The efficiency scope of work from home: A multidimensional approach and the significance of real estate

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Summary

The world of work, particularly the physical organization of work, is undergoing a profound transformation process. The causes of this transformation process are technological innovations, organizational changes, and the increasing pluralization of employee requirements. Even though this transformation process of the physical organization of work began several years ago, the COVID-19 pandemic has significantly increased its speed. As a measure to contain the COVID-19 pandemic, working from home enabled office workers worldwide to gain experience with this workplace. Work from home describes regular working from home, which is made possible using information and communication technologies. This gives employees a direct comparison between working in the office and working from home and allows them to choose their place of work more purposefully depending on their work activities. The widespread introduction of work from home influences life and work on several levels. At an individual level, the question arises as to which employees are generally suitable for working from home. At the level of the working environment, there needs to be more knowledge about the extent to which work from home influences the digital equipment of residential properties. Furthermore, it remains unclear how the interaction between the employee (person) and the working environment (environment) in work from home affects individual work success (fit). This dissertation explores these research questions with the help of a total of five research articles.

The first article classifies work from home in a hybrid working environment and uses an international comparison between the United States and Germany. Hybrid working is defined by the distribution of working hours between the office, work from home, and third places of work, and describes a combination of these places of work. The article shows that WFH is a high priority for many employees in a hybrid working environment. While working hours in the office are almost identical in both countries at around one-third, it is clear that third places of work (e.g., coworking spaces) are more important for employees in the United States than Germany. The article shows that this divergence is primarily cultural. Overall, this article shows that employees internationally attach great importance to WFH in a hybrid working environment.

The second article addresses the importance of work from home in a hybrid work environment and examines in a preliminary study which aspects enable successful work from home. The results of the article show correlative relationships between spatial, personal, and work-related characteristics on the one hand, and satisfaction and productivity on the other. Consequently, successful work at home is only possible if all three dimensions are met. This

article indicates that only around 25 % of employees who can work from home are successful there.

The third research article takes up the results of the second study. The aim is to take a closer look at these 25 % of employees who successfully work from home. The results make it clear that more experienced employees who live in well-equipped residential properties and have a high degree of work autonomy can work successfully from home. Career starters, who often live in properties that are not suitable for work from home, are less successful in working from home.

The fourth article is specifically dedicated to examining the influence of real estate characteristics on satisfaction and productivity in work from home. Furthermore, the relative importance of real estate characteristics is compared with organizational and socio-psychological characteristics. It is shown that real estate characteristics highly influence satisfaction and productivity in work from home. Compared to organizational and socio-psychological characteristics, real estate characteristics are the most important.

The fifth research article delves into the factors that impact the purchase intention of smart homes, shedding light on the heightened inclination towards technology, notably spurred by the COVID-19 pandemic and the surge in remote work. This study investigates the intricate interplay between these aspects, unravelling the nuanced role that the increased affinity for technology, especially in the context of the widespread shift to remote work, plays in shaping consumer attitudes toward smart home adoption. The social environment primarily influences the intention to buy smart homes. However, the results also make it clear that the increased affinity for technology improves attitudes toward such residential properties, leading to a higher purchase intention.

With these findings, this dissertation expands research on work from home. Work from home offers potential for both companies and society. At the same time, the dissertation also shows the risks associated with working from home. These potentials can only be realized by taking an individual view of an organization's workforce and combining the office, work from home, and third places. The dissertation offers a theoretical-conceptual classification in the current state of research and supported by the results, provides implications for practice to meet the challenges in the transformation process of the physical organization of work.

Zusammenfassung

Die Arbeitswelten und insbesondere die physische Organisation der Arbeit befinden sich in einem tiefgreifenden Transformationsprozess. Ursächlich für diesen Transformationsprozess sind technologische Innovationen, organisatorische Veränderungen und die zunehmende Pluralisierung der Anforderungen von Arbeitnehmenden. Auch wenn dieser Transformationsprozess der physischen Organisation der Arbeit schon vor einigen Jahren eingesetzt hat, hat die COVID-19 Pandemie die Transformationsgeschwindigkeit signifikant erhöht. Work from Home, als eine Maßnahme zur Eindämmung der COVID-19 Pandemie, ermöglichte es Büroarbeitenden weltweit Erfahrungen mit der Arbeit zu Hause zu sammeln. Work from Home beschreibt dabei das regelmäßige Arbeiten von zu Hause, das durch die Nutzung von Informations- und Kommunikationstechnologien ermöglicht wird. Arbeitnehmende haben dadurch den direkten Vergleich zwischen dem Arbeiten im Büro und dem Work from Home und wägen ihren Arbeitsort in Abhängigkeit der Arbeitstätigkeiten zielgerichteter ab. Die flächendeckende Einführung von Work from Home beeinflusst das Leben und Arbeiten auf mehreren Ebenen. Auf individueller Ebene stellt sich die Frage, welche Arbeitnehmenden grundsätzlich für das Work from Home geeignet sind. Auf der Ebene der Arbeitsumwelt fehlt es an Erkenntnissen, inwiefern Work from Home einen Einfluss auf die digitale Ausstattung von Wohnimmobilien hat. Weiterhin bleibt offen, wie sich das Zusammenspiel aus den Arbeitnehmenden (person) und der Arbeitsumwelt (environment) im Work from Home auf den individuellen Arbeitserfolg (fit) auswirkt. Diesen Forschungsfragen geht die vorliegende Dissertation mithilfe von insgesamt fünf Forschungsartikeln nach.

Der erste Artikel ordnet Work from Home in eine hybride Arbeitswelt ein und nutzt dazu einen internationalen Vergleich zwischen den Vereinigten Staaten und Deutschland. Hybrides Arbeiten definiert sich über die Verteilung der Arbeitszeit auf das Büro, das Work from Home und dritte Arbeitsorte und beschreibt eine Kombination dieser Arbeitsorte. Der Artikel zeigt, dass WFH in einer hybriden Arbeitswelt für viele Arbeitnehmende einen hohen Stellenwert einnimmt. Während die Arbeitszeit im Büro mit rund einem Drittel in beiden Ländern nahezu identisch ist, zeigt sich, dass vor allem dritte Arbeitsorte (z. B. Coworking Spaces) für Arbeitnehmende in den Vereinigten Staaten einen höheren Stellenwert als in Deutschland einnehmen. Der Artikel zeigt, dass diese Divergenz vor allem kulturell begründet ist. In der Summe zeigt dieser Artikel, dass Arbeitnehmende dem WFH in einer hybriden Arbeitswelt international einen hohen Stellenwert einräumen.

Der zweite Artikel greift den hohen Stellenwert des Work from Home in einer hybriden Arbeitswelt auf und untersucht in einer Vorstudie, welche Aspekte erfolgreiches Arbeiten zu Hause ermöglichen. Die Ergebnisse des Artikels zeigen, dass korrelative Zusammenhänge zwischen räumlichen, personenbezogenen und arbeitsbezogenen Merkmalen auf der einen Seite und der Zufriedenheit und Produktivität auf der anderen Seite existieren. Konsequenterweise ist erfolgreiches Arbeiten zu Hause nur durch positive Voraussetzungen aller drei Dimensionen möglich. Dieser Artikel gibt einen ersten Hinweis darauf, dass tatsächlich nur rund 25 % der Arbeitnehmenden, die die Möglichkeit haben von zu Hause zu arbeiten, dort auch erfolgreich sind.

Im dritten Forschungsartikel werden die Ergebnisse aus der zweiten Studie aufgegriffen. So ist das Ziel, diese 25 % der erfolgreich von zu Hause arbeitenden Arbeitnehmenden, näher zu betrachten. Die Ergebnisse verdeutlichen, dass insbesondere berufserfahrenere Arbeitnehmende, die in gut ausgestatteten Wohnimmobilien leben und eine hohe Arbeitsautonomie haben im Work from Home erfolgreich arbeiten können. Weniger erfolgreich im Work from Home sind vor allem Berufseinsteiger, die häufig in Immobilien wohnen, die nicht für das Work from Home geeignet sind.

