM)
Limited change management competence and under-estimation of people's resistance to and fear of change (PM; CO; IA)				
Groups had different questions in the different phases, making the process and the involvement difficult to handle (FM)				
				More engagement was expected of staff managers and employee representatives (FM; RE; PM; CO; ICT)
Limited and varied involvement of employee representatives from the different work units and ambiguities about timing, extent and purpose of involvement (TR; IA; RE; PM)				
Limited participation of HR created ambiguities throughout the project, e.g. with respect to number staff to be accounted for or HR-specific digital solutions (PM; TR; ICT)				
1. General planning	2. Requirement specification	3. Design & development	4. Building & change management	5-6. Moving & making it work

1. General planning	2. Requirement specification	3. Design & development	4. Building & change management	5-6. Moving & making it work
Identification of needs & customisation Need analyses focused on individuals and generic needs instead of unit-specific needs, and present needs instead of future ones (PM; TR; FM; ICT; IA)	Need analyses for IT-equipment (ICT)	Establishing a new IT-workplace concept with a new billing model (ICT)	Reduced IT-problems (ICT)	Handling maintenance problems, customisation requests, and high service expectations (FM; TR; PM; OHS)
	Weaving occupational health research in the process (OHS)	Pilots to help identify the service needs (FM)		
	Too early and too late need analyses efforts that did not feed into the office design decisions (FM; PM; OHS)	Some design and procurement decisions disregarded ergonomics guidelines (OHS)		
	Top-down decision on AFO-implementation imposed new ways of working (IA)	Interior design concept was based on project teams' requests and building limitations (IA)		
Communication with employees and managers Too late & indirect involvement of employees and managers led to a limited understanding of the change (CO)	Parallel organisational change processes imposed difficulties for needs analyses (TR)	Changes in expected occupancy necessitating re-work and creating a risk for crowding (IA)	Design choices disregarded some of the budgetary constraints and needs of service personnel, and were overruled by the project team (FM; IA)	Some groups were well-prepared due to engagement in the central change management activities (TR)
		Difficult to customise for a wide variety of work units and a large number of employees (IA; TR; FM)		
		Ambiguities in expected facility and IT services & organisational needs for service delivery (FM; ICT)		
		Reliance on the tenant representatives' individual drive to mediate between the work units and the project team (TR; CO)		
Initial decision, its motives, and information about the project was not clearly and sufficiently conveyed to the staff managers and staff (PM; RE; CO)	Pilots to help understand the new workplaces (FM; CO)	Employees were heard and seen during the change activities (OHS)		Change management activities within the units required time and resources; these were not prioritised by all managers, leading to different levels of maturity, preparedness, and compliance with AFO-rules (PM; TR; CO; ICT; RE; FM; IA)
	Low fidelity of the pilot made it difficult to understand the change (CO; ICT)	Limited participation in central change management activities due to a lack of time/interest (TR; CO; PM)		
	Limited information & communication about ways of working and AFO-rules (PM; FM; CO; IA; TR)	Change activities focused on detailed information instead of tailoring to the needs and maturity levels of the units (TR; CO; OHS)		
	Some groups were not listed as tenants and thus excluded from processes, leading to a negative experience and lack of knowledge (TR; PM)			
1. General planning	2. Requirement specification	3. Design & development	4. Building & change management	5-6. Moving & making it work

3.2 Staff management perspective

Findings from different phases are categorised into five concepts: *managers' viewpoints about AFOs; Participation; Communication; Identification of needs and customisation; and Pre-conditions and resources* (Figure 2).

Phases One-Three

Of the 22 interviewed managers, some (n=5) were directly involved in early phases, for example, in the steering group, the project team, or as TRs and move coordinators. A few others (n=3) voiced their needs, concerns, and suggestions through TRs. In general, those who were directly or indirectly linked to the process had a positive perception of the process and found the outcomes successful, both the solution and employees' adaptations and acceptance. In contrast, others (n=13) expressed that they were not involved in early phases of the planning, their units' needs were neglected and had limited possibilities to influence the process. As a result, the facilities were perceived to have shortcomings, not meeting the units' needs. Some were critical about standardised AFOs and the top-down decision for implementing AFOs. Nonetheless, the interviewees sympathised with the project team, having limitations to customise due to scale and complexity of the project. Despite their level of involvement and preconceptions about AFOs, assuming positive intent was considered a better approach than actively resisting the change.

Phase Four

The majority participated more actively in change management activities, that required time and resources. In this phase, managers played an intermediary role between the project team and their staff. Some managers conducted risk analyses within their units not only to identify risks and action plans, but also to create an opportunity for employees to voice concerns and prepare for the change. Further, a few engaged in negotiations with the project team to request customisations. The project team was perceived to be responsive, but limited changes were made as the building was being constructed. The participants mentioned that change activities provided information to prepare employees and encourage acceptance. Some appreciated these activities as a necessary way to learn about NWOW, leading to well-prepared and united staff who were satisfied and enjoyed working in the new facilities. However, others perceived these activities as pseudo-participation, "*forcing an ill-fitting way of working on us*". Consequently, they mentioned that their staff were frustrated, showed resistance, and rejected NWOW.

Phases Five-Six

While the smoothness of moving into the new buildings was a consensus among managers, a polarised view was identified about how well the building supported employees' and units' needs. Some perceived the facilities, services and their staff well-prepared. In contrast, others were concerned about those unmet needs such as limited storage or crowding. The latter group hoped for adjustments.

Figure 2. Success factors (green) and challenges (grey) according to managers

1-3. Project planning, requirement spec & design	4. Change management	5-6. Moving & making the concept work in practice
Cynicism about the AFO concept and decision to adopt it, but sympathy for the complexity of the project		No impacts on a group level
Concerns for fitness of AFO for all individuals/work units		Resistance, frustration and rejection of AFO rules and ways of working among employees
Would have been better to accept rather than to resist (as it did not make any difference)		Easy and smooth moving process
Assumed positive intent about the change		Well-prepared staff
		A satisfied majority
 Viewpoints about AFOs and its outcomes		Quick adjustment of staff to the AFO
		Cooperating and united staff
Limited/late involvement and/or exclusion of some work units as tenants in planning process		 Participation in the process
Unit-specific risk analysis to address employees' concerns		
Direct involvement in decision-making or indirect involvement through representatives		Available on-site to address employees' concerns
	Pilot testing to learn and prepare for AFO	
	Participation in central change activities	
	Organising unit-specific change activities	
Communication about the visions and decisions were perceived to be dishonest		 Communication
Ambiguities about the (limited) action space		
Lack of focus on new ways of working		Focus on policing
Limited communication about the process and unresponsive when information was requested		
Project team was perceived to be responsive to feedback		
	Responsive communication with own work group	
	Unrealistic expectations of staff	Some continue to wish for own workstations
	Difficult to envision usage and actual needs based on drawings and LO-FI pilots	Sub-optimal solution that neither fits individual nor unit-specific needs
Limited room for customisations		Need for post-occupancy adjustments to address tethering problems
Insufficient analyses of needs and activities		
 Identification of needs & customisation		Negotiations with project group to make (late) design changes
		Well-functioning offices and support
Parallel organisational changes made the change process more challenging for some units		 Pre-conditions and resources
Lack of support from own manager and leadership team		
Learned about AFOs to handle general misconceptions		
Easier to accept AFO when in need for better facilities		Allocate time for change among employees
		Requires time from staff managers to participate in central change activities & organising unit-specific activities
1-3. Project planning, requirement spec, & design	4. Change management	5-6. Moving & making the concept work in practice

4 DISCUSSIONS

The study presented a multi-perspective approach that allowed mapping challenges and success factors of such a large-scale complex process of implementing AFOs. Such insights can help improve implementation processes by drawing on success factors and anticipating challenges. The perspectives combined here range from facility management, architecture, human factors, occupational health to change management. This transdisciplinary perspective can inform development of methods for stakeholder involvement, planning and evaluations when implementing AFOs. Here, we discuss the main takeaways from the study.

Navigating among definitions. In our study, the practitioners viewed AFOs as a generic, mostly open, and standardised solution. Standardisation is time and cost-efficient in large organisations. Our study shows benefits of standardisation at a micro level, e.g., docking stations or IT-equipment for meeting spaces, but standardised spatial solutions and Ways of Working did not fit unit-specific needs. According to Appel-Meulenbroek et al. (2011), AFOs are about customising office design, to allow employees to choose a workspace that best fits their activities and preferences. Interpreting AFOs as standardised workplaces leads to challenges as (i) it does not fit all, (ii) omits participatory design processes, and (iii) contradicts the core definition of AFO - to support employees' work.

Analysis of needs and customisation. In large organisations understanding needs of many work units and creating tailored solutions may be challenging, particularly in public organisations where resources are limited and must be carefully allocated. Additionally, there are structural problem about program decisions: in our case, decisions were made with limited employee participation and tight deadlines for tenders, procurement, and design. Resources and competence for making these decisions were also limited, particularly when the organisation lacks prior experience in AFO implementation. Given that implementation of AFOs is a work system change and that participation is instrumental for its success (Lahtinen et al., 2015; Brunia et al., 2016; Babapour & Rolfö, 2019), financial investment for thought-through program decisions, thorough analyses of needs and participatory design processes should be a strategic consideration to ensure well-being and overall system performance.

Negotiation capacity. Our findings show that customisations are possible with persistence and engagement of employee representatives and managers, even if the project strives for standardisation. This however creates 'unfairness' due to reliance on negotiation capacity of individual representatives that may: (i) be at relational disadvantage with the project team and excluded from the conversations, or (ii) lack interest, knowledge, resources or time for negotiation. OHS experts can help resolving such issues by acting as *political reflective navigators* (cf. Broberg & Hermund, 2004), if they are involved throughout the process and given opportunity to facilitate understanding of unit-specific needs, and mediate between different stakeholders.

Communication with managers and employees. Providing adequate information is instrumental in workplace change management (Brunia et al., 2016; Rolfö, 2018; Babapour, 2019). In our study, the provided information did not seem to reach the units as widely as hoped for, partly due to reliance on representatives and managers, some of which failed to facilitate a bi-directional information exchange. Furthermore, goals of change and new ways of working were neither clearly defined nor communicated. Limited participation of employees in change activities was another issue. Employee participation can raise false expectations if not handled well (Sorela et al., 2021), which was the case here. Change activities without clear definition of boundaries can be interpreted as pseudo-participation, giving an impression of openness rather than a possibility to influence decisions. These aspects may have discouraged employees from participation. Workplace change processes should promote dialogue and enable

employees to experience the process as comprehensive, manageable, and meaningful, thus supporting their sense of coherence (Ruohomäki et al., 2015; Wijk et al., 2020).

Unit-specific change management. Our study shows differences in extent and content of change activities within work units. This was associated with adoption of and satisfaction with AFOs. This assumption is supported by a recent study about change-oriented leadership during AFO planning and its effects on employees' perceived performance (Bergsten et al., 2021). It is therefore important to differentiate between centralised and unit-specific change activities when implementing AFOs.

Feedback loops in design processes. Our findings point to a general limitation in building industry: lack of a feedback loop (Bordass & Leaman, 2005). Designers are often disconnected from projects after completion, moving onto next projects. As a result, users may never fully realise building's potential, and significant gaps between expectations and outcomes can remain undiscovered. Consequently, designers may not learn which mistakes to avoid or successes to replicate (ibid.). In our case, designers were also disconnected from need analyses, and had a limited understanding of unit-specific requirements. Creating feedback loops during and after a project requires a shift of attitude. Clients and the industry must recognise the value of feed-forward and back through pre- and post-occupancy evaluations.

Service expectations in shared workplace systems. A transition from individual to shared workstations can reduce consumption and contribute to Sustainable Development Goals (UN, 2016; EU, 2014), more so as the organization re-used older furniture. However, this transition from linear consumption to circular and shared practices introduced new interdependencies between: (1) sub-projects for delivery and timing of installations; (2) units and the project team to negotiate customisations; and (3) units and facility management as new services are required to make sharing work. Therefore, facility management in new workplace concepts should develop service offerings and value proposition on top of a physical workspace (Petrušaitienė et al., 2018).

Methodological considerations. First, we did not include employees. Future work should combine perspectives of project teams and managers with that of employees. Second, several managers in our study were directly involved in the process and represent, similar to other studies (e.g. Sirola et al., 2021), a privileged and biased perspective. Third, our data collection was a post-mortem evaluation, capturing more significant events that participants remembered. Collecting data during the process can provide a more thorough understanding. How planning duration impacts the outcomes is also worth investigating in comparative studies. Fourth, this study was conducted prior to COVID-19. Designing well-functioning offices in the aftermath of COVID-19 remains a topic for future investigations.

5 CONCLUSIONS

Our findings show how a successful AFO implementation is dependent on (1) thorough needs analyses with attention to unit-specific requirements; (2) participative processes where employees are not merely involved to receive information, but to give feedback that translates into action or to co-create solutions; (3) iterative processes to test and verify solutions; and (4) processes that enable and ensure all work units are involved, their voices heard, and are prepared and informed about the change. Customisation is a major challenge in implementing AFOs, that depends on negotiation capacity of employee representatives, particularly when leadership strives for standardisation.

REFERENCES

Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), An end-user's perspective on activity-based office concepts. *Journal of Corporate Real Estate*, 13(2), 122–135.

