III TWR CONFERENCE

TRANSDISCIPLINARY WORKPLACE RESEARCH

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

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Department of Architecture and Urban Studies
Department of Management, Economics and Industrial Engineering

TWR NETWORK

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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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Torben Bernhold, FH Münster University of Applied Sciences, Germany
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Christophe Demazière, Université de Tours, France
Halime Demirkan, Bilkent University, Turkey
Mina Di Marino, Norwegian University of Life Sciences, Norway
Gislene Feiten Haubrich, CITCEM, Portugal
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Vanja Garaj, Brunel University London, UK
Felix Gauger, Technical University Darmstadt, Germany
Pascal Glémain, Université Rennes 2, France
Brenda Groen, Saxion University of Applied Sciences, Netherlands
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Stefan Haefliger, Bayes Business School, UK
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Geir Karsten Hansen, Norwegian University of Science and Technology, Norway
Christopher Heywood, University of Melbourne, Australia
Henk-Jan Hoekjen, Center for People and Buildings, Netherlands
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Quan Jin, Chalmers University of Technology, Sweden
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Eunhwa Yang, Georgia Institute of Technology, USA
Georgi Zabunov, University of National and World Economy, Bulgaria
Daria Zueva, HUST, Vietnam

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 Unispace Workshop Room 16B.1.1	**Session W2** Lendlease Workshop Room 16B.2.1	**Session W3** CBRE Workshop 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

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 Villoresi 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 "inclusi*" 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
Willis (2009)	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.
Moschonas et al. (2014)	Elderly with motor, vision, hearing and cognitive impairment Fully capable VS strength limitations, motor deficiencies, Parkinsonians	Taking into account different users' capabilities, besides anthropometrics, 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
Kar and Mullick (2014)	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
Branham and Kane (2015)	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)
Afacan (2015)	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
Mathiansen & Frandsen (2016)	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
Kämpf-Dern and Konkol (2017)	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			
Wang and Piper (2018)	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
Lo & Diochon, (2019)	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
Smoll and & Morrison (2019)	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.
Know (2020)	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 (Deliberatly 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)
Van Laer et al. (2020)	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.
Marzban et al. (2021)	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			
Bend and Priola (2021)	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
Pacchi and Mariotti (2021)	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.

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