Der vierte Artikel widmet sich konkret der Frage, welchen Einfluss die immobilienwirtschaftlichen Merkmale auf die Zufriedenheit und die Produktivität im Work from Home haben. Des Weiteren wird die relative Bedeutung der immobilienwirtschaftlichen Merkmale im Verhältnis zu arbeitsbezogenen und sozial-psychologischen Merkmalen gesetzt. Es zeigt sich, dass die immobilienwirtschaftlichen Merkmale im Work from Home einen hohen Einfluss auf die Zufriedenheit und die Produktivität haben. Im Vergleich zu arbeitsbezogenen und sozial-psychologischen Merkmalen haben die immobilienwirtschaftlichen Merkmale sogar die größte Bedeutung.

Der fünfte Forschungsartikel untersucht, welche Aspekte die Kaufabsicht von Smart Homes beeinflussen und welche Rolle die gestiegene Technikaffinität, ausgelöst durch die COVID-19 Pandemie und insbesondere durch Work from Home, einnimmt. Die Kaufabsicht von Smart Homes wird vor allem durch das soziale Umfeld begünstigt. Die Ergebnisse machen aber auch deutlich, dass die gestiegene Technikaffinität die Einstellung gegenüber solchen Wohnimmobilien verbessert, was wiederum zu einer höheren Kaufabsicht führt.

Mit diesen Erkenntnissen erweitert die vorliegende Dissertation die Forschung rund um das Thema Work from Home. Work from Home bietet sowohl für die Unternehmen als auch für die Gesellschaft Potentiale. Gleichzeitig zeigt die Dissertation auch Risiken, die mit dem Arbeiten von zu Hause verbunden sind. Nur durch die individuelle Betrachtung der

Workforce einer Organisation und durch die Kombination des Büros, Work from Home und dritte Arbeitsorte lassen sich diese Potentiale realisieren. Die Dissertation bietet eine theoretisch-konzeptionelle Einordnung in den aktuellen Stand der Forschung und liefert mit den Ergebnissen Implikationen für die Praxis, um den Herausforderungen im Transformationsprozess der physischen Organisation der Arbeit gerecht zu werden.

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ãi	standardized fusion coefficient
ATI Scale	Affinity for Technology Scale
AVE	Average Variance Extracted
B	regression coefficient
β	standardized regression coefficient
BCa	bias-corrected and accelerated
ca.	circa
CO_2	Carbon Dioxid
CBD	Central Business District
CB-SEM	Covariance-based Structural Equation Modeling
COVID-19	Corona Virus Disease 2019
CRE	Corporate Real Estate
CREM	Corporate Real Estate Management
Ed./Eds.	Editor/Editors
e.g.	exempli gratia
etc.	et cetera
EFA	Exploratory Factor Analysis
et al.	et alii
et seq.	et sequens
H	Hypothesis
HRM	Human Resource Management
Hrsg.	Herausgeber (editor)
HTMT	Heterotrait-Monotrait
i.e.	id est
IEQ	Indoor Environmental Quality
ICT	information and communication technologies
ID	Identifier
JD-R	Job Demands-Resources Model
Max	Maximum
Min	Minimum
MSA	Measure of Sampling Adequacy
MTurk	Mechanical Turk
N/A	No answer
n/N	number of observations
No.	number

Nr.	Nummer (number)
OECD	Organization for Economic Co-operation and Development
ÖPNV	Öffentlicher Personennahverkehr/public transport
P-E fit	Person-Environment fit
PKW	Personenkraftwagen/car
PLS-SEM	Partial Least Squares Structural Equation Modeling
p/pp	page/pages
R	coefficient of determination
r	Pearson correlation coefficient
RQ	Research Question
S	standard deviation
SPSS	Statistical Package for Social Sciences
sq. ft	square feet
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TU	Technical University/Technische Universität
US/U.S.	United States
USA	United States of America
vgl.	vergleiche/see
VIF	Variance Inflation Factor
vs.	versus
WFH	work from home
$\bar{x}$	mean value
z. B.	zum Beispiel (for example)

1 Introduction

1.1 Motivation and research question

Over the years, organizations have been undergoing a profound change process that significantly impacts not only, but primarily, the work environment. Work environments encompass, on the one hand, the physical work environment and, on the other hand, the psychological aspects associated with it (Voll, Gauger, and Pfnür, 2022). Physical work environments in particular have constantly evolved over the last decades.

Whereas work in the pre-industrial era was initially performed from home (first place) – thus combining living and working – increased knowledge work has led to a spatial separation between living and working in the office (second place) for knowledge workers (Oldenburg, 1999). Since the 1980s, technological, economic, and social developments have led to an increasing flexibilization of work (Gauger, 2021; Krüger, 2023). Work-life balance increasingly became more important for employees, and the introduction of information and communication technologies (ICT) made it possible to work at other places (third place), such as coworking spaces, in addition to working from home or working in the office (Johns and Gratton, 2013). Work thus became increasingly flexible in terms of location and time, and the new ways of working approach was introduced by many organizations worldwide (Blok et al., 2011; Harris, 2015; Nijp et al., 2016; Gillen, 2019). Accordingly, in the future, knowledge workers will increasingly weigh up the location at which they would prefer to work and work from home (WFH) will play a crucial role because of the possibility to align, once again, work and life (Pfnür et al., 2021; Pfnür et al., 2023c).

Even before the COVID-19 pandemic, the proportion of WFH in Germany rose steadily. Between 2017 and 2019, the proportion of employees working at home, at least occasionally, ranged between 11 % and 13 % (Destatis, 2022). In a Europe-wide comparison of WFH percentages, Germany was only average, whereas the WFH percentage in The Netherlands, for example, was around 37 % (Bonin et al., 2020). The main reason for this low proportion in Germany was skepticism by employers (Pyöriä, 2011). However, the onset of the COVID-19 pandemic in 2020 forced organizations abruptly to change the physical organization of work and enabled their employees to WFH (Kramer and Kramer, 2020; Contreras, Baykal, and Abid, 2020), leading to a large-scale experiment. At peak times, up to 45 % of employees worked from home (Flüter-Hoffmann and Stettes, 2022). It became apparent that working from home turned out better than expected (Orel, 2021) and many studies assumed that WFH would continue to play an essential role for the physical organization of work in the post-COVID-19 pandemic era (Alipour et al., 2020; Brynjolfsson et al., 2020; Hofmann, Piele,

and Piele, 2020; Kleinert et al., 2021). Hence, it is not surprising that even after the COVID-19 pandemic, nearly one in four employees in Germany work from home (Destatis, 2022). Barrero, Bloom, and Davis, (2021) predict that in the future, 20 % of full workdays will be performed from home. Pfnür et al. (2023c) depict that WFH has become an indispensable part of the new way of working and has both social and economic potential.

Many studies have already shown that, on average, WFH can have a positive impact on job satisfaction and productivity in addition to employee retention and overall company success (Bloom et al., 2015; Fonner and Roloff, 2010; Harker Martin and MacDonnell, 2012). The positive experience of many employees with WFH during the COVID-19 pandemic confirms this trend. For example, Pfnür et al. (2021) find that employees are, on average, 14 % more productive when working from home compared to the office. Even post-pandemic, job satisfaction and productivity when working at home remain high (Pfnür et al., 2023c). These studies also show, however, that success at work when working from home varies widely. For instance, 40 % of employees are not more successful working from home than in the office (Pfnür et al., 2021). Instead, work success at home depends on the employee himself on the one hand and the work environment at home on the other. Especially young employees with less job experience are less successful working from home (Pfnür et al., 2021). Additionally, employees with a low tolerance for uncertainty and less agile work characteristics are less successful at home (Smith, Twohy, and Smith, 2020; Heidt, Gauger, and Pfnür, 2023). Hence, work success at home is only possible due to a fit between the person and their work environment (physical environment and psychological aspects associated with it) at home. There are hardly any studies that deal with the interaction between the person, the physical environment, and the associated psychological aspects when working from home.