- Babapour Chafi, M. (2019), *The Quest for the Room of Requirement - Why Some Activity-based Flexible Offices Work While Others Do Not*. Doctoral Thesis. Division Design & Human Factors, Chalmers University of Technology.
- Babapour Chafi, M., Rolfö, L. (2019), Policies in Activity-based Flexible Offices-‘I am sloppy with clean-desking. We don’t really know the rules.’. *Ergonomics*, 62(1), 1-20.
- Bergsten, E. L., Haapakangas, A., Larsson, J., Jahncke, H., Hallman, D. M. (2021), Effects of relocation to activity-based workplaces on perceived productivity: Importance of change-oriented leadership. *Applied Ergonomics*, 93, 103348.
- Bordass, B., Leaman, A. (2005), Making feedback and post-occupancy evaluation routine 1: A portfolio of feedback techniques. *Building Research & Information*, 33(4), 347-352.
- Broberg, O., Hermund, I. (2004), The OHS consultant as a ‘political reflective navigator’ in technological change processes. *International Journal of Industrial Ergonomics*, 33(4), 315-326.
- Brunia, S., de Been, I., van der Voordt, T. J. M. (2016), Accommodating new ways of working: lessons from best practices and worst cases. *Journal of Corporate Real Estate*, 18(1), 30–47. <https://doi.org/10.1108/JCRE-10-2015-0028>
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, A. (2019), “Is activity-based working impacting health, work performance and perceptions? A systematic review”, *Building Research and Information*, Vol. 47 No. 4, pp. 468-479.
- European Commission (2014), *Towards a Circular Economy: A Zero Waste Programme for Europe*, COM(2014) 398 Final/2. Brussels, Belgium.
- Hendrick, H. W., (2007). “Macroeconomics for Better Work Systems”, *Industrial Management*, 49(1).
- Häne, E., Windlinger, L. (2021), Switching behaviour in activity-based working environments: an exploration of the reasons and influencing factors. *Journal of Corporate Real Estate*.
- Lahtinen, M., Ruohomäki, V., Haapakangas, A., Reijula, K. (2015). Developmental needs of workplace design practices. *Intelligent Buildings International*, 7(4), 198–214. <https://doi.org/10.1080/17508975.2014.1001315>
- Miles, M. B., Huberman, A. M., Saldaña, J. (2020), *Qualitative data analysis: A methods sourcebook*. Sage publications. Fourth edition.
- Petrolaitiene, V., Korba, P., Nenonen, S., Jylhä, T., Junnila, S. (2018), From walls to experience—servitization of workplaces. *Facilities*.
- Rolfö, L. V. (2018), Relocation to an activity-based flexible office – Design processes and outcomes. *Applied Ergonomics*, 73, 141–150. <https://doi.org/10.1016/j.apergo.2018.05.017>
- Sirola, P., Haapakangas, A., Lahtinen, M., Ruohomäki, V. (2021), Workplace change process and satisfaction with activity-based office. *Facilities*.
- United Nations (2016), *Transforming Our World: the 2030 Agenda for Sustainable Development*, A/RES/70/1. United Nations Office, Geneva, Switzerland.
- Van Koetsveld, R., Kamperman, L. (2011), How flexible workplace strategies can be made successful at the operational level. *Corporate Real Estate Journal*, 1(4), 303–319.
- Van Meel, J. (2020), *The activity-based working practice guide* (second edition). BriefBuilder. <https://www.briefbuilder.com/pages/the-activity-based-working-practice-guide>
- Wijk, K., Bergsten, E. L., Hallman, D. M. (2020), “Sense of coherence, health, well-being and work satisfaction before and after implementing Activity-Based workplaces”, *International Journal of Environmental Research and Public Health*, Vol. 17 No. 14, p. 5250.

Active utilisation of different zones in ABW office - relationships to employee experience

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ABSTRACT

Activity-based offices has been implemented for a couple of time, but only recently the way activity-based offices are practically used by the employees has attracted research interest. In this study results of a comprehensive post-occupancy survey in a Finnish governmental organization are provided. The post-occupancy survey measured several aspects of the actual ABW office use both in individual and work community level: (1) which of the working zones employees actually utilised; (2) how often they utilised different working zones; (3) how many times per day employees switched their working zone; (4) how much time they spent when switching zones per day; (5) how the working zone specific speech rules and other codes of conduct were applied and obeyed; (6) were the differences in working zone switching behaviour related to differences in the employee and workplace experiences. The results of this study showed that not all working zones of the activity-based office were used actively. The basic principle of utilizing different working zones for different work activities was not fully applied. A big share of employees do not switch their work station during the work day at all. The behavioural norms regarding the use of different working zones were not fully obeyed. Those who switch their work station at least once in a working day were more proactive planners of their work and they manage more actively their work environment. Overall sense of self-rated productivity and work well-being did not differ between switchers and non-switchers. The overall sense of community was high among work communities, and the activity-based working does not seem to harm work community.

Keywords

Activity-based office, Speech rules, Employee experience, Sense of community, New ways of working

1 INTRODUCTION

Activity-based working (ABW) and activity-based offices (ABO) with a variety of working zones and non-assigned workstations has been applied for a while as a more cost and energy efficient office solution compared to cell offices and conventional open-space offices. Conventional open-space offices are criticized for their noise and constant flow of interruptions the shared environment generates. Activity-based offices provide possibilities to find suitable spaces to work both in solitude and silence, and to collaborate and interact. However, empirical results about the experiences related to possibility to concentrate and on the other hand to collaborate smoothly in ABOs has been mixed. While the office layouts following the idea of providing different zones for different work modes and related employee experiences has been studied widely, the actual extent of use of different zones has not been studied that often (see as an exception e.g. Haapakangas et al, 2018; Hoendervanger et al., 2019). In addition, the central and distinctive element of ABOs making them work properly – the speech rules and other codes of conduct associated to different working zones of the office – has not generated much research interest (see as an exception e.g. Bababour Chafi and Rolfö, 2019; Bababour 2019; Franssila & Kirjonen, 2022).

In this study results of a comprehensive post-occupancy survey in a Finnish governmental organization are provided. In the study several aspects of the actual ABW office use both in individual and work community level were analysed and following research questions are explored:

1. which of the working zones employees actually utilised;
2. how often they utilised different working zones;
3. how many times per day employees switched their working zone;
4. how much time they spent when switching zones per day;
5. how the working zone specific speech rules and other codes of conduct were applied and obeyed;
6. were the differences in working zone switching behaviour related to differences in the employee and workplace experiences.

2 BACKGROUND

The impacts of activity-based working on various employee experience measures have been according to the earlier research mixed. According to the recent review of research on activity-based working over last ten years, shortcomings related to the activity-based working are not related to the ABW concept itself, but rather to the way how working is implemented and how occupants use the work environment (Marzban et al., 2022). While ABOs provide new resources and new means to support ones' ability to execute knowledge work and control work environment, the ways of working in a new way and utilizing the new premises has not developed in the same pace. In one of the earliest studies observing work zone switching in ABW office, Appel-Meulenbroek et al. (2011) found out that 68% of the respondents never switched their work station during working day. Hoendervanger et al. (2016) reported in their study of activity-based working, that workplace switching is very rare, only 4% switch multiple times per day, and nearly half (48%) switch never or less than once a week. In the multiple-case study of ABW change, Babapour Chafi and Rolfö (2019) found out that the switching behavior varied from case to case. In most of the case sites at least half of the informants changed their workstation at least periodically, but in the one case site the informants mainly chose the same work station from day to day. On the other hand, Haapakangas et al. (2018) reported in their study, that majority of respondents (72%) switched their workspace at least once a day. In a similar vein, Windlinger and Kim (2020) reported, that 70% of their respondents switched their workplace voluntarily at least once a day.

In general, very little is known about actual frequencies of using different zones in ABW offices, or about the amount time spent in working in different zone. In their experience-sampling study Hoendervanger et al. (2022) made a remarkable finding, that most of the work (72%) was executed in open work settings, and that individual high-concentration work was less often performed in closed work setting than in open work setting. One possible reason behind the reluctance to switch ones' working zone in ABW office can be the time lost in the transitions from one zone to another and in the setup of the workstation in the new zone. Couple of earlier studies have observe the estimated time spent in transitions. Respondents in the study of Rolfö et al. (2018) spent daily in average 7.84 minutes for finding appropriate workplace. In Haapakangas et al. (2018) nearly 50% of respondents spent at least 6 minutes per day for looking for a workspace.

The most common behavioral codes or norms in ABW office regard desk-sharing and the clean-desk policy. These norms apply to all zones in activity-based office, but each zone should have also zone-specific speech and phone/video rules and norms considering acceptable periods of non-attendance in the claimed work-stations. The application of speech rules and other behavioral norms and their success in ABW has attracted only scant attention in earlier

studies. Rolfö et al. (2018) reported about negative effects of rule ambiguity on performance and satisfaction in ABW. Babapour Chafi and Rolfö (2019) found out in their qualitative cross-case study, that the level of formalization and unambiguousness of the behavioral norms varies from case to case, and violations of behavioral norms occur often.

It can be concluded from the earlier studies, that both the actual use behavior of different zones and the status of application of behavioral norms in ABW offices requires extra attention.

3 RESEARCH SITE, METHODS AND DATA

The study was conducted in the office site of a governmental organization in Finland in 2019. The organization with nearly 400 employees moved to the activity-based office in 2018. The staff participated into training related to activity-based working and as part of the training the code of conduct and speech rules of the each working zone were created in participatory manner. The participation on the training was not mandatory. Part of the employees had already practical experience about working in activity-based office without assigned seats, but some of the employees were new to activity-based working. Participation rate into the training was quite low, appr. 10% of the staff participated into the training.

The activity-based office was located on three floors in old, renovated office building. Each of the floors of the office had slightly different layout. The zones in each floor differed in their size and slightly in their shape. To maintain anonymity of the building and the organization, actual floor plan of the office is not presented. Characteristics of the office spaces in each of zones were the following:

- open workstation zone for individual and pair work with a permission to speak, take calls and participate into video meetings involving moderate amount of speaking (variable number of work stations);
- open but acoustically protected work station zones for individual work without permission to speak, take calls or interrupt by contacting face-to-face someone working in the zone (variable number of work stations);
- open collaborative meeting zones for informal and ad hoc meetings and gatherings not requiring high privacy with variable furniture (from formal to informal);
- walk-in rooms for individual work for phone and video discussions requiring confidentiality and for side-by-side work (but not for silent individual work);
- break-out spaces for recreation and informal gatherings;
- reservable meeting rooms for internal meetings (various amounts and sizes);
- reservable meeting rooms for external meetings (various amounts and sizes);
- reservable project rooms for internal, periodical task-force working.

In each floor of the office there was available all of the above working zones except the reservable meeting rooms for external meetings and project rooms for internal task-force working were available only in one floor.

The data for the study was collected with an extensive post-occupancy survey. The activeness of use of different zones, experiences about appropriateness of the zoning and codes of conduct, aspects of quality of work community issues and comprehensive employee experiences concerning work environment, ways of working in individual and group level, personal work well-being and self-assessed productivity were operationalized in the survey. The survey items for operationalizing use of different zones, experiences about appropriateness of zoning and codes of conduct, sense of community and sense of access to colleagues were developed for the purposes of this study. The survey items operationalizing employee experiences concerning physical and virtual work environment, ways of working in individual and group level, work

well-being and self-assessed productivity were obtained from the Smart Ways of Working - framework (Palvalin, 2017; Palvalin 2019).

The post-occupancy survey was sent to all employees of the organization after working over one year in the new office site. Altogether 227 responses were collected to the survey.

4 RESULTS

In the next sections, first the descriptive statistical results of actual usage of the different zones of the activity-based office are presented. After that, assessment of the codes of conduct and expected behavior in the activity-based office are discussed. Next, experiences and practices related to the sense and maintenance of work community are explored. Finally, employee experiences related to the different facets of work environment and work practices are compared between active switchers of working zones to the experiences of non-switchers. Switching is regarded as active, if the respondent switched their work station at least once a day.

In general, the switching of the working zone during the working day was not common practice to all respondents. Only half of the respondents switched their work station during the working day at least once or more often. Nearly half of the respondents never switched their work station during the day. The average time spent per day on searching and reaching new work station was only 1-5 minutes, which reflects the big amount of employees who do not switch their work station during the at all (see Table 1.).

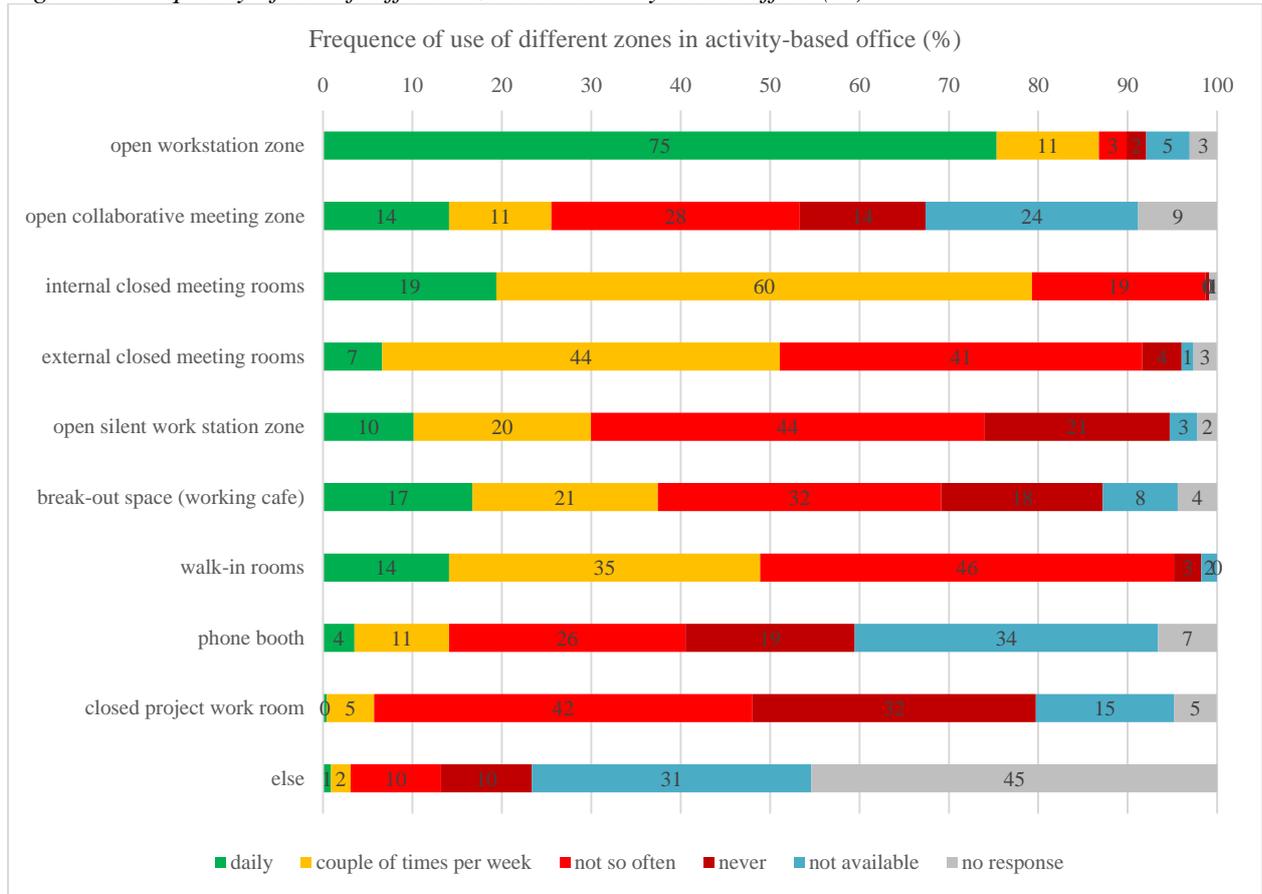
Table 1. Number and frequency of work station switches

How many times during the work day you switch your work station?		
number of switches	amount of respondents	% of respondents
0	112	49,3
1	58	25,6
2	34	15,0
3	10	4,4
4	9	4,0
5	2	0,9
6	1	0,4
8	1	0,4
Average time spent on searching work stations during the working day: 1-5 minutes		

4.1 Actual use frequency of different zones in activity-based office

Activity-based office under study provided wide variety of different kinds of working zones both for individual work and for collaboration. The most popular and most frequently used work zone was open workstation zone, where it was possible also to speak and take calls. What was distinctive was that the open silent workstation zone was not very popular and there was a big share of respondents (21%) who never used the silent zone. What was interesting to observe was that not all of the respondents recognised that their office included certain working zones or spaces. This indicates difficulties some of the respondents experienced when interpreting the function or characteristics for certain spaces in their ABO (see Figure 1.).