Hence, the primary objective of this dissertation is to address the existing research gap comprehensively. This will be achieved through a thorough examination of WFH, focusing on the alignment between individuals and their respective work environments.. This investigation expands the theoretical understanding of WFH through a broader investigative approach. Thus, studies are initially carried out at the level of the person. Then, work success is analyzed with the help of the interaction between the person, their physical environment, and socio-psychological aspects. Finally, the impact of increasing affinity for technology on housing is considered due to use cases of digitalization like WFH.

Consequently, the dissertation aims to answer the following research questions:

1) Which employees work successfully from home?

2) What role do real estate factors play in being able to work successfully from home and what is their relative importance compared to organizational and socio-psychological factors?
3) Does increased affinity for technology in the society, partly caused by WFH, lead to the purchase intention of smart homes?

To answer these research questions, five studies were conducted with partially varying datasets while different methods were used.

1.2 Positioning of the thesis

WFH is a research field that can be viewed from different perspectives and, thus, is highly complex. To do justice to this complexity and to be able to answer the research questions, a broad theoretical approach is needed. Due to its versatility and theoretical breadth, the person-environment fit (P-E fit) theory is used as a theoretical framework (Conway, Vickers, and French, 1992; Kristof-Brown, Zimmerman, and Johnson, 2005).

The origins of the P-E fit theory can be traced to Frank Parsons, who expressed through the trait-factor approach that a good fit between the work environment and employees' abilities can lead to higher work success (Parsons, 1909). The trait-factor approach has been the dominant approach in this research field for a long time (Su, Murdock, and Rounds, 2015). While Holland's (1966) theory of vocational choice describes that individuals choose work environments congruent to their personalities, the theory of work adjustment indicates that there is no perfect fit between individuals and their environment, so adjustments in behavior must be made (Rounds, Dawis, and Lofquist, 1987). These findings led to the addition of the assumption to the trait-factor approach; i.e., that there is a reciprocal interaction between persons and their environment (Pervin, 1968; Chartrand, 1991). The relatively static trait-factor approach was replaced by the more dynamic P-E fit approach (initially called "individual-environment fit"). The core message of the theory is that the person and the environment influence each other, and an initial mismatch can be eliminated by adjustments of the person or the environment (Chartrand, 1991).

Overall, the P-E fit theory has several theoretical assumptions:

- The interaction between a person and their environment is reciprocal and ongoing (Chartrand, 1991; Edwards, Caplan, and Harrison, 1998).
- The fit can be directly or indirectly measured and it can be objective or subjective (Edwards, Caplan, and Harrison, 1998).

- The goodness of fit between a person and their environment increase the probability of positive outcomes (Chartrand, 1991).
- Humans are capable of rational decision making (Chartrand, 1991).
- Individuals are looking for congruent environments (Chartrand, 1991).

The P-E fit theory and its basic relationships are shown in Figure 1.

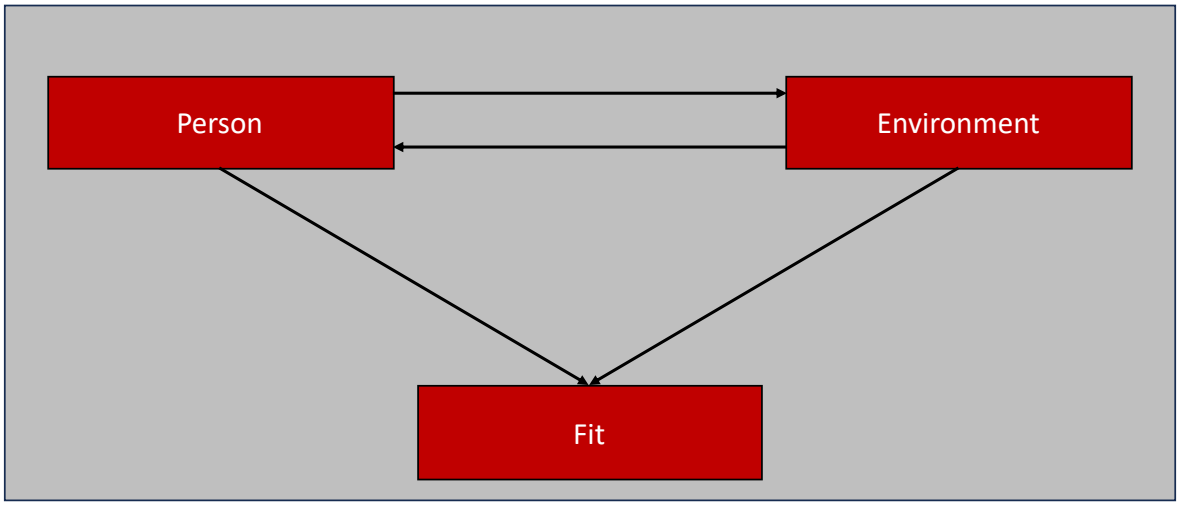

Figure 1: P-E fit theory (own illustration based on Chartrand, 1991)

Due to the broad definition of the P-E fit theory, many variations exist. While the dimension of the person is regularly not subject to any modification, the dimension of the environment is often modified in the research process. Kristof-Brown, Zimmerman, and Johnson (2015) performed a meta-analysis in which they identify four modifications of the P-E fit theory: person-job fit, person-organization fit, person-group fit, and person-supervisor fit. Above all, this meta-analysis makes it clear that it is necessary to delimit the dimensions of the P-E fit theory, particularly the environment dimension.

The fit between the person and the environment is of particular importance. Kristof-Brown and Billsberry (2013:1) state that fit is "assessed by the explicit comparison of person and environment characteristics to determine whether or not there is a match." It is essential to distinguish between the conceptualization and the fit measurement. In the frame of the conceptualization, a differentiation between the complementary and supplementary fit can be made. While the complementary fit results from a match of a person and their environment through mutually complementary characteristics, the supplementary fit occurs due to matching the characteristics of a person and their environment (Muchinsky and

Monahan, 1987; Schneider, 1987). Regarding measuring the fit, two different aspects have to be considered. First, the measurement can be direct or indirect. Second, and more important, the measurement can be subjective or objective. If the attributes of the P-E fit theory are derived from the employee's perception, then it is a subjectively measured fit, whereas attributes derived from other sources are objectively measured (van Vianen, 2018). Frequently, the fit is measured according to stress or job satisfaction (Edwards, 2008).

Person-centered approaches in workplace design have been introduced previously. Taylor (1911) and Weber (1947) were the first to suggest the influence of the workspace on work success and well-being of employees. In the workspace, the human-environment principles were often used (Becker, 1991). Primarily because of the versatile applicability of the P-E fit theory, it is also helpful for topics related to the workplace. For example, activity-based flexible work results from the P-E fit theory (Armitage and Amar, 2021). Leonard (2013) describes the P-E fit theory as a new way of designing workspaces. In addition, the P-E fit theory should also be used more against the background of changing working environments (Armitage and Amar, 2021). Against the backdrop of increased work from home, the dimensions of person and environment are becoming more critical.

In addition to the advantages that the P-E fit theory can be used in different contexts and has been used frequently for years (Caplan, 1987; Kristof-Brown, Zimmerman, and Johnson, 2005), there are also various disadvantages or limitations of this theory. Edwards, Caplan, and Harrison (1998) state that the P-E fit theory does not concretize the dimensions of person and environment and that those other sources are necessary for the specification. The two dimensions must be delimited, leading either to inflate or to limit the effects in the P-E fit theory. Furthermore, the fit between a person and their environment is only a snapshot, and the approach has no anticipatory, prognostic character. Ultimately, it cannot be ruled out that the fit always leads to positive results (De Cooman et al., 2019).

1.3 Thesis structure and synopses

With the help of the P-E fit theory, WFH can be examined holistically from the employee's perspective. First, hybrid work environments, which have been subject of much discussion since the COVID-19 pandemic, must be examined more closely. In this study, hybrid work environments include the office, WFH, and third places such as coworking spaces. This is followed by a deep dive into WFH, which includes studies on the dimensions of person and environment as well as their fit. It must be mentioned that the studies cannot be assigned to

a specific dimension. Instead, the studies set a focus and repeatedly touch on other dimensions. Figure 2 shows the studies of this cumulative dissertation integrated into the P-E fit theory.

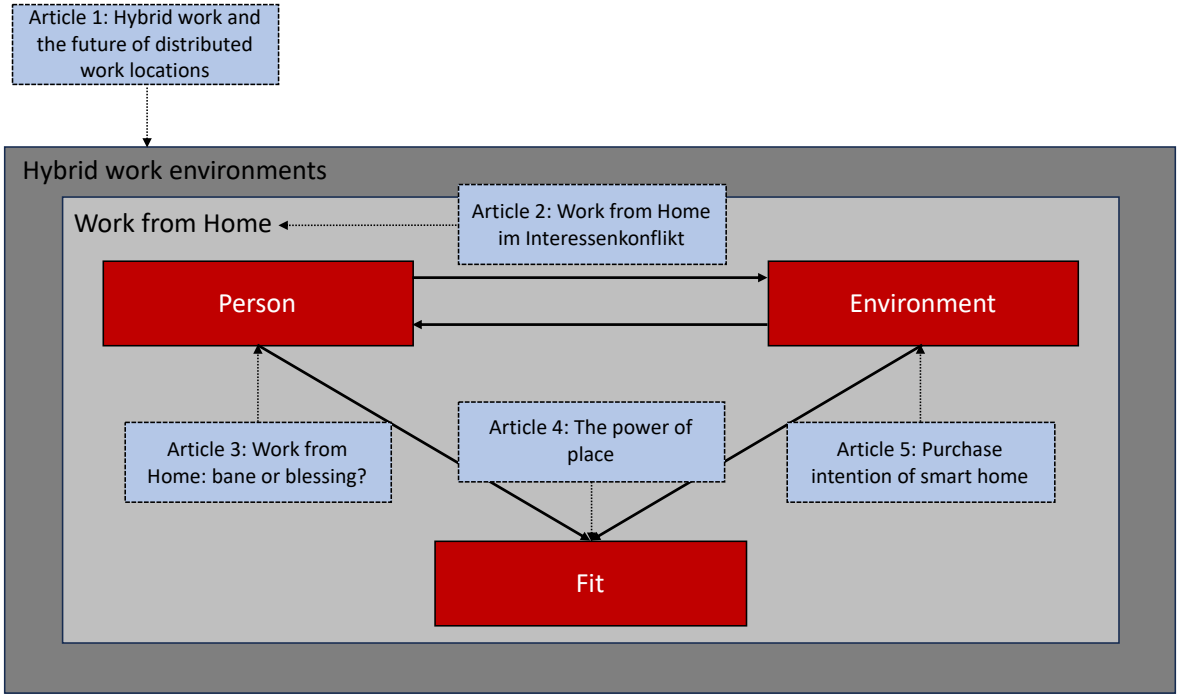

Figure 2: Theoretical framework and integration of the research articles

The dissertation comprises a total of eight chapters. In the introduction, the motivation and the research gaps are first derived, and the research questions are developed. In the second chapter, definitional demarcations are made and the impact of WFH on work success, society, and the economy is investigated. The various studies are presented in Chapters 3-7. The eighth and final chapter summarizes the results of the dissertation, classifies them in the research field, derives theoretical and practical implications, and gives recommendations for future research fields.

All articles included in this dissertation have been submitted to double-peer-reviewed research outlets. Articles 1-3 all have been published, while Articles 4 and 5 are submitted. The originally published or submitted versions are slightly adapted to ensure a consistent layout. Table 1 offers an overview of the included research articles.

Table 1: Overview of the research articles included

Chapter 3 (Article 1)	**Work experience from home: Hybrid work and the future of distributed work locations – a comparative empirical analysis between the US and Germany** Gauger, Felix; Bachtal, Yassien; Pfnür, Andreas (2022). In: *Corporate Real Estate Journal*, *11(3)*, 280-292.	**Published**
Chapter 4 (Article 2)	**Work from home im Interessenkonflikt. Empirische Analyse veränderter Arbeitsorte und praktische Implikationen** Pfnür, Andreas; Bachtal, Yassien; Gauger, Felix (2023). In: *WSI-Mitteilungen*, *76(1)*, 38-45. DOI: https://doi.org/10.5771/0342-300X-2023-1.	**Published**
Chapter 5 (Article 3)	**Work from home: bane or blessing? Implications for corporate real estate strategies** Höcker, Martin Christian; Bachtal, Yassien; Pfnür, Andreas (2022). In: *Zeitschrift für Immobilienökonomie*, *8(2)*, 101-137. DOI: https://doi.org/10.1365/s41056-022-00061-3.	**Published**
Chapter 6 (Article 4)	**The power of place: The impact of real estate on work success when working from home** Bachtal, Yassien; Voll, Kyra; Gauger, Felix; Pfnür, Andreas (2024). In: *Human Resource Management*	**Submitted**
Chapter 7 (Article 5)	**The purchase intention of smart homes and the moderating role of affinity for technology** Bachtal, Yassien; Lachenmayer, Fabian; Voll, Kyra; Pfnür, Andreas (2024): In *Building Research & Information*	**Submitted**

In addition to the research articles listed above, the following articles were also published or submitted for publication during the author's time as a research assistant and doctoral student. However, these articles are not part of the dissertation:

1. **Höcker, M. C.; Bachtal, Y.; Pfnür, A.:** Make the office great again – An empirical user-based evaluation of the office in times of hybrid working. *Submitted to: European Management Review.*
2. **Voll, K.; Bachtal, Y.; Pfnür, A.:** Employees' intention to adopt the digital workplace – the role of corporates in fostering digital transformation. *Submitted as book chapter. Book title: Humanizing the Digital Workplace: Creativity, Innovation, and Leadership in the Age of Technology*.
3. **Pfnür, A.; Voll, K.; Höcker, M. C.; Bachtal, Y. (2023):** Von der Pandemienotlösung zum Konzept multilokaler Arbeit – Empirische Studie zu den Erfahrungen der Beschäftigten für eine Zukunft an verteilten Arbeitsorten. In: Andreas Pfnür (Hrsg.): Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 50, Technische Universität Darmstadt.
4. **Pfnür, A.; Lachenmayer, F.; Bachtal, Y.; Voll, K. (2023):** So wohnen wir in Zukunft: Wie der soziodemografische Wandel das Wohnen verändert – Empirische Studie bei privaten Haushalten. In: Andreas Pfnür (Hrsg.): Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 49, Technische Universität Darmstadt.
5. **Pfnür, A.; Voll, K.; Bachtal, Y.; Lachenmayer, F. (2023):** So wohnen wir in Zukunft: Wie die Digitalisierung das Wohnen verändert – Empirische Studie bei privaten Haushalten. In: Andreas Pfnür (Hrsg.): Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 46, Technische Universität Darmstadt.
6. **Pfnür, A.; Bachtal, Y.; Voll, K.; Gauger, F. (2022):** Ökologische Nachhaltigkeit als Treiber der Transformation des Wohnens in Deutschland – Empirische Studie bei privaten Haushalten. In: Andreas Pfnür (Hrsg.): Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 45, Technische Universität Darmstadt.
7. **Pfnür, A.; Bachtal, Y. (2022):** The power of place: Die multilokale Zukunft der Arbeitswelten. In: Denkanstöße (iddiw).
8. **Bachtal, Y. (2021):** Work organization and work psychology theories in the context of Work from Home – A literature-based overview. In: Andreas Pfnür (Hrsg.): Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 42, Technische Universität Darmstadt.
9. **Pfnür, A.; Gauger, F.; Bachtal, Y.; Wagner, B. (2021):** Homeoffice im Interessenkonflikt. Ergebnisbericht einer empirischen Studie. In: Andreas Pfnür