Figure 1. Frequency of use of different zones in activity-based office (%)

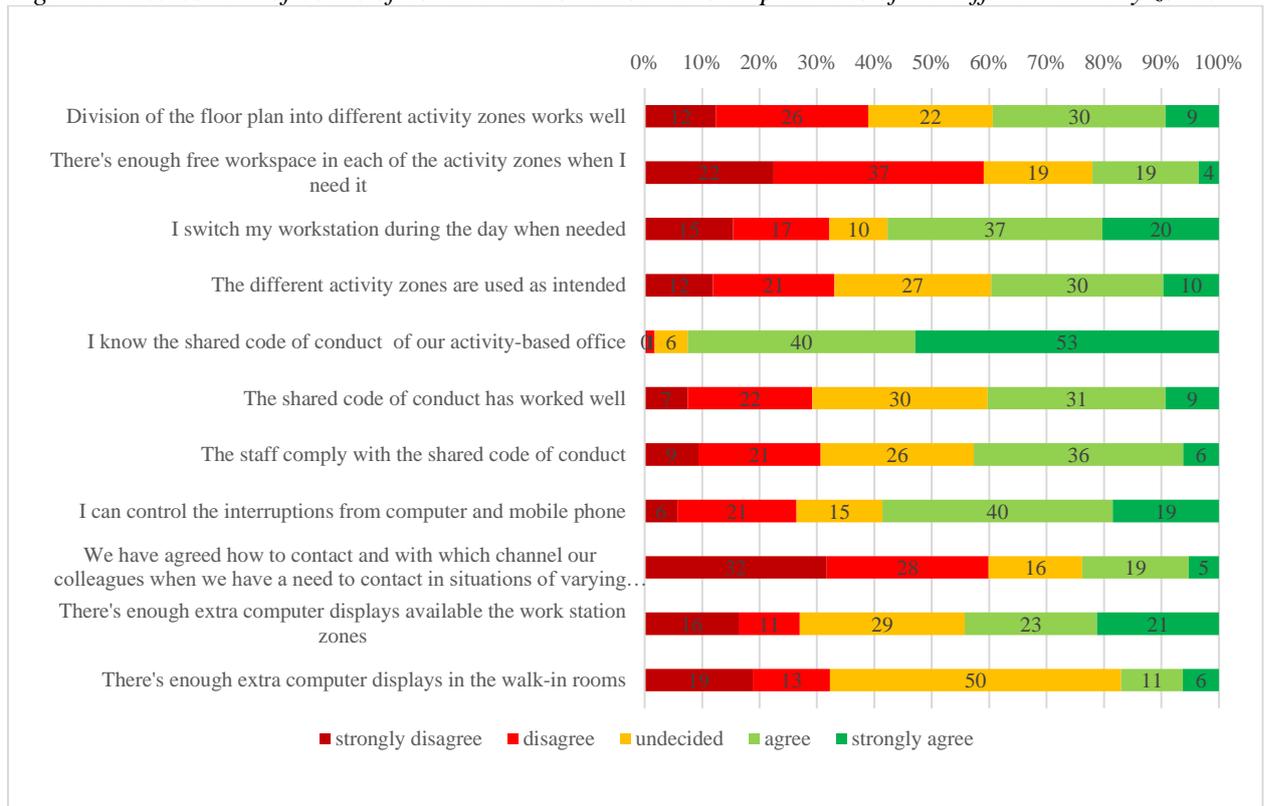


4.2 Codes of conduct and other behavioral practices of the different activity zones

Working zone-specific codes of conduct, speech rules and other explicit behavioral agreements make activity-based work environment “work”. Only physical layout or certain interior design solutions do not make activity-based office serve different modes of knowledge work and meet associated criteria for efficient and appropriate working space. Also the behavior of users of the shared spaces needs to be designed and modeled. Without agreed behavioral norms activity-based office do not meet the expectations to provide better work environment compared to the conventional open-plan office. If the behavioral norm of not occupying a certain work station continuously for whatever work activity regardless of the speech rule of the associated working zone is obeyed, this kind of usage “spoils” the work environmental quality of the associated working zone. For example, if walk-in rooms, which are designed and dedicated for temporary work requiring privacy and acoustic proofing are instead used for silent individual work from day to day, the space is not in an appropriate use and this usage convention may generate scarcity of these spaces for their appropriate use.

In this study various aspects of the functioning and status of behavioral norms were addressed (see Figure 2). It was found out, that less than half of the respondents had an experience, that the codes of conduct and behavioral norms were adhered. There was also considerable share of the respondents (over 30%), who do not switch their workstation during the working day at all. This kind of behavioral conventions may explain partly the experience of many respondents, that there’s not enough free workspace in each of the activity space when one needs it.

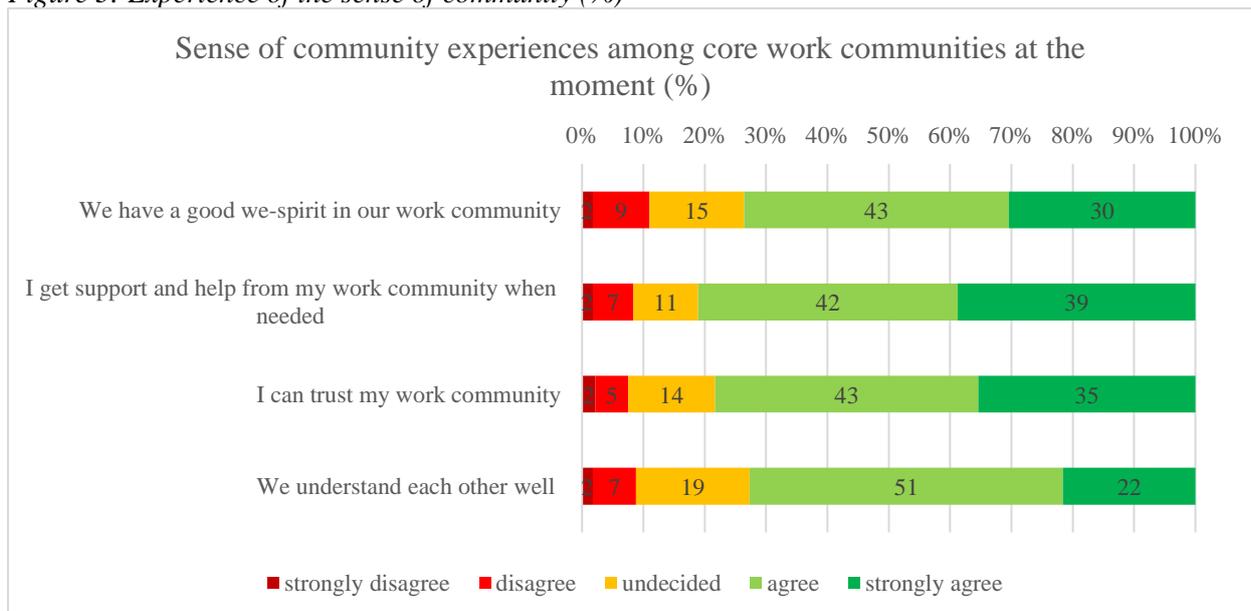
Figure 2: Assessment of codes of conduct and other behavioral practices of the different activity zones



4.3 Sense of community

A common worry and concern related to the activity-based office without assigned seats is the expected loss of the sense of community, we-spirit and trust. In this study it was found out, that the sense of community is in high level, and only small share of respondent express concerns related to it (see Figure 3.).

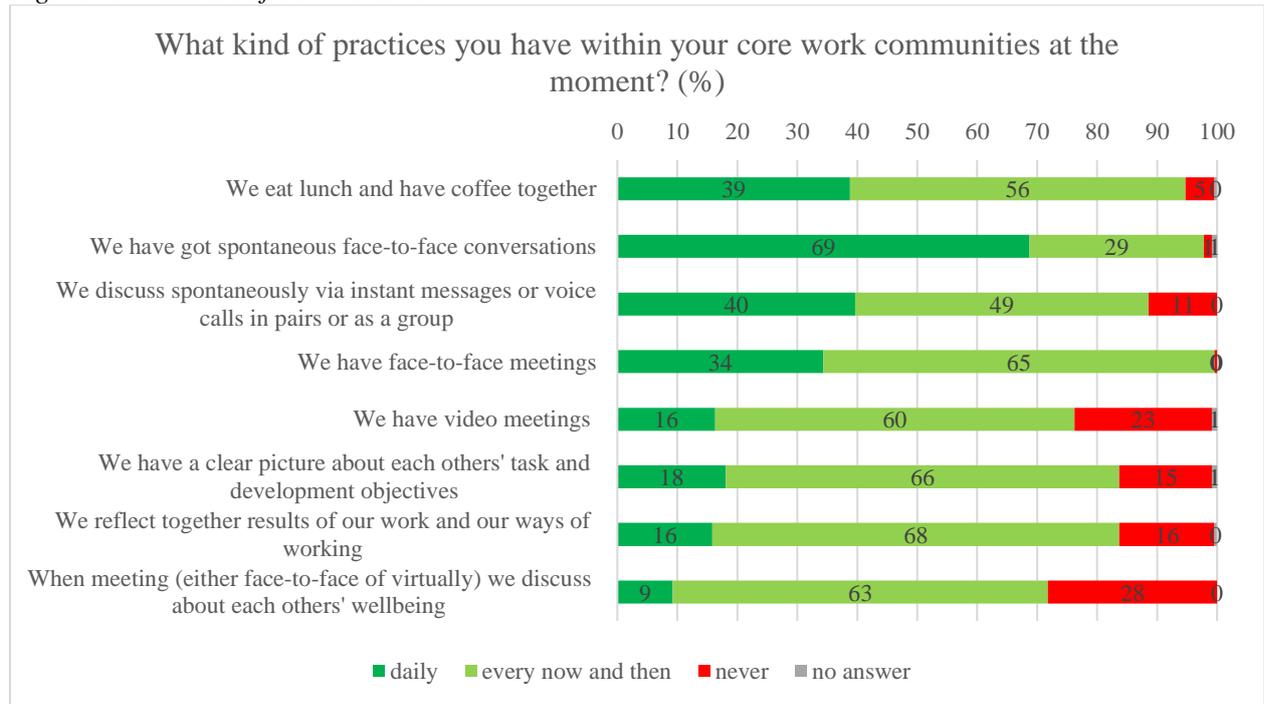
Figure 3: Experience of the sense of community (%)



4.4 Practices to maintain sense of community in the activity-based office

While the sense of community, and the maintenance and building work of communities are of great concern in activity-base office settings, certain practices may indicate if the concern is real. In this study frequency of variety of practices related to the daily maintenance of community were observed (see Figure 4). It was found out that variety of practices and habits related to maintenance of community were actively applied.

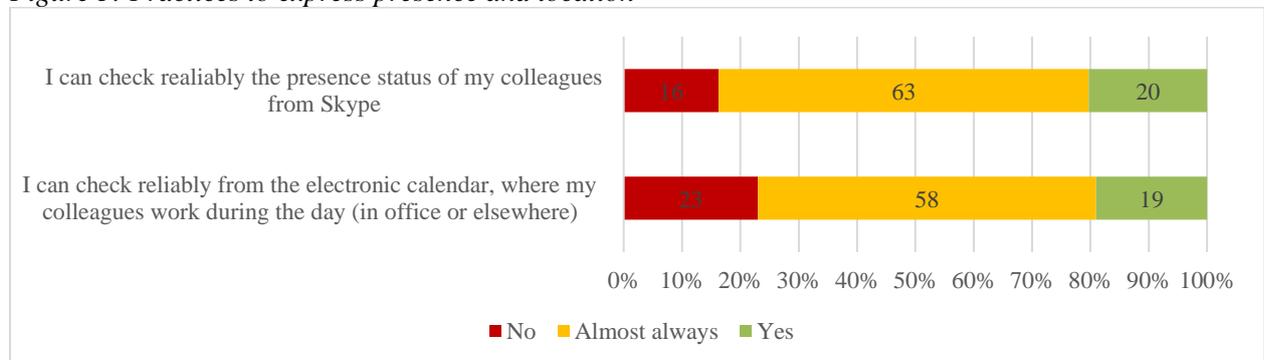
Figure 4: Practices of communities



4.5 Practices to express presence and location

In activity-based office without assigned seats you cannot anymore expect to find certain colleague regularly from the certain part of the office space. In this study new practices to support observing the presence and awareness of the working location of colleagues were studied. It was found out that a share of respondents still had difficulties to be able follow their colleagues presen and location with the help of electronic means (see Figure 5.)

Figure 5: Practices to express presence and location



4.6 Employee experiences and switching behavior

The core promise of activity-based working is, that if you actively manage your work environment by choosing a working zone which support the needs of your current work activity, your work environment experience should be satisfying. If your work activity mode changes during the day, e.g. from an spoken interaction with other colleagues to an activity which require absolute silence, you should switch your workstation into appropriate working zone. Are those employees switching more frequently their working station and working zone different or does switching has an impact on employee experiences? In this study various facets of employee experience were analysed and potential differences between switchers and non-switchers were studied.

4.6.1 Physical work environment

The experiences of affordances of physical work environment did not differ between switchers and non-switchers. However, the switchers were statistically significantly more critical concerning the ergonomic arrangements of the works stations at the workplace (see Table 2).

Table 2. Experiences of physical work environment.

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD
There is a space available for tasks that require concentration and peace at our workplace when needed.	3,30	1,35	3,04	1,42
There are enough rooms at my workplace for formal and informal meetings.	2,60	1,23	2,64	1,32
The facilities at my workplace enable spontaneous interaction between workers.	3,63	1,21	3,44	1,26
The ergonomic arrangements of the work stations at my workplace are in order.	3,50 **	1,31	3,02 **	1,37
There are generally no disruptive factors in my work environment (like sounds or movements).	2,29	1,30	2,25	1,26
There is a place in which I can discuss or talk on the phone about matters which I do not want others to hear.	3,21	1,37	3,21	1,37
The facilities at my workplace are conducive to efficient working.	2,88	1,18	2,77	1,27
Scale: 1 = strongly disagree, 5 = strongly agree				
Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				

4.6.2 Virtual work environment

Experiences of the affordances of the virtual work environment differed between switchers and non-switchers in several aspects. Switchers were statistically significantly more critical concerning the experiences of usability of the software and access to information regardless. They were also less satisfied with the mobile devices provided by the employer (see Table 3).

Table 3. Experiences of virtual work environment.

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD

The usability of the main software for doing my work tasks is good	3,43 *	1,25	3,07 *	1,20
I can access the information I need wherever I am	3,75 *	1,06	3,377 *	1,10
Workers can see other workers' electronic calendar	4,02	0,96	3,93	1,05
Workers can communicate with instant messaging tools (e.g. Skype)	4,62	0,65	4,62	0,67
My workplace has sufficient equipment for virtual negotiations	3,54	1,21	3,39	1,23
My workplace has electronic teamwork tools (like MS Sharepoint)	4,41	0,84	4,38	0,78
There are appropriate mobile devices available at my workplace (e.g. laptop, smartphone)	4,41 *	0,85	4,14 *	0,98
Scale: 1 = strongly disagree, 5 = strongly agree				
Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				

4.6.3 Social work environment

Switching behavior was not influencing the experiences concerning the functioning of the social work environment but concerning the meeting practices switchers were more critical (see Table 4).

Table 4. Experiences of social work environment.

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD
I am able to work in the ways and at the times which suit me best	3,46	1,24	3,41	1,23
Telework is a generally accepted practice at my workplace	4,37	0,86	4,49	0,79
Operations at my workplace are open (e.g. decision-making and information flow)	3,38	1,11	3,20	1,12
Information flows well among the people important for my work	3,45	1,07	3,33	1,12
The meeting practices at my workplace are efficient	3,24 *	1,04	2,94 *	1,11
Our workplace has clear guidelines regarding the use of IT and communication tools	3,21	1,06	3,14	1,15
I have clear goals set for my work	3,59	1,10	3,42	1,15
My work is assessed in terms of results achieved, not only hours worked	3,66	1,14	3,72	1,04
My work tasks constitute a reasonable whole	3,83	1,08	3,74	1,05
New ways of working are actively explored and experimented at my workplace	3,11	1,15	2,91	1,13
Scale: 1 = strongly disagree, 5 = strongly agree				
Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				

Switchers and non-switchers did not differ in their experiences concerning the sense of community (see Table 5).

Table 5. Sense of community at work

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD
We have a good we-spirit in our work community	3,98	0,93	3,84	1,05
I get support and help from my work community when needed	4,12	0,92	4,08	0,99
I can trust my work community	4,02	1,00	4,03	0,99
We understand each other well	3,87	0,85	3,81	0,95
Scale: 1 = strongly disagree, 5 = strongly agree				
Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				

4.6.4 Individual work practices

The biggest differences between switchers and non-switchers were related to the individual work practices. In several aspects concerning the individual work practices switchers were more advanced compared to the non-switchers. They were more active utilizers of technologies in their mobile work. In addition, they used more actively the possibility to choose quiet place to do the work requiring concentration and they closed down disruptive software. They were also more systematic advance planners of their daily working (see Table 6).

Table 6. Individual work practices

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD
I use technology (e.g. videoconferencing or instant messaging) to reduce the need for unnecessary travelling	3,83 **	0,96	4,17 **	0,91
I utilize mobile technology in work situations where I have to wait about (e.g. working on the laptop or phone in the train)	3,65 **	1,36	4,19 **	1,09
I try to manage my workload by prioritizing important tasks	4,21	0,80	4,38	0,72
I do things that demand concentration in a quiet place (e.g. in the quiet room or at home)	3,78 **	1,17	4,19 **	0,94
I prepare in advance for meetings and negotiations	4,05	0,80	4,04	0,85
I take care of my well-being during the working day (e.g. by changing my work position or the place I work in)	3,53	1,14	3,74	1,05
I follow the communication channels at my workplace	3,79	1,00	3,82	0,97
If necessary I close down disruptive software in order to concentrate on important work task	3,25 *	1,28	3,61 *	1,23
I regularly plan my working day in advance	3,10 *	1,15	3,58 *	1,08
I actively seek out and test better tools and ways of working	3,28	1,03	3,54	1,09
Scale: 1 = strongly disagree, 5 = strongly agree				
Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				

4.6.5 Well-being at work

Experiences of wellbeing at work did not differ between switchers and non-switchers. In overall, the longer-term stress and difficulties to resolve conflicts at work were biggest obstacles in the work-wellbeing (see Table 7.).

Table 7. Work well-being

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD
I enjoy my work	3,98	0,93	3,97	0,90
I am enthusiastic about my job	3,79	1,00	4,03	0,89
I find my work meaningful and it has a clear purpose	4,07	0,97	4,10	0,90
My work does not cause continuous stress	3,26	1,19	3,07	1,26
My work performance is appreciated at my workplace	3,55	1,07	3,55	1,03
My work and leisure time are in balance	3,69	1,09	3,58	1,16
The atmosphere at my workplace is pleasant	3,94	0,90	3,78	1,02
Conflict situations at my workplace can be resolved quickly	3,17	1,07	3,12	1,13
Scale: 1 = strongly disagree, 5 = strongly agree				
Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				

4.6.6 Self-assessed productivity

Whether one switches or not ones working zone during the work day was not related the different aspects of self-assessed productivity. In overall, respondents in both groups had most difficulties with the continuous stress caused by their work and in the resolving conflict situations in workplace (see Table 8).

Table 8. Self-assessed productivity

Variable	No switching (n=112)		At least one switch per working day (n=115)	
	Mean	SD	Mean	SD
I achieve satisfactory results in relation to my goals	3,99	0,92	3,98	0,79
I can take care of my work tasks fluently	3,88	0,95	3,93	0,95
I can use my working time for matters which are right for the goals	3,57	1,07	3,38	1,06
I have sufficient skills to accomplish my tasks efficiently	4,21	0,76	4,25	0,71
I can fulfill clients' expectations	4,03	0,80	4,01	0,77
The results of my work are of high quality	4,10	0,67	4,04	0,71
The group(s) of which I am a member work efficiently as an entity	3,68	1,00	3,50	1,00
Scale: 1 = strongly disagree, 5 = strongly agree				

Statistical significance of the difference of the means: *** p<0.001, ** p<0.01, * p<0.05				
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5 CONCLUSIONS

The results of this study show, that in the governmental research site not all of the working zones of the activity-based office were used actively. The success of agreed behavioral norms regarding the use of different working zones was not perfect. The basic principle of utilizing different working zones for different work activities was not fully applied. A big share of employees did not switch their work station during the work day at all. Those who switch their work station at least once in a working day were more proactive planners of their work and they managed more actively their work environment. However, overall sense of self-rated productivity and work well-being did not differ between switchers and non-switchers. The results of the study also showed that overall sense of community is high among work communities, and the activity-based working does not seem to harm work community. In addition, various informal practices (both face-to-face and virtual) to maintain sense on community were applied actively.

6 DISCUSSION AND IMPLICATIONS

According to the results of this study, the core pain points in the application of activity-based working are the switching and appropriation of behavioral norms for the use of the shared work environment.

As a new result compared to earlier studies on work setting switching in activity-based office, this study showed that there were no significant differences in work well-being and self-assessed productivity between non-switchers and those who switch at least once a day their working zone. This differs from the results of Wohlers et al. (2019), who found out that job attitudes and vitality were more positive among those employees who used the variety of work environment zones appropriately. Also Haapakangas et al. (2018) reported higher productivity and better well-being among more active switchers. However, the results are not fully comparable, because both Wohlers et al. (2019) and Haapakangas et al. (2018) used different scales measuring well-being and productivity than was used in this study. In Haapakangas et al. (2018) the share of active switchers was higher than in this study. In this study the share of active switchers (at least one switch during the day) was 51% compared to the 72% in the study of Haapakangas et al. (2018).

An ABW change is newer only a change in physical work environment. It is from the employees' viewpoint change from the personal work station-based way of working to mobile, activity-based work, where work settings are switched and selected based on the quality of the current work activity at hand. To enable this change in the way of working to happen, various means to support the employees during the change need to be secured. Extensive training of the concept of activity-based working is needed, alongside with the participatory design of behavioral norms for the work in the shared work environment. The key to successful application of activity-based working is the employees' ability and willingness to switch ones' work settings during the workday, when work activity changes. As the results of this study show, the employees who already do switching have strong habits to plan their working day in advance, maintain proactively their ability to concentrate, utilize the resources the work environment provides and utilize mobile ICT in their work. In the future, more emphasis is needed to support the formation of these habits and work skills as part of the ABW implementation process.

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REFERENCES

- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), An end-user's perspective on activity-based office concepts. *Journal of Corporate Real Estate*, Vol. 13 No. 2, pp. 122-135.
- Babapour Chafi, M., Rolfö, L. (2019), Policies in Activity-based Flexible Offices - 'I am sloppy with clean-desking. We don't really know the rules.'. *Ergonomics*, 62(1), 1-20.
- Babapour, M. (2019), *The Quest for the Room of Requirement: Why Some Activity-Based Flexible Offices Work While Others Do Not*. Department of Industrial and Materials Science, Division Design and Human Factors, Chalmers University of Technology, Gothenburg.
- Franssila, H., Kirjonen, A. (2022), Impact of activity-based work environments on knowledge work performance—quasi-experimental study in governmental workplaces. *Journal of Corporate Real Estate*. <https://doi.org/10.1108/JCRE-01-2021-0001>
- Haapakangas, A., Hallman, D.M., Mathiassen, S.E., Jahncke, H. (2018), Self-rated productivity and employee well-being in activity-based offices: the role of environmental perceptions and workspace use. *Building and Environment*, Vol. 145, pp. 115-124.
- Hoendervanger, J. G., De Been, I., Van Yperen, N. W., Mobach, M. P., Albers, C. J. (2016), Flexibility in use: Switching behaviour and satisfaction in activity-based work environments. *Journal of Corporate Real Estate*, Vol. 18 No. 1, pp. 48-62.
- Hoendervanger, J.G., Van Yperen, N.W., Mobach, M.P., Albers, C.J. (2019), Perceived fit in activity-based work environments and its impact on satisfaction and performance. *Journal of Environmental Psychology*, Vol. 65, p. 101339.
- Hoendervanger, J. G., Van Yperen, N. W., Mobach, M. P., Albers, C. J. (2022), Perceived fit and user behavior in activity-based work environments. *Environment and Behavior*, 54(1), 143-169.
- Marzban, S., Candido, C., Mackey, M., Engelen, L., Zhang, F., Tjondronegoro, D. (2022), A review of research in activity-based working over the last ten years: lessons for the post-COVID workplace. *Journal of Facilities Management*. <https://doi.org/10.1108/JFM-08-2021-0081>
- Palvalin, M. (2017), How to measure impacts of work environment changes on knowledge work productivity—validation and improvement of the SmartWoW tool, *Measuring Business Excellence*, Vol. 21 No. 2, pp. 175-188.
- Palvalin, M. (2019), *Knowledge Work Performance Measurement in the New Ways of Working Context*. Tampere University Dissertations 47, Tampere University.
- Rolfö, L., Eklund, J., Jahncke, H. (2018), Perceptions of performance and satisfaction after relocation to an activity-based office. *Ergonomics*, Vol. 61, No. 5, pp. 644-657.
- Windlinger, L., Häne, E. (2020), Switching behaviour in activity based working environments: an exploration of the reasons and influencing factors of switching behaviour in ABW. In *Transdisciplinary Workplace Research (TWR) Conference*, Frankfurt, Germany, 16-19 September 2020, pp. 116-125, TWR Network.
- Wohlens, C., Hartner-Tiefenthaler, M., Hertel, G. (2019), The relation between activity-based work environments and office workers' job attitudes and vitality. *Environment and Behavior*, 51(2), 167-198.

Activity-based or availability-based? Factors influencing employees' choice of workstation in activity-based offices

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ABSTRACT

"If it is available is an important issue in this office!" The concept of Activity Based Offices (ABOs) provides a selective choice of workstations depending on the activity type in work environments. In practice, although there are other factors besides the nature of the activities that influence employee's choice of workstation. These factors occasionally play an obstructing role and lead to the selection of a workstation that does not fit the employee's work activities. Also, there is still a gap in our current understanding of why employees prefer certain workstations. We therefore see the need to investigate this issue and aim to identify various physical and non-physical aspects that influence employees' preference in choosing a workstation in ABOs. For qualitative data collection, 21 participants are selected on a voluntary basis among knowledge workers in three ABOs. Interviews are conducted for data collection using the Critical Incident Technique (CIT), a method that examines significant situations of a particular activity from the participants' perspective. Although this study is focused on the creative activities of knowledge workers, whose work often involves solving multiple problems, the emphasis is on the factors (rather than the type of activity) that influence individuals in their choice of workstation. The results identified seven important factors categorized by employees' priorities in choosing a workstation in ABOs. These factors are personal, policy-related, psychosocial, organizational, resource availability, inspirational, and functional. These results clarify why some workstations are considered as underutilized and do not fit the activity that employees are working on, as well as why some spaces are more popular and are always occupied. Furthermore, these help to reduce the gap in understanding the reasons why employees do not use ABOs as planned and in relation to their activities. Recognizing these factors is therefore necessary for facility management practitioners, designers and planners of ABOs to understand how to adapt the work environment to the needs of employees.

Keywords

Desk sharing, Workstation selective choice, Activity-based offices, New ways of working, Office design.

1 INTRODUCTION

An Activity-Based Office (ABO) is a non-territorial office environment that provides various spaces and workstations for individual and group activities (Appel-Meulenbroek, Groenen, & Janssen, 2011; Bodin Danielsson and Bodin, 2008). Workspaces in ABOs include open spaces with unassigned workstations that are categorized such as individual and collaborative spaces, which are divided into different zones with speech policies (e.g., semi-silent, silent, active). Also, ABOs involve enclosed spaces for individual and group activities with a different level of concentration (Harris, 2015; Yekanielibeiglou et al., 2021). However, contrary to the desired purpose of introducing ABOs, employees do not always have sufficient and appropriate choices in their office to meet their preferences. In the previous literature, it is reported that employees' interaction and use of physical environment both have major impacts on employee productivity (Haynes 2007a; Olson, 2002) and creativity (Yekanielibeiglou et al., 2021). Overall, however, there are few studies that address employees' use of ABOs, their selective choice of workstation, and how they match with their preferences (e.g., Chafi et al., 2020; De Been and Beijer, 2014). The architectural features that employees perceive when choosing their workstations have also rarely been addressed in the literature (Chafi et al., 2020). Thus, better insight is needed into how employees choose their workstations and the factors that lead them to choose or avoid a workstation. This will help workplace managers, designers and planners of ABOs to understand how to adapt the work environment to the real needs of employees. In this context, the main research question of this paper is: How do employees choose their workstation for a particular activity in ABOs and what factors influence their choice?

We adopt the person-environment fit theory, within the context of interaction psychology that refers to the compatibility of people with their environment (e.g., Kristof-Brown et al 2005). This theory helps to define the fit between employees' personal traits, their work environment, and their tasks (Hoendervanger et al., 2019), which is consistent with the aim of this study. For tasks, we are mainly focused on high concentrated and low concentrated work activities both at the individual and group levels. The original data had focused on creative activities rather than routine tasks (see Yekanielibeiglou et al., 2021 for more details on this). The daily work of knowledge workers often involves multi-part tasks and projects that require solving multiple problems while using multiple sources of knowledge (Dul et al., 2011). Therefore, creative tasks are a large part of their daily activities. Gerdenitsch et al. (2018) assume that ABOs, which offer employee's various choices, has the potential to support the fit between person-environment, and thus, provide an increase in employee's satisfaction with the environment. According to this theory, a mismatch between activity, preferences, and environment characteristics should lead employees to change their workstation to achieve a better fit (Kristof-Brown & Guay, 2011). In practise, however, it seems that some constraining factors force the choice of a workstation that does not match employee's preferences. However, this still needs to be researched. Therefore, it is important to explore this issue to determine whether ABOs have the potential to support employee's preferences in selective choice of a workstation.