(Hrsg.): Arbeitspapiere zur immobilienwirtschaftlichen Forschung und Praxis, Band Nr. 41, Technische Universität Darmstadt.

1.4 Presentation of the research articles

The following section provides an overview of the five research articles. For each of the five articles, the motivation of the study, the methodological approach, the main results, and the main implications are presented (see also Table 2).

Article 1 (Chapter 3): Work experience from home: Hybrid work and the future of distributed work locations – a comparative empirical analysis between the US and Germany

The first research article examines the relationship between work satisfaction and productivity depending on the place of work. Consequently, the focus is on hybrid work environments. In an international comparison between the U.S. and Germany, the article examines how hybrid work environments could look like and how companies should position themselves in such a working environment.

Flexible work regarding where and when to work has been the new normal since the COVID-19 pandemic. With the accurate use of hybrid work, both social and organizational potential can be leveraged. Broadly speaking, the success of hybrid work hinges on various factors. First, it relies on the individual employee, emphasizing the significance of their personal attributes, spatial considerations, and job-related characteristics. Simultaneously, the cultural conditions prevalent in a country play a pivotal role in shaping the dynamics of hybrid work. The article, therefore, examines which characteristics of an employee should be considered in hybrid work settings and to what extent cultural differences play a role.

To pursue these research questions, data were collected in the U.S. (n = 549) and in Germany (n = 467) in June, August, and October 2020 and a panel was established. Hofstede's cultural dimensions scores were used to quantify cultural differences. The results show that successful hybrid work depends on an employee's personal, spatial, and work-related characteristics. It also becomes clear that working in coworking spaces is less widespread in Germany compared to the U.S. This is mainly cultural as Germans prefer to avoiding uncertainty and having a long-term orientation.

Hybrid working offers companies immense added value. However, the employee and his personal, spatial, and work-related characteristics must be urgently considered. This requires structured and integrative change management.

Article 2 (Chapter 4): Work from home im Interessenkonflikt. Empirische Analyse veränderter Arbeitsorte und praktische Implikationen

The second research contribution is explicitly dedicated to WFH by daring a deep dive and looking at employees' work situations, work success at home, and their determinants. The analyses provide a basis for companies and their management to receive information about necessary changes in their Corporate Real Estate Management (CREM).

Almost all office workers have had the experience of working from home during the COVID-19 pandemic. Besides the traditional office, another workplace is now an option for employees. The physical organization of work has thus become the focus for employees and they carry out mental accounting between the different work locations. The experiences of knowledge workers explicitly allow conclusions to be drawn about the work situation and work success as well as the determinants of success.

With the help of data from German office workers ($n = 467$), the work situation and work success at home are described first. Subsequently, bivariate, correlative relationships between personal, spatial and work-related characteristics are laid as the first basis for further causal-analytic research.

The results show that satisfaction and productivity correlate with various personal, spatial, and work-related characteristics. It becomes clear that there are winners and losers in WFH and that WFH needs to hold the potential for increasing success for every office worker.

Article 3 (Chapter 5): Work from home: bane or blessing? Implications for corporate real estate strategies

The third research article is devoted to different subgroups of office workers in Germany and the U.S. It examines whether there are differences between the subgroups concerning the distribution of working time among WFH, the office, and third places. Furthermore, the article investigates whether the desired distribution of work locations also increases employee satisfaction and productivity. Based on different clusters of office workers, the paper thus provides a decision-making basis for Human Resource Management (HRM) and CREM.

The experience with WFH has revealed the immense potential of this work location. Even if, on average, work success could be increased individually, many employees show losses in productivity when working at home. WFH is only equally suitable for some office workers. Instead, the question should be answered for which office workers WFH offers added value

and for which it does not. Accordingly, there is an urgent need for the office and third places as alternatives to WFH, which are needed for different office workers in different time scales.

Sub-clusters are identified using data from Germany (n = 243) and the U.S. (n = 245). A hierarchical cluster analysis is performed, including personal, spatial, and work-related characteristics.

The results illustrate that employees in Germany and the U.S. choose their place of work according to where they can work successfully. At the same time, companies must objectively decide which employees should work at which work location with a view to the company's success. It is also clear that with increasing hybrid work setting, spatial factors take on an important role both for work success at the individual and company levels as well as in creating a corporate culture.

Article 4 (Chapter 6): The power of place: The impact of real estate on work success when working from home

The fourth research article focuses on work success at home. It examines the impact of real estate factors on satisfaction and productivity of employees when working from home. It also presents the relative importance of real estate factors compared to organizational and socio-psychological factors. The study provides a holistic approach by integrating multiple influencing factors into one model. Organizations need to look not only at the necessary condition of suitable work tasks when deciding to grant more WFH but also at the real estate conditions of the employees at home.

The research article uses the Job Demands-Resources (JD-R) model to integrate real estate, organizational, and socio-psychological factors holistically. The sample size includes n = 502 knowledge workers from Germany and the U.S. Data were analyzed using partial least squares structural equation modeling (PLS-SEM).

Results show a significant relationship between real estate factors and satisfaction and productivity in WFH. Compared to the organizational and socio-psychological factors, they have the most significant impact on satisfaction and, thus, on productivity.

Article 5 (Chapter 7): The purchase intention of smart homes and the moderating role of affinity for technology

The fifth research article investigates on the process of purchasing smart homes; particularly, the impact of increasing affinity for technology is examined. Due to the COVID-19 pandemic, individuals were rapidly forced to use smart technologies in different areas. Especially to maintain work productivity at home, employees used smart technologies more often. Nowadays, WFH is one of the main reasons for individuals to purchase smart homes. Thus, a shift toward a more digital affine society is observed.

The study uses the theory of planned behavior (TPB) to address the research question. For this purpose, a total of $n = 748$ private households in Germany were surveyed. The results were analyzed using PLS-SEM.

The results show that digitalization in housing is slowly gaining momentum through use cases such as WFH. In this context, subjective norms, i.e., the influence of family, friends and colleagues, have a remarkable impact on the willingness to purchase smart homes. Furthermore, the perceived control of private households, i.e., the available resources such as money or information, influences the willingness to purchase. In some cases, affinity for technology moderates the effect positively, so an increasing affinity for technology in society leads to a higher willingness to buy smart homes.