2 METHODS

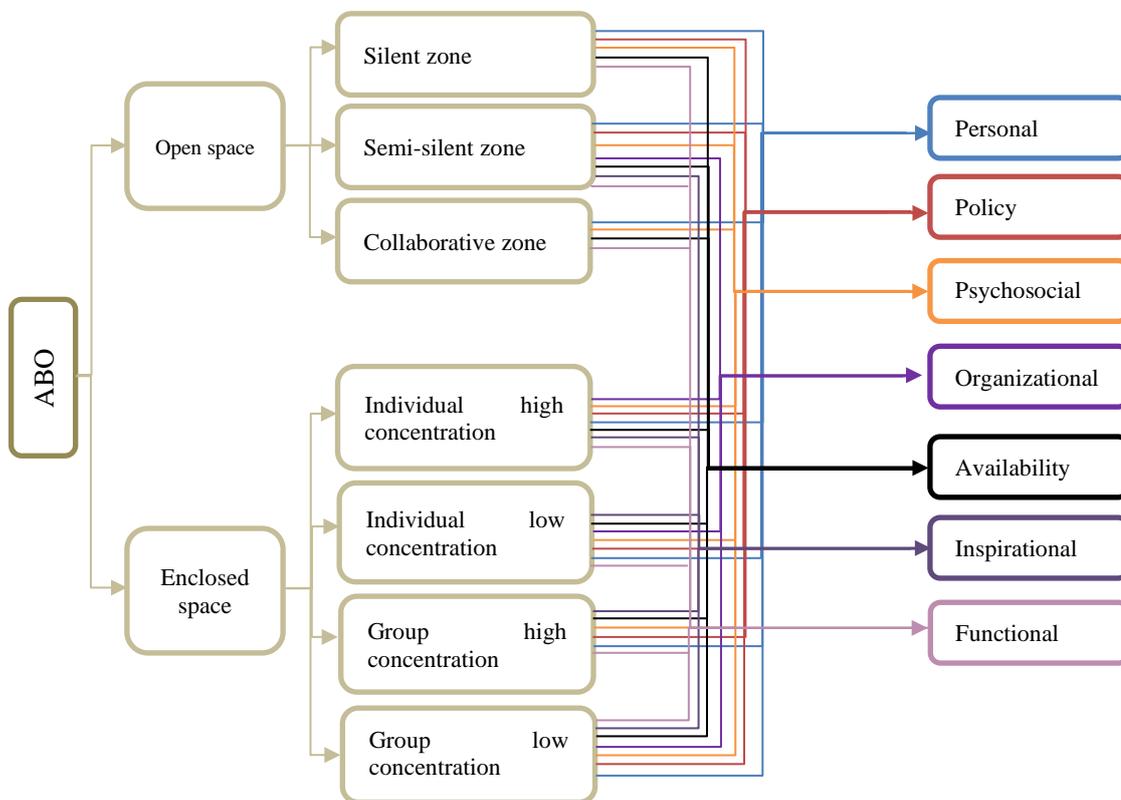
The case study approach is chosen for the study of three organizations in Sweden, in 2019. A non-probability purposive sampling method was used to select the three international companies in Gothenburg, Sweden. This study involves a qualitative data collection approach through interviews with knowledge workers using the critical incident technique (CIT) (Flanagan, 1954). "A critical incident is an observable human activity that contributes to or detracts from the general aim of the activity in a significant way" (Bitner et al., 1990; p. 73). The CIT inquires the participants to focus on actual incidents in the office instead of providing

general opinions about the office environment (Serenko, 2006). Twenty-one participants were selected for this study based on self-selection in three case studies (seven participants in each case). Participants were asked to recall one or more recent incidents in which they had been involved in (Hughes et al., 2007) and to explain which office spaces they had chosen for a particular individual and team activity and their reasons for doing so. They were also asked to state their preferred and non-preferred spaces in the office for a particular type of activity and why they prefer that space for that activity. Data collection was conducted over 3 days in Cases 1 and 2 and over 1 week in Case 3 in 2019. Participants were almost evenly split between genders-54 percent men and 46 percent women. The average age was 38 years. Interviews were recorded and transcribed verbatim. A thematic content analysis (Braun & Clarke, 2006) of the transcripts was conducted collaboratively by the authors and facilitated by a qualitative data management tool (NVIVO).

3 RESULTS

The main aim of the current study is to identify the important physical and non-physical factors that influence employees' preferences in choosing workstations in ABOs. Furthermore, it intends to find the limiting factors that negatively influence the choice of workstations and causes of choosing workstations that do not match with employees' preferences. The study revealed seven important factors: 1. personal factors (e.g., personality, feelings, habits), 2. policy-related factors, 3. psychosocial factors, 4. organizational factors (e.g., culture, leadership), 5. availability (e.g., time, space), 6. inspirational factors (e.g., colour, decoration), and 7. functional aspects (see Figure 1). Moreover, the results reflected the reasons why some workspaces are more popular and always are used for certain activities, while others are underutilized.

Figure 1. Factors influencing employees' choice of workstation in ABOs



All important factors are listed with the stated relevant reasons for choosing or avoiding that particular workspace in Tables 1 and 2. The tables are depicted respectively, for open and closed spaces in ABOs: 1. open spaces, which are the central areas for work; 2. enclosed spaces, which provide space for high- and low-concentration for individual and group activities. Open spaces are categorized as silent, semi-silent and collaborative zones (Table 1). In Case 3, the kitchen area was in an open area, while in Cases 1 and 2 it was in an enclosed area. However, even in Case 3, the kitchen was divided by partitions, so it was considered along with the other enclosed spaces in this study. Table 1 shows the main reasons involved in choosing or avoiding workstation in open spaces, in the silent, semi-silent and collaborative zones.

Table 1. Factors with the reasons of choosing or avoiding each workspace according to the zone type in open spaces

Space type	Factors	Reasons for choosing this space (+)/avoiding this space (-)
Open space: silent zone	<ul style="list-style-type: none"> • Personal* • Policy* • Psychosocial** * • Availability* • Functional* 	<ul style="list-style-type: none"> + Feel calm and relaxed + Speech policy helped to have a quiet area - Forget the quiet policy and whisper + No distribution; No phone or chatting + Sit and be alone; Hide from others + Have control over not being disturbed - Talk to people nearby; Sitting with others is disruptive - No partition between desks; No privacy - Not enough ergonomic furniture to work with - No time to plug in monitors and adjust chairs/desks + Ergonomic furniture; Two monitors - Technical issues limit workstation uses and availability
Open space: semi-silent zone	<ul style="list-style-type: none"> • Personal* • Policy*** • Psychosocial** * 	<ul style="list-style-type: none"> + Feeling spoiled here - Feeling lonely; Anxious; Burn out - Not able to say no! To people who want to talk - Switching desks is an extra challenge; Refuse to share desks - Different policies for different teams/companies; Resistance with groups that joined later than others - Leave stuff on the desk and go to the meeting; Take the same desk for days - Sharing desks are appropriate for managerial tasks; Switching does not fit to all tasks - A matter of habit to switch desks - Too quiet for people who make noise; Too loud for others + Overhearing useful information + Be able to choose which colleague to sit next to + Sit far from my team to work focused + Recognizing more people compared to before + Privacy; Hiding from others: No one sees me there; No one walks behind me because of the wall - Disclosing confidential information while on the phone/skyping; Overhearing on other teams

	<ul style="list-style-type: none"> • Organisational*** • Availability** • Inspirational** • Functional*** 	<ul style="list-style-type: none"> - Social and audible distractions; Visual distraction from people walking around + Accessibility and visibility to the team (from the leader's perspective) + Flat culture; Easier to reach managers + Greater understanding of what other teams are doing - Loose team identity and sense of belonging; Excluding from team - Hard to find colleagues/team/managers - Not overhearing one's own team - Difficult to find an available preferred place or any available workstation at all - Limited number of ergonomic desks; Technical issues limit preferences; Limited time - No spot for taking calls + Beautiful design and open environment - Anonymous/impersonal/uninviting - Too quiet or too loud, no zone in between + Double screens; Height adjustable desks + Openness helps to be reached by team - Cannot adjust chairs; Difficulty having personal ergonomic supports; Technical issues
<p>Open space: collaborative zone</p>	<ul style="list-style-type: none"> • Person-related* • Psychosocial** • Availability* • Functional** 	<ul style="list-style-type: none"> + Insensitive to distraction and sound - Distraction by people nearby; No visual or auditory privacy - Next to the corridor and cross traffic - Continuously unoccupied; Not used - Not ergonomic - A waste of space, would be better to have workstations instead

*:1-4 references

** :5-9 references

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Some examples of preferred and unpreferred workstations in the open space are shown in Figure 2, along with the related comments of employees. In all areas of open space, some degree of visual and acoustical privacy appears to be important to employees when choosing where to work. It is especially important to control privacy and distractions in the silent zone, as this is where employees can best concentrate on the work.

Figure 2. Open space examples with or without partitions in silent and collaborative zones



a) Open silent zone; Case 3
With enclosed partitions



b) Open silent zone; Case 1
Without enclosed partitions



c) Open collaborative zone; Case 3
No privacy and close proximity to the corridor

Comments:

- a) *“When things are boiling in my head and I need to prioritize and calm down, I go to the silent zone to be alone and be able to think undisturbed” (Case 3).*
- b) *“You cannot have a quiet area with people around you and no partitions. If you sit there all day, you will find yourself talking to others or be distracted by their movements” (Case 1).*
- c) *“There was no available space, we had to sit in the active zone, but it was not good, because people walked by and disturbed us with their greetings! We need privacy and walls!” (Case 3).*

The important factors and the reasons stated by employees for choosing or avoiding a workspace in enclosed spaces (high and low concentration) are shown in Table 2.

Table 2. Factors with the reasons of choosing or avoiding each workspace according to the concentration level in individual and group activities in enclosed spaces

Space type	Factors	Reasons for choosing this space (+)/avoiding this space (-)
Individual high concentration	Personal*	+ Feel more relaxed - Get in the habit of taking a room and staying there all day - Feel isolated and lonely; Feel more old school
	Policy**	- Use it like your own office - all day - Not bookable, so no control over usage and availability - Same people sitting in the same room
	Psychosocial***	+ Control over social interactions; no interference from + No footsteps, sounds, and people passing by + High privacy for sensitive conversations - Others may need it more
	Organisational*	+ Managers may need it more
	Availability**	- Few numbers - Not available; No guarantee of finding a room; Prefer to stay home to concentrate (due to unavailability)

	<p>Inspirational**</p> <p>Functional***</p>	<ul style="list-style-type: none"> + Quietness and no noise; Window/view - No window to the corridor + Proximity to lockers and coffee machine + Enclosed/walls and doors + Double screen; Whiteboard - No whiteboard - Too cramped as in a closet
<p>Individual low concentration (Wellbeing space)</p>	<p>Personal**</p> <p>Policy*</p> <p>Psychosocial**</p> <p>Organisational* Availability**</p> <p>Inspirational**</p> <p>Functional*</p>	<ul style="list-style-type: none"> + Introverted and with a need for isolation and relaxation - Fear of being judged for taking that place - Not “feel OK” to relax at work + Flexibility provides opportunity to take time to relax - Privacy; a sign on the door to tell others not to disturb - The signal in the office is “you cannot relax” - No time for it - Access to the balcony (not available) - Need for coffee (not available) + View to the outside; Window - Not cosy; Grey and cold colours - Distance not easily walkable
<p>Group high concentration</p>	<p>Personal**</p> <p>Policy**</p> <p>Psychosocial**</p> <p>Availability***</p> <p>Inspirational***</p> <p>Functional****</p>	<ul style="list-style-type: none"> + More relaxed feeling due to informal spaces - No feeling of safety due to poor sound insulation - Tendency to go to the same room Using meeting room as single space; Not training how to use the spaces + Both bookable and non-bookable rooms are needed + OK to sit closer to known colleagues in small rooms + Private; Isolated and no people around - Visual and acoustic distractions from transparent walls + Not bookable, quick meeting rooms offer availability + Rooms for spontaneous/shorter meetings encourage creativity - Fully booked - Not enough rooms + Inviting and informal + View and windows; Light + Feel more alert with standing chairs; Good for quick meetings - Some rooms seem old-fashioned - No ventilation and hot air + Screens; Whiteboard; Speaker; Microphone - Not adjustable; Not comfortable furniture for longer sessions - Room size, round table and non-flexible chairs do not support hybrid meetings - Exposes screen contents; Poor soundproofing - Furniture wheels are broken; Not comfortable to sit on
	<p>Personal*</p>	<ul style="list-style-type: none"> - Feel lonely and isolated

Group low concentration (Break out zone)	Psychosocial****	<ul style="list-style-type: none"> - Meeting new people every day causes stress + Privacy; Private corners and semi-private sofas + Easier to meet new people - Not much social activities, bonding and informal interaction - Hard to find colleagues naturally and spontaneously gathering - Open kitchen interrupts people around
	Organisational Availability*	<ul style="list-style-type: none"> + More organized social bonding activities - No time for socializing - The pace is too fast
	Inspirational****	<ul style="list-style-type: none"> + Relaxing, informal atmosphere helps to unwind + Openness; Windows and view - The design is cold and sterile
	Functional**	<ul style="list-style-type: none"> + Big kitchen that naturally gathers people around it + Coffee machine

*:1-4 references

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In the case of enclosed spaces for highly concentrated tasks, the main problem seems to be the availability of these spaces, since the number of these spaces is limited and some employees tend to use them throughout the day. The lack of equipment also limits employees' choices.

"When you are here, you do not have preferences, you just say, *oh this room is available, let us go here! We feel like I am lucky to get the fruit*" (Case 1). Control over social interactions is also referred as one of the important reasons for choosing individual, highly concentrated spaces. This not only helps employees focus on their tasks, but also helps them relax. Figure 3 shows examples of these spaces in Cases 1 and 3.

Figure 3. Enclosed spaces: individual high concentration spaces



a) Individual high concentration space; Case 3
Blocked eye level visibility for privacy (preferred)



b) Individual high concentration space; Case 1
No screen in the room, not available (neutral)

- a) *“We always see the same people sitting in the same room. People come early in the morning and take up the space for the whole day”* (Case 2).
- b) *“If I have a virtual meeting, I hope I find an available private room, because they are not bookable. I never go to a private room without a screen”* (Case 1).

In the meeting rooms, employees particularly mentioned that the glass walls led to visibility of screen information, low visual privacy and high distraction (see Figure 4 for Case 1-3). Meeting spaces should also provide supportive furniture, technology and an appropriate size for hybrid meetings, which are so important for flexibility and the future of work. For spaces used for low concentration tasks, psychosocial characteristics (privacy, social bonding, etc.) were also mentioned as the most important features (see Figure 5).