Table 2: Overview of the research articles

Study	Research Question	Methodology	Main Contributions
Article 1	Does work success in a hybrid work setting depend on space and what role does culture play?	Quantitative approach using data and bivariate analyses	Successful hybrid work depends on an employee's personal, spatial, and work-related characteristics and on the culture of a country.
Article 2	Are there employees who are particularly successful when working from home?	Quantitative approach using data and bivariate analyses	The results show that satisfaction and productivity correlate with various personal, spatial, and work-related characteristics.
Article 3	Are there subgroups of employees who strive for a different distribution of working hours at different locations?	Quantitative approach using data and hierarchical cluster analyses	The results illustrate that employees in Germany and the U.S. choose their place of work according to where they can work successfully.
Article 4	Is there an impact of real estate factors on satisfaction and productivity and how important is real estate in comparison to organizational and socio-psychological factors at WFH?	Quantitative approach using data and PLS-SEM	Results show a significant relationship between real estate factors and work success in WFH; compared to organizational and socio-psychological factors, these have the most significant impact.
Article 5	What are the antecedents of the purchase intention of smart homes and is there a moderating effect of affinity for technology?	Quantitative approach using data and PLS-SEM with moderation	The results show that digitalization in housing is slowly gaining momentum through its use cases such as WFH.

2 Theoretical foundation and review of the literature

In this chapter, the theoretical foundations are first discussed in order to create a better framework for understanding of the subsequent research articles. The definitional foundations are laid at the beginning. In particular, the terms “remote work”, “telework”, “WFH”, and “hybrid” or “multilocal” work are defined. Subsequently, existing scientific findings regarding the connection between telework or WFH and work success of employees are discussed. The chapter ends by presenting the social and economic effects of WFH.

2.1 Definitional delimitation of different work concepts

In the past, knowledge work was usually performed in the office. This rigid concept of working at a centralized workplace has increasingly dissolved and remote forms of work are gaining ground. Remote work does not occur at a centralized workplace such as an office (Heidt, 2023). Most studies dealing with remote work have examined the specific remote form, known as “telework.”

Telework is the result of different but simultaneous acting megatrends. Above all, digitalization, globalization, and flexibilization meant that telework became increasingly important in the 1970s (Gschwind and Vargas, 2019; López-Igual and Rodríguez-Modroño, 2020). The debate surrounding telework is broad and, consequently, there is no uniform definition of the term. However, certain aspects of the debate keep emerging. Telework is remote work (work from outside the office) that is only made possible through the use of ICT (Olson and Primps, 1984; Gillespie, Richardson, and Cornford, 1995; Huws, 1996; Nilles, 1997; Pérez Pérez, Martínez Sánchez, and Pilar de Luis Carnicer, 2003). Due to the breadth of the definition of telework, depending on the research focus, various subcategories of telework have emerged. This means there is a need for a more precise, project-specific definition of the work location (Yap and Tng, 1990; Sullivan, 2003). Early research on telework focused primarily on the potential of telework to reduce or eliminate commuting and was subsumed under the term “telecommuting” (Saxena and Mokhtarian, 1997). Another subcategory of telework that has rapidly gained prominence in science is working from home using ICT (Huws, 1997). In the literature, the terms “telework” and “WFH” have often been used synonymously (Lamond, Standen, and Daniels, 1998; Baruch, 2000). Studies on “telehomeworkers” are the predecessors to today’s studies focusing on WFH. Based on the previous statements, in this dissertation, WFH means working from home at least one day per week by using ICT.

However, many employees not only WFH but also spend a certain proportion of their working time either in the office or at third places. Therefore, hybrid work is becoming increasingly important in the work environment. Halford (2005:22) states that "hybrid workspaces are not simply relocated or dislocated, but multiply located. People work both from home and from an organizational workplace using virtual technologies to connect the two spaces." An essential feature of hybrid work is that it is not limited to working from home or in the office but also includes work at third places, with the free choice of work location for employees (Bouncken and Gantert, 2021; Gauger, Bachtal, and Pfnür, 2022). At the same time, the term "multilocality of work" is often used in this context. Multilocality of work includes the combination of office, WFH, and third places as work locations, made possible through ICT (Pfnür et al., 2023c). Hybrid work and multilocality of work are also often used as synonyms (Voll, Gauger, and Pfnür, 2023; Bouncken, Lapidus, and Qui, 2022; Pfnür et al., 2023c). In this dissertation, hybrid work or multilocality of work is understood as a concept that combines the office, WFH, and third places, and is possible due to the use of ICT.

2.2 Work from home and its impact on work success of employees

Classification of the term "work success" is a highly debated topic in research and encompasses several dimensions. Yalabik et al. (2013) describe work success as a process that directly influences job performance (output) based on employees' attitudes (input). However, at the same time, employee attitudes can also indirectly influence job performance through work engagement (throughput). The causal relationships are shown in Figure 3.

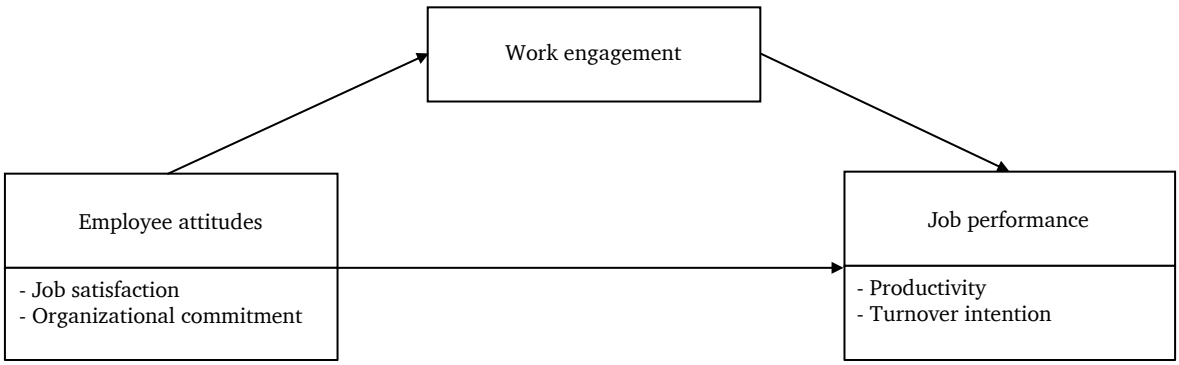

Figure 3: Causal relationships on work success (own representation based on Yalabik et al., 2013)

Employee attitudes toward their job or organization can be represented, for example, by job satisfaction. Job satisfaction describes the extent to which employees like or dislike their job and its various facets (Locke, 1976). Weiss (2002) describes job satisfaction as an emotional state in which people affectively and cognitively weigh what they feel or think about their job. Organizational commitment is another construct often used to measure employee attitudes (Yalabik et al., 2013). Work engagement in this context is seen as a mediator between employee attitudes and job performance. Work engagement is a psychological status that measures involvement, commitment, enthusiasm, and passion toward the job (Attridge, 2009; Bakker and Demerouti, 2008; Yalabik et al., 2013). The output of the process of work success is job performance, which is often measured by individual productivity. Productivity represents the ratio of output achieved to resources used (Brinkerhoff and Dressler, 1990; Aronoff and Kaplan, 1995). In the model of Yalabik et al. (2013), turnover intention is also used as a construct to measure job performance.

The relationship between employee attitudes (in particular job satisfaction) and job performance is strongly discussed. Judge et al. (2001) examined different relationships between job satisfaction and job performance as summarized in Table 3.

Table 3: Causal relationships between job satisfaction and job performance (based on Judge et al., 2001)

Model	Causal Relationship
1	Job satisfaction causes job performance.
2	Job performance causes job satisfaction.
3	Job satisfaction and job performance are reciprocally related.
4	The relationship between job satisfaction and job performance is spurious.
5	The relationship between job satisfaction and job performance is moderated by other variables.
6	There is no relationship between job satisfaction and job performance.
7	Alternative conceptualizations of job satisfaction and job performance.

Due to its frequent use in science, this dissertation uses Model 1 and Model 5 for the causal relationship between job satisfaction and job performance.