Figure 4. Enclosed space

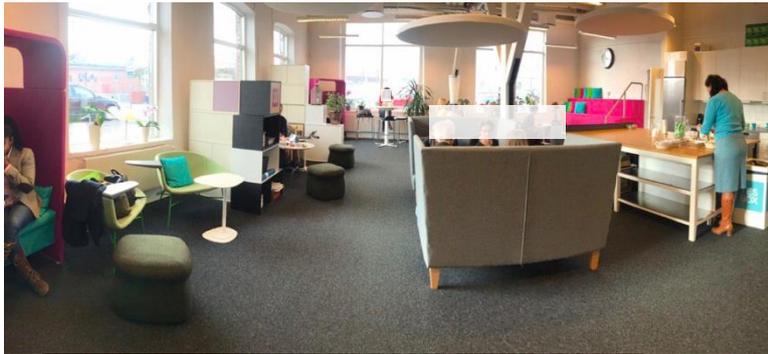


- a) Bookable, meeting room; Case 1
Glass walls cause distraction, (unpreferred)
- b) Non-bookable, meeting room; Case 3, (preferred)
- c) Bookable, meeting room; Case 2, (unpreferred)

Comments:

- a) *“You are like a ‘fish in the bowl’ people standing outside. Like aquarium with two glass walls”* (Case 1).
- a) *“The furniture is not adjustable and the round table is not good for virtual meetings. How am I supposed to look at the screen when I sit behind it and the chair is not flexible?”* (Case 1).
- b) *“This gives us the opportunity to have time for ad hoc meetings. You can always find a room for a spontaneous and short meeting. More efficient. Write on whiteboards”* (Case 3).
- c) *“We do not like this room. The room does not help us share our thoughts. It's more like you are the audience and your boss is up front running the meeting - that's not the culture of this company”* (Case 2).

Figure 5. Enclosed spaces: group low concentration spaces



a) Kitchen; Case 2 (preferred)



b) Enclosed sofa; Case 3 (preferred)

Comments:

- a) *"We usually meet by coffee machine, a little bit with ourselves in enclosed sofa when we do not want to disturb others"* (Case 3).
- b) *"Enclosed sofa, we want to feel a bit private"* (Case 2).

Overall, the availability of preferred workspaces that provide the required technology is considered the most important need of employees. ABOs are usually designed for 70% of the workforce (Bodin Danielsson and Bodin, 2008). In Case 1, the company's workforce grew after some time and the office, which was only designed for 70% of the original workforce, could no longer meet even the basic needs of the employees after the growth. For example, one of the employees said that if he did not arrive at the office on time in the morning, he might not have access to the available ergonomic workstations: *"It's not OK, if you do not have an available desk. When I work here, I expect a desk and not some space in the kitchen, then I would rather stay at home. I must have ergonomic furniture available"* (Case 1). Employees also did not follow the policy of not occupying a workstation for the whole day because they were afraid of not finding a free workstation: *"I do not follow the policy and change workstations because there is no available space"* (Case 1). The lack of equipment and non-functioning screens and technology-related devices at all workstations, as well as information technology (IT), also pose a major problem for employees when they want to move and choose: *"The challenges of IT limit the choice of seating in the open area. We cannot move around because of the technical problems"* (Case 2). While participants in both Case 1 and Case 2 reported that their workspace did not meet their needs because of these problems, the results in Case 3 were different. An adequate number of fully equipped workstations and workspaces provide employees with the opportunity to highly match their needs and their workplace. This is also demonstrated in the same concept of flexible working in ABO, how availability and supportive factors can enhance the experience of employees in choosing a suitable workplace for their needs.

4 DISCUSSION AND CONCLUSION

The main objective of this study was to find out why employees in ABOs prefer certain workstations in three organizations with ABO design. The following were identified as important factors influencing the employees in choosing or avoiding a workstation: personal traits, policy-related, psychosocial, organizational, availability, inspirational, and functional aspects. However, the availability of fitting spaces (preferred spaces with the most supportive factors) was found to be critical in the interaction between employees and their office in the selection process.

ABOs are designed to allow individuals to choose their office workspace according to their different needs and abilities (Appel-Meulenbroek, et al., 2020; Kristof-Brown, Zimmerman & Johnson, 2005). However, in the current study, the availability of fitting workstations was found to play a crucial role in the choice of a particular workstation in ABOs (mostly spaces for formal activities). If ABO does not provide available matching workstations in spaces with supporting factors for activities, the concept of 'activity-based' and the possibility of 'choice' become questionable. This unavailability could be due to a high ratio of employees to workstations (as in Case 1), the tendency to take ownership of the workstation (Chafi et al., 2020), a limited number of equipment, technical problems in most workstations, a low number of preferred workstations with the desired level of privacy, etc., which consequently lead to no switching between workstations. Hoendervanger et al. (2016) also found that most people do not switch between spaces and many even occupy the same spot for days and come earlier to guarantee its availability.

Person-environment fit theory assumes that a mismatch between activity, preference and environment leads to switching, as proposed by Kristof-Brown and Guay (2011). In this study, however, it was found that the limited availability of matching workspace can lead to limit the fit between employees' needs and the environment of ABO. In some cases, employees refrained from talking about their preferences and were forced to choose from the only available spaces due to the limited choice of workstations. Considering that this study was conducted before the pandemic COVID -19, the results of this study may be compromised, and further studies will be needed given the major changes expected after the global pandemic. However, the results of the current study are important because the desire for more flexibility, digitalization and a rethinking of the way employees work after COVID - 19 could be a strong catalyst for the adoption of ABO-style office arrangements. Moreover, now that there is a tendency in many companies to cut down on redundant office space and focus on providing a better experience in the small spaces due to the hybrid working style, it is important to reiterate the importance of having a sufficient number of fully equipped and variable spaces in the office for which it is worthwhile for employees to commute to work. Therefore, it is important to know what factors influence the choice of workspace that lead to a better match between their needs and the available space in flexible offices.

Finally, although ABOs are designed to support flexible and hybrid way of working, our study found that there are some unsupportive and non-preferred physical factors in meeting spaces that do not support hybrid meetings, such as round tables, non-flexible furniture and small spaces that are not suitable for the camera due to proximity. Future studies could focus on this and find out what factors are important to adapt meeting rooms to the needs of employees to improve their experience with hybrid meetings.

REFERENCES

- Appel-Meulenbroek, H. A. J. A., Aussems, R. I. M., Le Blanc, P. M., Arentze, T. A. (2020), The association between office use and the burnout-engagement continuum in activity-based offices, in *2nd Transdisciplinary Workplace Research conference* (pp. 54-63). TWR network.
- Appel-Meulenbroek, R., Groenen, P., Janssen, I. (2011), An end-user's perspective on activity-based office concepts. *Journal of Corporate Real Estate*, 13(2), 122–135.
- Bitner, M. J., Booms, B. H., Tetreault, M. S. (1990), The service encounter: Diagnosing favorable and unfavorable incidents, *Journal of Marketing*, 54(1), 71–84.
- Braun, V., Clarke, V. (2006), Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

- Chafi, M. B., Harder, M., Danielsson, C. B. (2020), Workspace preferences and non-preferences in Activity-based Flexible Offices: Two case studies. *Applied ergonomics*, 83, 102971.
- Danielsson, C. B., Bodin, L. (2008), Office type in relation to health, well-being, and job satisfaction among employees. *Environment and behavior*, 40(5), 636-668.
- De Been, I., Beijer, M. (2014), The influence of office type on satisfaction and perceived productivity support. *Journal of Facilities Management*.
- Dul, J., Ceylan, C., Jaspers, F. (2011), Knowledge workers' creativity and the role of the physical work environment. *Human Resource Management*, 50(6), 715-734
- Edwards, J., Caplan, R., Van Harrison, R. (1998), "Person-environment fit theory: conceptual foundations, empirical evidence and directions for future research", *Theories of Organizational Stress*, Oxford University Press, Oxford, pp. 28-67.
- Flanagan, J. C. (1954), The critical incident technique. *Psychological Bulletin*, 51, 327-358.
- Gerdenitsch, C., Korunka, C., Hertel, G. (2018), "Need-supply fit in an activity-based flexible office: a longitudinal study during relocation." *Environment and Behavior*, 50, 3, 273-297.
- Harris, R. (2015), "The changing nature of the workplace and the future of office space", *Journal of Property Investment & Finance*, 33(5), 424-435.
- Haynes, B. P. (2007), "Office productivity: a theoretical framework", *Journal of Corporate Real Estate*, 9(2), 97-110.
- Hoendervanger, J. G., De Been, I., Van Yperen, N. W., Mobach, M. P., Albers, C. J. (2016), "Flexibility in use Switching behaviour and satisfaction in activity-based work environments", *Journal of Corporate Real Estate*, 18(1), 48-62.
- Hoendervanger, J. G., Van Yperen, N. W., Mobach, M. P., Albers, C. J. (2019), "Perceived fit in activity-based work environments and its impact on satisfaction and performance", *Journal of Environmental Psychology*, 65.
- Hughes, H., Williamson, K., Lloyd, A. (2007), Critical incident technique. *Exploring Methods in Information Literacy Research*, 28, 49-66.
- Kristof-Brown, A., Guay, R. P. (2011), Person-environment fit. In *APA handbook of industrial and organizational psychology, Vol 3: Maintaining, expanding, and contracting the organization*. (pp. 3-50). American Psychological Association.
- Kristof-Brown, A. L., Zimmerman, R. D., Johnson, E. C. (2005), "Consequences of individuals' fit at work: a meta-analysis of person-job, person-organization, person-group, and person-supervisor fit." *Personnel Psychology*, 58, 2, 281-342.
- Olson, J. (2002), "Research about office workplace activities important to US business - and how to support them", *Journal of Facilities Management*, 1(1), 31-47.
- Serenko, A. (2006), The use of interface agents for email notification in critical incidents, *International journal of human-computer studies*, 64(11), 1084-1098.
- Yekanielibeiglou, S., Demirkan, H., Denti, L. (2021), Enhancing creativity in activity-based offices: A critical incident study of knowledge workers, *Creativity and Innovation Management*, 30(4), 763-782.

The role of cohesion and connection within the ABW framework: A critical elaboration

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ABSTRACT

We question the manageability of the three dimensions (spatial, digital, social) of Activity-Based Working (ABW). This framework lacks a solution to deal with the necessity to facilitate social needs of knowledge workers. The urgency of this problem is structurally labelled in literature, but never successfully addressed. Research concerning working at home during COVID-19 has revealed the importance of cohesion and connection within organizations. Bonding with colleagues and the organization is often recognized as a point of attention, but is hardly incorporated in the framework. We explore how the framework deals with bonding, by applying the social needs theory. The framework lacks focus on informal social relations that bind people with their peers and organization. We expect that, in the future, knowledge work will partly move to spaces outside the office. This endangers conservation of social interaction, teambuilding, involvement, identification, and the creation and sharing of knowledge. This makes the need to assess the framework even more pressing. We analysed 30 documents on ABW offices of a large Dutch public organization, interviewed two policy makers and two independent experts. The results were compared with literature. We used the ABW framework of Van Meel (2020) to identify challenges regarding the adoption of ABW and the role of social needs within the work environment. While social interaction, teambuilding, involvement and identification with colleagues and organization are regarded as important within ABW, they are difficult to implement in practice. Our case-study shows that these factors are insufficiently covered, and thus realized, in practice. More research is needed. We theorize about better ABW environments, where knowledge sharing and interaction is secured. While continually addressed in literature, these aspects were never incorporated in the current framework. Working more remotely – or hybrid – in the future makes the subject more important than ever.

Keywords

Activity-Based Working, Bonding, Hybrid working, Belonging, Social needs.

1 INTRODUCTION

In our contemporary knowledge economy, the role of the knowledge worker is significant. They are characterized by expertise, high level of education and experience. They are mainly concerned with the creation, distribution and application of knowledge (Davenport, 2005). Work consists of various activities, like writing, reading and meeting (Huffman et al., 1968; Van den Berg et al., 2020). Furthermore, it is characterized by the high degree of autonomy

and the great importance of social interactions with colleagues (Davenport, 2005). Until COVID-19 and the associated mandatory working from home, the office was historically the central workplace of the knowledge worker (La Brijn et al., 2022). It provided spaces for concentrated work, and created an environment in which connection and interaction with organization and colleagues was expressed and facilitated (Hofkamp & Van Meel, 2013; Kojo & Nenonen, 2016). The office concept and philosophy of Activity-Based Working (ABW) tries to fit work-related activities with different places in the office (Duffy & Powel, 1997; Hoendervanger et al., 2018). ABW is defined as a '*workplace strategy that provides people with a choice of settings for a variety of workplace activities*'. (Marzban et al., 2022, Introduction, 1).

During COVID-19 both individual and collaborative activities could still be executed, due to digital software (Barrero et al., 2020; Van Breukelen, 2021). From what is now known – in the wake of the pandemic – it is to be expected that employees will make a more deliberate choice between working at home and at the office in the future (La Brijn et al., 2022; Van Breukelen, 2021). A larger proportion of knowledge workers will be frequently working from home. While this seems a break with the past, this 'hybrid' way of working fits well with the philosophy of ABW: *work is something that gets done, not a place people go to* (Marzban et al., 2022, Introduction, 2).

So, is 'hybrid working' a desirable development? Literature refers to negative impact on team performance and individual productivity when working from home (Van der Lippe & Lippényi, 2020). From an organizational perspective, working from home could weaken the control and visibility of employees (Van Breukelen, 2021). And at an individual level, social and professional isolation are often pointed out (La Brijn et al., 2022; Mann & Holdsworth, 2003; Van Breukelen, 2021; Van Veldhoven & Van Gelder, 2020). These are serious risks, given the added value of social interaction within knowledge work (Marzban et al., 2021). Is therefore the ABW office *the* place where the knowledge worker is able to operate to the fullest, exchanges knowledge with peers and develops new knowledge?

While it may be obvious to assign social value to the ABW office, especially after the pandemic, we should be hesitant. Even in an ABW environment, positive interaction and connection are not always achieved. Wohlers and Hertel (2018) argue that ABW has negative effects on communication, cohesion and interaction. By allocating places to activities, teams are shattered and finding your colleagues becomes a hassle. Marzban and colleagues (2022) also stress the negative effects of ABW on social connections with colleagues. Philosophising about the post-pandemic office, they argue that digital communication will play a larger part in an effort to connect colleagues. At the same time, the physical office environment will continue to ensure face-to-face contact within the organization.

If past research states that ABW puts pressure on social needs, do the framework and philosophy behind ABW meet the practical requirements of facilitating knowledge work?

In this paper, an effort is made to theorize about better ABW environments, where the exchange of knowledge and contact is secured. Putting the issue on the agenda helps thinking about work environments after COVID-19. The ABW framework is used to explore whether a change in perspective is needed. To achieve this, the following research question is formulated:

What is the position of social needs of knowledge workers within the conceptual framework of Activity-Based Working?

An answer is formulated using an explorative and qualitative study within a large Dutch public organization (paragraph 3). This study confirms what has been noted in the literature: social ties in ABW environments are under pressure (paragraph 4). Hopefully our attempt stimulates future research on the position of social needs in ABW environments.

2 THEORY

The ABW framework is made up of a spatial, digital and social dimension (Baane et al., 2010; Clapperton & Vanhoutte, 2014; Den Hartog & Belschak, 2012; De Kok et al., 2014; Van Diermen & Beltman, 2016; Veldhoen, 2005). The spatial dimension consists of the building and different workspaces. The digital dimension is about information and communication technologies (ICTs), which are essential to work in and outside offices. And the social dimension consists of work routines and managerial practices.

The implementation of ABW has been valuable for organizations (Appel-Meulenbroek, 2011; Davis et al., 2011; Gerards et al., 2018; Haapakangas et al., 2019; Rolfö et al., 2018; Van Koetsveld & Kamperman, 2011; Van Meel, 2020). Aforementioned studies show that flexible work arrangements increase employees' commitment and engagement, create better social relations and promote knowledge-sharing and collaboration. Furthermore, ABW causes better space utilization, reduces costs and attracts skilled talent. All are considered important factors for organizational productivity in knowledge work (Sveiby & Simons, 2002). On the other hand, higher-density workplaces, often present in ABW offices, are associated with increased distractions and perceptions of crowding (Arundell et al., 2018). These negative effects could result in lower levels of satisfaction with communication, social relations and emotional demands (Haapakangas et al., 2019). They could also cause professional and social isolation (Cooper & Kurland, 2002; Morganson et al., 2010).

The impact of fostering the social needs of employees is being researched in a variety of different areas. For individuals, interactions and relationships with people around them are crucial to their health and well-being (Diener & Seligman, 2004; Ryff & Keyes, 1995). The need to belong is a universal and influential human drive that shapes emotion, cognition, and behaviour. Frequent contact with and a continuous relationship between people is essential (Baumeister, 2012). The need for social interactions and belongingness does not disappear when entering an office building (Colenberg, et al., 2021; Kahn, 2007; Rath & Harter, 2010). Here, every aspect of the work environment should contribute towards the building and preservation of social relationships. How do the ABW dimensions add towards this though?

2.1 Spatial manifestation of belongingness

Designated areas that enable team collaboration and communication can foster the development of team cohesiveness and thus enhance the feeling of belongingness (Peterson & Beard, 2004; Hammitt et al., 2006). As social bonds between individuals strengthen, a stronger sense of emotional attachment develops between individuals and the place (Kyle et al., 2006). This also applies to ABW environments. These are designed to promote social interaction through openness, transparency and informal meeting spaces (Hofkamp & Van Meel, 2013). As a consequence, ABW should provide ample opportunity to build and maintain strong relationships with colleagues (Engelen et al., 2019; Wohler & Hertel, 2017). Marzban and colleagues (2021) saw that ABW users reported higher levels of incidental communication and inter-team collaboration. However, more communication and collaboration between employees does not necessarily help to build or maintain significant relationships. Interaction is more frequent, but also superficial and less personal (Marzban et al., 2021). The non-territorial foundation of ABW further threatens the development of group identity (Rosengren et al., 2019).

Thus, more social interactions are not always beneficial for the (social) well-being of employees (Colenberg et al., 2021) and the perceived bonding between colleagues (Marzban et al., 2021). Not being able to frequently have meaningful personal or private conversations with colleagues is a potential risk. This endangers the sense of belongingness and, as a result, could have negative effects on social support and emotional demands (De Been & Beijer, 2014; Haapakangas et al., 2019).

2.2 Digital manifestation of belongingness

The digital workplace is essential within ABW. Here lies a potential danger. A larger share of teleworking leads to a greater reliance on online communications to stay in contact with colleagues (Collins et al., 2016). Research on teleworking shows that working remotely decreases the opportunities to develop social relationships with colleagues (Illegems & Verbeke, 2004; Pearce, 2009). Notable drawbacks of digital communication are the lack of nonverbal cues and the absence of the ‘warmth’ of face-to-face interaction (Allen et al., 2015, Standaert et al., 2022; Vayre & Pignault, 2014). Simultaneously, there are indications that the digital workspace can combat these problems. Fay and Kline (2011) assert that digitally discussing informal topics with colleagues, may reduce teleworkers’ feelings of isolation. A recent study (Karl et al., 2021) reported that online meetings could enhance the social relationships with co-workers, by seeing and learning more about their home environment. Still, it is uncertain if this is enough to create lasting relationships. When not properly addressed, the digital workspace could lead to technostress or even an experienced gap between office-based employees and teleworkers (Collins et al., 2016; Van Vuuren et al., 2020).

2.3 Social manifestation of belongingness

In order to achieve a sense of belongingness, it is important that employees share common experiences, interests and identity with the place (Cuba & Hummon, 1993; Filstad et al., 2019; Kyle & Chick, 2002; Raymond et al., 2010). Therefore, the creation and conservation of an ‘imagined community’ is essential (La Brijn et al., 2022). This is difficult to achieve in practice. ABW offices are fluid in meaning and employees have considerable freedom in space selection. While the concept assumes that users make rational and equal choices in where they work (according to their activities), practice shows that there are competing rationales and behaviours (Bäcklander et al., 2021; Colenberg et al., 2021; Haynes et al., 2019; Van Koetsveld & Kamperman, 2011). The discrepancy between intended, collective and individual behaviour in the work environment could endanger the organizational community. As a result, this difference could hinder – instead of strengthen – the imagined community and therefore meaningful relationship building within the work environment.

3 METHOD

This study is conducted in a Dutch public organization. The organization has more than 10.000 employees, with a multitude of offices. Since 2013 this organization applies the latest standards for Dutch governmental offices and implements and evaluates its environment via the ABW framework. The organization shared all their available evaluation documents for the purpose of this research.

3.1 Research design

A mixed method research design is used, consisting of a document analysis and semi-structured interviews with policymakers (PM1 & PM2) and ABW experts (E1 & E2). The policymakers work for the Dutch government and embed insights, gathered within this public organization, to develop new policy. The experts work for different independent not-for-profit organizations and were periodically asked by the public organization to evaluate their ABW environments. Interviews were used to address the content of the documents in perspective of the spatial, digital and social dimension. These results were compared with literature on ABW. Reason for this triangulation is twofold. Firstly, it limits the risk of research bias (Fischer, 2006). Secondly, it links practical issues of our casus to the discussion in literature. This deepens the understanding of ABW, for both practice and science.

3.2 Document analysis

We analysed the content of 30 documents from the period 2012-2021; internal documentation and external *independent* research on the environments of the organization. The framework of

Van Meel (2020, see Figure 1) is used to structure the content of the obtained documents. This makes it possible to investigate in which manner social needs are being discussed in practice and whether there is a discrepancy between theory and practice.

Figure 1. The ABW framework with dimensions and sub dimensions, composed by Van Meel (2020)

SPATIAL DIMENSION (BRICKS)	DIGITAL DIMENSION (BYTES)	SOCIAL DIMENSION (BEHAVIOUR)
<i>The building and the spaces it provides</i>	<i>The technologies needed for mobile working.</i>	<i>The way staff and management work, manage and interact.</i>
Diversity – Different settings for different activities, balancing open and enclosed spaces.	Mobile devices – Light, powerful tools with long battery lives that can be quickly fired up from any location.	Autonomy – Greater freedom (and responsibility) for employees to decide when and where to work.
Free seating – All spaces can be used by everyone.	Collaboration apps – Applications that allow employees to stay in touch in an easy and intuitive way.	Results-oriented management – Judging employees on their performance rather than their presence in the office.
Availability – Workspace numbers should provide staff with real choice.	Workplace apps – Apps that enable employees to find empty workspaces and to locate their colleagues.	Mutual trust – As employees are not necessarily in the direct sight of their managers, mutual trust is essential.
Ergonomics – All settings should be usable by everybody.	Cloud solutions – Internet-based applications and filing systems that allow employees to work from anywhere.	Courtesy and respect – Sharing workspaces requires that people are more considerate of one another's workplace needs.
Zoning – Different areas for quiet and lively activities.	Top-notch infrastructure – All the practicalities: docking stations, power sockets, a robust Wi-Fi network and high-quality screens.	Being mobile – Moving to different spaces or locations when the task requires it.
Limited storage – As few filing cabinets as possible, although there should be room for personal items and some team storage.		

3.3 Research procedure

The researchers coded the content of the documents dichotomously. When a document addressed an aspect of the dimensions (as shown in Figure 1), it was coded as present. Otherwise, the coding was 'absent'. To map the frequency in which social needs are addressed, different criteria were used.

3.4 Additional search criteria

Social needs of ABW users are not included in the framework. Therefore, the researchers derived different elements of social needs in the context of ABW from literature. Terms that were used are: "social cohesion", "coherence", "social needs", "community", "bonding", "social behaviour", "social support", "social affordances" and "sense of belongingness".

4 RESULTS

4.1 Primary document analysis

In the first analysis, we structured the content following the ABW framework. Table 1 shows per dimension how many documents address the different aspects of ABW. The results indicate that the social dimension is most commonly mentioned.

Table 1. Distribution of the (sub)dimensions in absolute numbers

	Total documents (max. 30)
Spatial dimension	
<i>Diversity</i>	13
<i>Free seating</i>	11
<i>Availability</i>	10
<i>Ergonomics</i>	5
<i>Zoning</i>	8
<i>Limited storing</i>	0
Digital dimension	
<i>Mobile devices</i>	5
<i>Collaboration apps</i>	6
<i>Workplace apps</i>	3
<i>Cloud solutions</i>	8
<i>Top-notch infrastructure</i>	10
Social dimension	
<i>Autonomy</i>	17
<i>Results-oriented management</i>	15
<i>Mutual trust</i>	12
<i>Courtesy and respect</i>	17
<i>Being mobile</i>	10

4.2 Secondary document analysis

In the subsequent analysis, we looked exclusively at social needs. A third of the documents referred to social needs of knowledge workers. The first signs that social needs of knowledge workers are under pressure date from 2015. A reduced social cohesion was noticed due to an increased physical distance between employees. Contact with colleagues now required extra effort. From a more recent external evaluation the conclusion regarding social interactions was: “Many people feel that the quality of contacts with direct colleagues is decreasing. Yet the number of contacts with various indirect colleagues increased.” (External document 17, 2017). Another evaluation stated: “Applying multiple areas/zones in the office could help employees finding the right space, but on the other hand could affect the social cohesion within the team. 90% of the employees did not move throughout the day. When the degree of flexible working increases, team identity or a sense of belongingness is an important challenge.” (External document 11, 2019).

4.3 Interviews

About the design of their work environment, PM2 says: *At [organization], [ABW] was driven by housing. That aspect is slower than IT and the development of the organization. (...) Work environments were already there, but [end-users] could not adapt to them. (...) We felt that it was an organizational and cultural change.*

PM1 adds: *In all those years of [ABW], the behavioural side has always been less tangible. The focus has gone more to the ‘bricks’.*

The difficulty experienced in aligning the behavioural aspects within ABW philosophy is underlined by the experts. E1 sees a discrepancy between the places offered and the way these places are used. The expert identifies several serious risks: temporary occupancy, claiming behaviour and territorial behaviour. According to E1, it is important that the autonomy that is expected of an employee in an ABW environment is also promoted by the culture of an organization. This was lacking in the examined organization.

E2 also sees that employees have all the equipment at their disposal, but do not adapt their behaviour to ABW: *Not much attention is given to behaviour and how people experience an environment. Good ICT is important and buildings must be nicely furnished. But if the behaviour does not change, you will be in trouble. I think that people are aware of the importance of the behavioural side, but they do not really want to do anything about it.*

Both experts agree that behaviour in the ABW environment is a bottleneck in its success. With statements about occupying specific places, they confirm what the policy makers identify: the working environment is set up for ABW, but the cultural change is not there. Does this mean that the social dimension is not properly taken into account in the work environment?

Both policy makers agree that the social dimension is too broad. PM2 thinks that it does not cover the full meaning of what it should be about. PM1 indicates that the working environment should not exclusively focus on behaviour: *“How do you remain an attractive employer for the coming generations?”*

PM2 adds: [Behaviour] *also has to do with identity. Who we want to be to the outside world. That is too little connected with [ABW], identity and culture.*

In addition, PM2 argues that the limited involvement of Human Resources (HR) has led to a lack of clarity in terms of social norms and cultural aspects surrounding working in an ABW environment.

According to E1, the responsibility that PM2 places on the HR-department is a logical consequence of the framework. E1 argues that, in practice, the three dimensions are often carried out by the department to which they naturally belong. The spatial dimension belongs to Facility Management (FM) and the digital dimension to IT. Here E1 detects a flaw: *Behaviour is often not linked to Human Resources by HR itself. (...) Maybe the definition of the social dimension is too broad, because it is more than only HR.*

E2 seems to share this view: *Behaviour is an all-purpose word. We need to refine this further. It is about attitude and behaviour.*

E2 recognizes the urgency, also for the organization, to further refine the understanding of the social dimension. For the upcoming years the organization will have to deal with challenges surrounding the emerging of ‘hybrid working’, among which are the attracting and retaining of new talent, the sharing of information and creating involvement within the organization.

I do think that, in the future, we have to think about how to feed the organization as a whole and make sure that people know what is happening in the organization. The organization must actively contribute to this (E2).

5 CONCLUSION

Facilitating social needs in ABW environments is difficult. In both the document analysis and the interviews, the struggle to deal with the social dimension is evident. While an ABW environment can be equipped relatively easily with the right equipment and digital infrastructure, it is more difficult to get users ‘behave’ as intended. In most of the analysed documents, the social dimension was labelled as difficult to address. Furthermore, we found in more than one third of the documents statements related to social needs and the sense of belongingness. We were unable to place these in the framework.

Implementing social needs and a sense of belongingness in the spatial dimension could cause a paradox. In most offices the amount of social interactions have increased, while the quality of these interactions have decreased. Remarkably, ABW could create an increased experienced social distance (Colenberg et al., 2021). In the digital dimension there is an overestimation of technological solutions. While digital communication will play an even larger part in an effort to connect colleagues after COVID-19, earlier research illustrates that ICT’s lacks the ‘warmth’

of face-to-face interactions. These are vital for developing closer social relationships (Vayre & Pignault, 2014), further stressed by research conducted during COVID-19.

The position of social needs in ABW is limited. The existing framework does too little to address and facilitate a crucial element of knowledge work. We fear that, following literature and our own findings, the current framework of ABW environments cannot sufficiently address social needs after COVID-19. How the framework should be altered is unclear. Add an extra dimension - like bonding or belongingness – or critically evaluate the existing sub dimensions? This is a consideration to be explored in future research.

5.1 Limitations

While this study is explorative by nature, the absence of empirical data limits the generalizability of its statements. However, all of the results are placed in a broader perspective to address a known issue. While this study is not enough, it brings different insights on ABW together and adds the evaluation of a large Dutch public organisation. The analysed documents are original and were written in a time period of nine years. They are in line with research previously done on ABW. However, to deepen the understanding of this subject, research should be extended by including (empirical) data from more (public and private) organisations.

5.2 Future directions

To explore the role of social needs in ABW, empirical data is required. What knowledge workers expect from their ABW environment should be charted. Employee experiences and reasoning to work in ABW offices after COVID-19 could be helpful to deepen the understanding of the added value of face-to-face social interactions. Furthermore, earlier research already indicated that belongingness, social interactions and cohesion are often being researched from an individual point of view (Colenberg et al., 2021). Gifford (2014) also stated that scholars should be aware of the complex mutual nature of social interactions. This detracts from the complex, dynamic and evolving relationship between employees and their managers in knowledge work. We invite researchers to consider mereology, which is the philosophical study of individual parts (like people) and the collective entity they form (like an organization) (Hawley, 2017). Because in the end, an organization is more than the sum of its individual employees. The interaction between the employees adds something, essential in knowledge work. ABW should actively contribute to this phenomenon, in all three dimensions.