Job satisfaction as a measure of employee attitudes and productivity as a measure of job performance have also been studied in the context of WFH, albeit often separately. The studies often came to different conclusions. Bellmann and Hübler (2021) state that remote work does not clearly affect job satisfaction. In contrast, Bloom et al. (2015) show in an experiment that WFH can lead to higher job satisfaction. Other studies are more cautious, stating that WFH can impact job satisfaction and that this positive signal should receive more attention from companies (Irawanto, Novianti, and Roz, 2021). These different assessments of the connection between WFH and job satisfaction are mainly because the assessment of WFH varies widely among the respondents. Pfnür et al. (2021) depict that real estate, organizational, and socio-psychographic factors should be considered when employees individually assess WFH. For example, job satisfaction when working from home is rated higher by employees who have a high family centrality at home (higher home-to-work enrichment) (Bölingen, Carrillo, and Weller, 2023) and respondents with a separate room and adequate ergonomic furniture are often more satisfied by working at home (Tleuken et al., 2022).

The study situation is also diverse concerning productivity, with most studies postulating a positive impact of WFH on productivity and only a few showing no or a negative relationship (Anakpo, Ngwayibana, and Mishi, 2023). Alfanza (2021) reports no significant relationship between productivity and the amount of remote work. On average, Shi et al. (2020) indicate that only 23.8 % of employees are more productive at home, finding that productivity fell by as much as 8-19 % among employees in IT (Gibbs, Mengel, and Siemroth, 2021). In contrast, Barrero, Bloom, and Davis (2021) show a productivity increase of around 5 % through optimized work arrangements and the integration of WFH, and Pfnür et al. (2021) show an average productivity growth of 14 %. Here, too, it is clear that these are average values and that the individual situation of each employee must always be considered. Thus, family-work conflict (Tsang, Liu, and Nguyen, 2023; Galanti et al., 2021) and social isolation (Toscano and Zappalà, 2020) have a negative impact on productivity at home while self-leadership and autonomy are positively associated with productivity at home (Galanti et al., 2021).

2.3 Work from home and its impact on society and economy

WFH can not only offer added value at the level of work success of an employee or the company but can also offer potential for society and the economy as a whole. The number of hours worked at home amplifies positive and negative spillovers on employees' work and lives (Massar et al., 2023; Bölingen, Carrillo, and Weller, 2023). Due to WFH, labor markets

are no longer regionally limited and the potential group of employees is, thus, larger for companies (Mello, 2007). At the same time, the COVID-19 pandemic forced people to adapt, accept, and use technology at home more quickly (Maalsen and Dowling, 2020). As a result, the willingness of the population to use technology has increased massively and WFH is intensifying the process of integrating more smart home technologies (Alhussein, Kocaballi, and Prasad, 2022). In particular, technologies that support WFH are becoming increasingly important (Barrero, Bloom, and Davis, 2021). Guan et al. (2022) describe that WFH can increase a company's overall productivity with the help of the right technologies at home. Thus, Rana et al. (2021) report increased productivity and well-being among workers working from smart homes. WFH has led to an increase in the degree of digitization; in particular, the appropriate use of smart home technologies can further increase the efficiency of WFH. The ICT infrastructure is still the most significant challenge when integrating WFH and smart home technologies (Malti and Wamba, 2023).

The blurring of boundaries between living and working leads to increased adaptation of technologies at home, and WFH is changing living as a whole. If more people work from home, then this could lead to a shift in the desired form of housing, reconsidering one's own living location, and changing housing markets (Doling and Arundel, 2022; Pfnür et al., 2023a). Mainly due to WFH, there is a tendency of private households wanting to live more in the outskirts of the city and not in the inner city (Pfnür et al., 2023b), and they are more sensitive to amenities in the neighborhood (Robbennolt, Haddad, and Bhat, 2023). As a result, average house prices in inner-city locations are falling while prices in peripheral areas are rising (Delventhal, Kwon, and Parkhomenko, 2022). These urban exodus tendencies due to WFH directly affect the inner cities themselves. Studies assume that WFH directly reduces spending in major city centers by at least 5-10 % compared to the pre-pandemic period (Barrero, Bloom, and Davis, 2021).

3 Article 1: Work experience from home: Hybrid work and the future of distributed work locations – a comparative empirical analysis between the US and Germany

Title:	Work experience from home: Hybrid work and the future of distributed work locations – a comparative empirical analysis between the US and Germany[1]
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Published in:	Corporate Real Estate Journal

Abstract

Already two decades ago it was claimed that "work is no longer a place – it is an activity that can be conducted anywhere". This quote is equally true and false. While COVID-19 demonstrated in a large-scale experiment that a significant proportion of work activities can be performed flexibly and in the home office, the importance of place has come to the forefront of employee's minds. Although work is not necessarily tied to a place, the location determines the efficiency of work performance to a significant extent. This paper shows how work satisfaction and productivity depend on space and elaborates on future distributed work locations and spatial split where the different activities will ideally be performed. Future work will be multilocal, divided between the "first", "second" and "third" place. Whereas the first place – the home office – is ideal for concentrated tasks with high work autonomy, the second place – the corporate office – becomes more and more a place for social interactions and face-to-face tasks. If employees have no ideal work conditions at home, third places – such as coworking spaces – can serve as a "first" place for employees and take over its function, but third places can also serve as substitute for the second place. Empirical data shows that these alternative work environments will gain traction in the post-COVID world, especially in the US.

[1] Please note that this article is written in British English and therefore differs from the rest of the dissertation, which generally uses American English.

3.1 Hybrid, multilocational work

Location independence of work has become the new normal since the COVID-19 pandemic has changed the way we work. Employees have largely worked from home, allowing companies and employees to gain large-scale home office experience that would otherwise probably not have occurred to such an extent without the pandemic. These flexible work practices, virtual teamwork, and working from home, at least for some days a week, could remain part of the future way of working (Brynjolfsson et al., 2020; Bloom, 2020). While positive effects for organisations have already been demonstrated for telework (Harker Martin and MacDonnell, 2012), the experience that corporates and employees gained due to flexible work from home has also been predominantly positive. It became apparent that working from home turned out better than expected; work underwent a metamorphosis and resurfaced in new forms (Orel, 2021). Thus, employees are constantly evaluating their workplace and adjusting their work patterns regarding time, space and location of work. There has never been a greater focus on organising the physical workplace and employees are aware of the significance of their spatial work settings that determine work success. Consequently, the organisational distribution of work locations could be an even more important argument for corporates regarding the recruitment of employees ("war for talents") than it was before.

While concentrated work and working productively in a home office was very successful, collaboration, team spirit and social interaction was not as effective from home. Employees missed social exchange, spontaneous chats in the coffee kitchen and having other people around. It turned out that implicit knowledge could not be shared sufficiently. In addition, the good results due to working from home were achieved because many employees already knew each other through face-to-face work in the corporate office before COVID-19. Employees already knew the right contacts and knowledge holders in the company. This simplified knowledge processes and made it easy to move communication from the physical into the digital realm. In addition, the positive results of working from home can only be evaluated on average. A certain number of employees, especially younger employees with less job experience, were less successful working from home (Pfnür et al., 2021).

This also shows, however, that the experience during COVID-19 cannot be transferred one-to-one to the future world of work. For new employees who are not yet familiar with the organisational structures, new challenges arise because they do not yet know their colleagues, frameworks and knowledge processes well enough (Blanchard, 2021). Young talents in particular need the physical social interaction and exchange of ideas on site. For

companies, challenges but also new potentials for acquiring talents arise when employees are more distributed and are no longer concentrated in certain regions or labour pools. In addition, companies could lose an important competitive advantage as a result of the lack of employer branding when not using the corporate building.