REFERENCES

- Allen, T. D., Golden, T. D., Shockley, K. M. (2015), “How effective is telecommuting? Assessing the status of our scientific findings”, *Psychological Science in the Public Interest*, 16(2), 40-68. <https://journals.sagepub.com/doi/10.1177/1529100615593273>
- Appel-Meulenbroek, H. A. J. A., Groenen, P. J. M., Janssen, I. I. (2011), “An end user’s perspective on activity-based office concepts”, *Journal of Corporate Real Estate*, 13(2), 122-135. <http://dx.doi.org/10.1108/14630011111136830>
- Arundell, L., Sudholz, B., Teychenne, M., Salmon, J., Hayward, B., Healy, G., Timperio, A. (2018), “The impact of Activity Based Working (ABW) on workplace activity, eating behaviours, productivity, and satisfaction”, *International Journal of Environmental Research and Public Health*, 15(5). <https://doi.org/10.3390/ijerph15051005>
- Baane, R., Houtkamp, P., Knotter, M. (2010), *Het nieuwe werken ontrafeld: Over bricks, bytes en behaviour*, Van Gorcum, The Hague.
- Bäcklander, G., Fältén, R., Bodin Danielsson, C., Toivanen, S., Richter, A. (2021), “Development and validation of a multi-dimensional measure of activity-based working behaviors”, *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.655881>

- Barrero, J. M., Bloom, N., Davis, S. J. (2020), "Why working from home will stick", Working Paper Series [28731], National Bureau of Economic Research, Cambridge, MA, April 2020. <https://doi.org/10.3386/w28731>
- Baumeister, R. F. (2012), "Need-to-belong theory", Van Lange, P. A. M., Kruglanski, A.W., Higgins E.T. (Eds.), *Handbook of theories of social psychology*, Sage Publications Ltd., London, 121-140. <http://dx.doi.org/10.4135/9781446249222.n46>
- Clapperton, G., Vanhoutte, P. (2014), *The smarter working manifesto: When, where and how do you work best?*, Sunmakers, Oxford.
- Colenberg, S., Appel-Meulenbroek, H. A. J. A., Romero Herrera, N., Keyson, D. (2021), "Conceptualizing social well-being in activity-based offices", *Journal of Managerial Psychology*, 36(4), 327-343. <https://doi.org/10.1108/JMP-09-2019-0529>
- Collins, A. M., Hislop, D., Cartwright, S. (2016), "Social support in the workplace between teleworkers, office-based colleagues and supervisors", *New Technology, Work and Employment*, 31(2), 161-175. <https://doi.org/10.1111/ntwe.12065>
- Cooper, C. D., Kurland, N. B. (2002), "Telecommuting, professional isolation, and employee development in public and private organizations", *Journal of Organizational Behavior*, 23(4), 511-532. <https://doi.org/10.1002/job.145>
- Cuba, L., Hummon, D. M. (1993), "A place to call home: Identification with dwelling, community and region", *The Sociological Quarterly*, 34(1), 111-131. <https://doi.org/10.1111/j.1533-8525.1993.tb00133.x>
- Davenport, T. H. (2005), *Thinking for a living. How to get better performance and results from knowledge workers*, Harvard Business School Press, Boston, Massachusetts.
- Davis, M. C., Leach, D. J., Clegg, C.W. (2011), "The physical environment of the office: Contemporary and emerging issues", Hodgkinson, G.P., & Ford, J.K. (Eds.), *International Review of Industrial and Organizational Psychology*, 26, Wiley, Chichester, UK, 193-235. <http://dx.doi.org/10.1002/9781119992592.ch6>
- De Been, I., Beijer, M. (2014), "The influence of office type on satisfaction and perceived productivity support", *Journal of Facilities Management*, 12(2), 142-157. <https://doi.org/10.1108/JFM-02-2013-0011>
- Den Hartog, D. N., Belschak, F. D. (2012), "When does transformational leadership enhance employee proactive behavior? The role of autonomy and role breadth self-efficacy", *Journal of Applied Psychology*, 97(1), 194-202. <https://doi.org/10.1037/a0024903>
- De Kok, A., Koops, J., Helms, R. W. (2014), "Assessing the new way of working: Bricks, bytes and behaviour", *PACIS 2014 Proceedings*. Paper 7. <http://dx.doi.org/10.13140/RG.2.1.2057.5602>
- Diener, E., Seligman, M. E. (2004), "Beyond money: Toward an economy of well-being", *Psychological Science in the Public Interest*, 5(1), 1-31. <https://doi.org/10.1111/j.0963-7214.2004.00501001.x>
- Duffy, F., Powell, K. (1997), *The new office*. Conran Octopus, London.
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., Bauman, A. (2019), "Is activity-based working impacting health, work performance and perceptions? A systematic review", *Building Research & Information*, 47(4), 468-479. <https://doi.org/10.1080/09613218.2018.1440958>

- Fay, M. J., Kline, S. L. (2011), "Coworker relationships and informal communication in high-intensity telecommuting", *Journal of Applied Communication Research*, 39(2), 144-163. <https://doi.org/10.1080/00909882.2011.556136>
- Filstad, C., Traavik, L. E. M., Gorli, M. (2019), "Belonging at work: The experiences, representations and meanings of belonging", *Journal of Workplace Learning*, 31(2), 116-142. <http://dx.doi.org/10.1108/JWL-06-2018-0081>
- Fischer C. T. (2006), *Research methods for psychologists: Introduction through empirical studies*, Elsevier Academic Press, Cambridge, Massachusetts.
- Gerards, R., De Grip, A., Baudewijns, C. (2018), "Do new ways of working increase work engagement?", *Personnel Review*, 47(2), 517-534. <https://doi.org/10.1108/PR-02-2017-0050>
- Gifford, R. (2014), *Environmental psychology: Principles and practice* (5th edition), Optimal Books, Victoria.
- Haapakangas, A., Hallman, D. M., Mathiassen, S. E., Jahneke, H. (2019), "The effects of moving into an activity-based office on communication, social relations and work demands – A controlled intervention with repeated follow-up", *Journal of Environmental Psychology*, 66(2019). <https://doi.org/10.1016/j.jenvp.2019.101341>
- Hammitt, W. E., Backlund, E. A., Bixler, R. D. (2006), "Place bonding for recreation places: Conceptual and empirical development", *Leisure Studies*, 25(1), 17-41. <https://doi.org/10.1080/02614360500098100>
- Hawley, K. (2017), "Social Mereology", *Journal of the American Philosophical Association*, 3(4), 395-411. <https://doi.org/10.1017/apa.2017.33>
- Haynes, B. P., Suckley, L., Nunnington, N. (2019), "Workplace alignment: An evaluation of office worker flexibility and workplace provision", *Facilities*, 37(13-14), 1082-1103. <https://doi.org/10.1108/F-07-2018-0082>
- Hoendervanger, J. G., Ernst, A. F., Albers, C. J., Mobach, M. P., Van Yperen, N. W. (2018), "Individual differences in satisfaction with activity-based work environments", *PLoS ONE*, 13(3). <https://doi.org/10.1371/journal.pone.0193878>
- Hofkamp, G., Van Meel, J. (2013), *De Werkplekwijzer*, Center for People and Buildings, Delft.
- Huffman, H., Brady, M. M., Peterson, M., Lacy, A. (1968), *A Taxonomy of Office Activities for Business and Office Education*, Ohio State University, Columbus.
- Illegems, V., Verbeke, A. (2004), "Telework: what does it mean for management?", *Long Range Planning*, 37(4), 319-334. <https://doi.org/10.1016/j.lrp.2004.03.004>
- Kahn, W. A. (2007), "Meaningful connections: Positive relationships and attachments at work", Dutton, J. E., Ragins, B. R. (Eds.), *Exploring positive relationships at work: Building a theoretical and research foundation*, Lawrence Erlbaum Associates Publishers, Mahwah, New Jersey, 189-206.
- Karl, K. A., Peluchette, J. V., Aghakhani, N. (2022), "Virtual work meetings during the COVID-19 pandemic: The good, bad, and ugly", *Small Group Research*, 53(3), 343-365. <https://doi.org/10.1177/10464964211015286>
- Kojo, I., Nenonen, S. (2016), "Typologies for co-working spaces in Finland – what and how?", *Facilities*, 34(5/6), 302-313. <http://dx.doi.org/10.1108/F-08-2014-0066>

- Kyle, G. T., Absher, J. D., Hammitt, W. E., Cavin, J. (2006), "An examination of the motivation—involvement relationship", *Leisure Sciences*, 28, 467-485. <http://dx.doi.org/10.1080/01490400600851320>
- Kyle, G. T., Chick, G. (2004), "Enduring leisure involvement: The importance of personal relationships", *Leisure Studies*, 23(3), 243-266. <http://dx.doi.org/10.1080/0261436042000251996>
- La Brijn, D., Hoekjen, J. H., Pullen W. P. (2022), "Kennis verwerken in de virtuele agora. Thuiswerken en gemeenschappelijkheid na COVID-19", *Gedrag & Organisatie*, 35(2), 142-166. <https://doi.org/10.5117/GO2022.2.002.LABR>
- Mann, S., Holdsworth, L. (2003), "The psychological impact of teleworking: Stress, emotions and health", *New Technology, Work and Employment*, 18(3), 196-211. <https://doi.org/10.1111/1468-005X.00121>
- Marzban, S., Candido, C., Mackey, M., Engelen, L., Zhang, F., Tjondronegoro, D. (2022), "A review of research in activity-based working over the last ten years: Lessons for the post-COVID workplace", *Journal of Facilities Management*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/JFM-08-2021-0081>
- Morganson, V. J., Major, D. A., Oborn, K. L., Verive, J. M., Heelan, M. P. (2010), "Comparing telework locations and traditional work arrangements: Differences in work-life balance support, job satisfaction, and inclusion", *Journal of Managerial Psychology*, 25(6), 578-595. <https://doi.org/10.1108/02683941011056941>
- Pearce, J. A. (2009), "Successful corporate telecommuting with technology considerations for late adopters", *Organizational Dynamics*, 38(1), 16–25. <http://dx.doi.org/10.1016/j.orgdyn.2008.10.002>
- Rath, T., Harter, J. (2010), *Wellbeing: The five essential elements*, Gallup Press, Washington D.C.
- Raymond, C. M., Brown, G., Weber, D. (2010), "The measurement of place attachment: Personal, community, and environmental connections", *Journal of Environmental Psychology*, 30(4), 422-434. <http://dx.doi.org/10.1016/j.jenvp.2010.08.002>
- Rolfö, L., Eklund, J., Jahncke, H. (2018), "Perceptions of performance and satisfaction after relocation to an activity-based office", *Ergonomics*, 61(5), 644-657. <https://doi.org/10.1080/00140139.2017.1398844>
- Rosengren, C., Ottosson, M. (2019), "Conflict, resistance and the symbolic meaning of space. Activity based work and possibilities to express work-related identities in everyday working life", *Management Revue*, 30(4), 412-431. <https://doi.org/10.5771/0935-9915-2019-4-412>
- Ryff, C. D., Keyes, C. L. M. (1995), "The structure of psychological well-being revisited", *Journal of Personality and Social Psychology*, 69(4), 719-727. <https://doi.org/10.1037/0022-3514.69.4.719>
- Standaert, W., Muylle, S., Basu, A. (2022), "Business meetings in a postpandemic world: When and how to meet virtually", *Business Horizons*, 65(3), 267-275. <https://doi.org/10.1016/j.bushor.2021.02.047>
- Sveiby, K. -E., Simons, R. (2002), "Collaborative climate and effectiveness of knowledge work: An empirical study", *Journal of Knowledge Management*, 6(5), 420-433. <https://doi.org/10.1108/13673270210450388>

- Peterson, T. O., Beard, J.W. (2004), "Workplace technology's impact on individual privacy and team interaction", *Team Performance Management*, 10(7/8), 163-172. <https://doi.org/10.1108/13527590410569887>
- Van Breukelen, J. W. M. (2021), "Telewerken en thuiswerken. De stand van zaken vóór het uitbreken van COVID-19", *Gedrag & Organisatie*, 34(4), 425-459. <https://doi.org/10.5117/GO2021.4.002.BREU>
- Van den Berg, J. C., Appel-Meulenbroek, H. A. J. A., Kemperman, A. D. A. M., Sotthewes, M. (2020), "Knowledge workers' preferences for important characteristics of activity-based workspaces", *Building Research & Information*, 48(7), 703-718. <https://doi.org/10.1080/09613218.2020.1726169>
- Van der Lippe, T., Lippényi, Z. (2020), "Co-workers working from home and individual and team performance", *New Technology, Work and Employment*, 35(1), 60-79. <https://doi.org/10.1111/ntwe.12153>
- Van Diermen, O. G., Beltman, S. (2016), "Managing working behaviour towards new ways of working: A case study", *Journal of Corporate Real Estate*, 18(4), 270-286. <https://doi.org/10.1108/JCRE-11-2015-0039>
- Van Koetsveld, R., Kamperman, L. (2011), "How flexible workplace strategies can be made successful at the operational level", *Corporate Real Estate Journal*, 1(4), 303-319.
- Van Meel, J. (2020), *The activity-based working practice guide* (2nd edition), Pantheon drukkers, Velsen-Noord.
- Van Veldhoven, M., Van Gelder, M. (2020), "De voor- en nadelen van verplicht thuiswerken tijdens de lockdown", *Tijdschrift voor HRM*, 23(3), 66-90. <https://doi.org/10.5117/THRM2020.3.VELD>
- Van Vuuren, T. C. V., Peeters, M. C. W., Diaz, S. P., Van Veen, B. (2020), "Het verband tussen technostress en duurzame inzetbaarheid: Doet leeftijd ertoe?", *Gedrag en Organisatie*, 33(4), 300-323. <https://doi.org/10.5117/2020.033.004.003>
- Vayre, E., Pignault, A. (2014), "A systemic approach to interpersonal relationships and activities among French teleworkers", *New Technology, Work and Employment*, 29(2), 177-192. <https://doi.org/10.1111/ntwe.12032>
- Veldhoen, E. (2005), *The Art of working. De integrale betekenis van onze virtuele, fysieke en mentale werkomgevingen*. Boom, The Hague.
- Wohlers, C., Hertel, G. (2017), "Choosing where to work at work – Towards a theoretical model of benefits and risks of activity-based flexible offices", *Ergonomics*, 60(4), 467-486. <https://doi.org/10.1080/00140139.2016.1188220>
- Wohlers, C., Hertel, G. (2018), "Longitudinal effects of activity-based flexible office design on teamwork", *Frontiers in Psychology*, 9(2016). <https://doi.org/10.3389/fpsyg.2018.02016>

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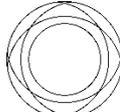
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