This suggests that no complete spatial delimitation of the office will occur, as the office is still an important place for social interaction, creativity, branding and collaboration. The sense of community and creativity through cooperation and collaboration with others influences work success. Therefore, the right mix of different workplaces results in massive advantages in terms of employee satisfaction and productivity. This mix is called hybrid working, which can provide a suitable solution by combining work from home, office and other independent workplaces. Table 4 shows some of the definitions of hybrid working given so far in the literature.

Table 4: A definition of hybrid working

Definition of hybrid working	Source
"Hybrid workspaces are not simply relocated or dislocated, but multiply located. People work both from home and from an organisational workplace, using virtual technologies to connect the two spaces. This raises questions about practices of work, organisation and management where individuals are relocated *and* dislocated *and* continue to participate in more traditional organisational spaces. Spatial hybridity changes the nature of work, organisation and management across domestic space, organisational space and in cyberspace."	Halford (2005:19 et seq.)
"A hybrid workforce essentially refers to a workforce that is distributed across different locations, from traditional office and factory spaces to remote locations, including within employees' living space, be it a family home or shared apartment. A hybrid working model is characterized by the flexibility and choices it offers employees, and it can be an innovative way of driving new approaches to agility, collaboration, and ways of working."	Capgemini (2020:2)

Basically, this work model means a combination of mobile working, semi-mobile working and office-based working. (...) Hybrid working gives employees the choice of how, when and, crucially, from where they work best.	Hoog (2020)
"We identify boundarylessness, multitasking, non-work-related interruptions, and demand for constant learning as hybrid work characteristics in the modern work environment."	Xie et al. (2019:479)

A common feature of the definitions is that hybrid working does not only refer to the interaction of working in the corporate office and from home, but rather to flexible working from any location (third places) with the employees' own choice of their workplaces (Bouncken and Gantert, 2021). Furthermore, the term hybrid working also includes aspects that involve the realisation of spatial factors, flexibility, sensemaking of work and a high degree of self-responsibility (Bouncken and Gantert, 2021). While there is a consensus that only a certain amount of work will be done from the office and that hybrid working will be a significant part of future office work, research is still in the early stages on how this mix can be achieved and when it will lead to the highest possible success for organisations (Yang et al., 2022). We are therefore examining the factors that influence employee satisfaction in this hybrid work settings and how corporates can understand and influence employee productivity when working flexibly and hybrid. Therefore, we analyse important factors of work satisfaction and productivity that were gained through a research project during COVID-19 in the US and Germany to better understand the role of the office in the future. We also give hints when to use which work location and how to combine office, work from home and third places. Additionally, the paper provides practical implications to achieve the benefits of hybrid working environments.

3.2 Work efficiency as a function of the workplace

While the office is the place for work, the home is supposed to be the place for living, privacy and recreation. This allocation has changed dramatically, however, due to working from home, and boundaries between work and life have become blurred. This is also evident from the fact that job satisfaction is massively dependent on the spatial conditions and the physical workplace, not only with regard to the office but to all other workplaces as well. Satisfaction with home office work is positively related to job satisfaction (reflected with a correlation

coefficient of r=.34). US employees showed a high satisfaction working from home with a mean of 5.75 on a scale from 1 = highly unsatisfied to 7 = highly satisfied. Compared to Germany, having a mean of 5.64, US respondents were slightly more satisfied with working from home. Nevertheless, it should be mentioned that employees in both countries show a high level of satisfaction when working from home.

The higher satisfaction of American employees in home office can be partly explained by real estate factors. In the US, participants indicate having more living space on average. Not only is the total living space larger, but the area of workspace at home, with an average of 249sq. ft, is also nearly 86sq. ft larger than in Germany. While the German participants report having an average of around 3.8 rooms per household, in the US the average is 4.3 rooms. Fifty-five per cent of German participants have a separate room to use as home office, compared to around 69 per cent of US participants (see Figure 4).

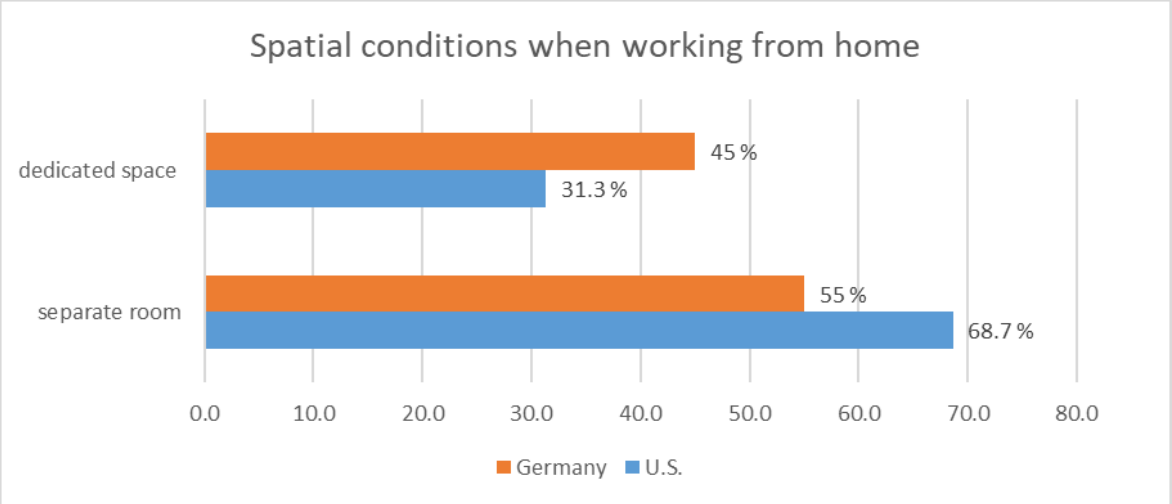


Figure 4: Spatial conditions in home office

This suggests that the better, more comfortable and larger living situation in the US is the reason for the higher level of work satisfaction in home office. Both US and German participants state that on average, they are able to work more productively from home than in the corporate office. Although they suffer from more loneliness working from home, about 68 per cent of the American participants (German participants: 56 per cent) would rather agree that they are more productive working from home compared to the office. These findings are in line with Leesman (2021), who find that more people work productively from the home office compared to their office environment. This emphasises the fact that corporate offices, which were meant to solely fill the function of high work productivity, in

their present form are no longer up to current requirements and circumstances of employees' needs. Work has increasingly shifted to knowledge work, which requires an alternation between concentration tasks and creative tasks in direct exchange with people. For example, a large part of work time is now spent on processing e-mails, which can be done in a more concentrated manner in home office. If, on the other hand, teamwork is required, the corporate office can provide the necessary space and contribute substantially to a collaborative work environment.

Two considerations can be taken into account in this context. On the one hand, work thrives on multilocality and a flexible choice of work location. If employees have the flexibility to choose where to perform certain tasks, they achieve the highest fit between type of work and spatial supporting conditions. In addition to this freedom of choice, the nature of work plays a major role. Home office has its advantages when work can be done in a concentrated way at a stretch, making people feel more efficient and productive. Creative and innovative work that benefits from close interaction, on the other hand, requires the joint presence of those involved.

For this reason, the office remains important, but will fulfil a different function in the future. It will become a place of social connectivity.

Our results also show that people with higher incomes, older people and people with more job responsibility feel more comfortable working from home, while young people benefit even more from direct exchange on site.

The survey reveals that future use of the corporate office will account for around one-third of the working time in both countries. About 43 per cent of the working time in the US will be spent in home office and around one-quarter in third spaces, such as coworking spaces. In Germany, coworking spaces play a minor role. These multi-occupied flexible and vibrant offices can specifically serve as a substitute for the corporate office or the home office. All those employees who do not find ideal working conditions at home or in the office will find good working conditions for creative and productive work in coworking spaces. Figure 5 shows the proposed share of working time of the multiple workspaces in future.

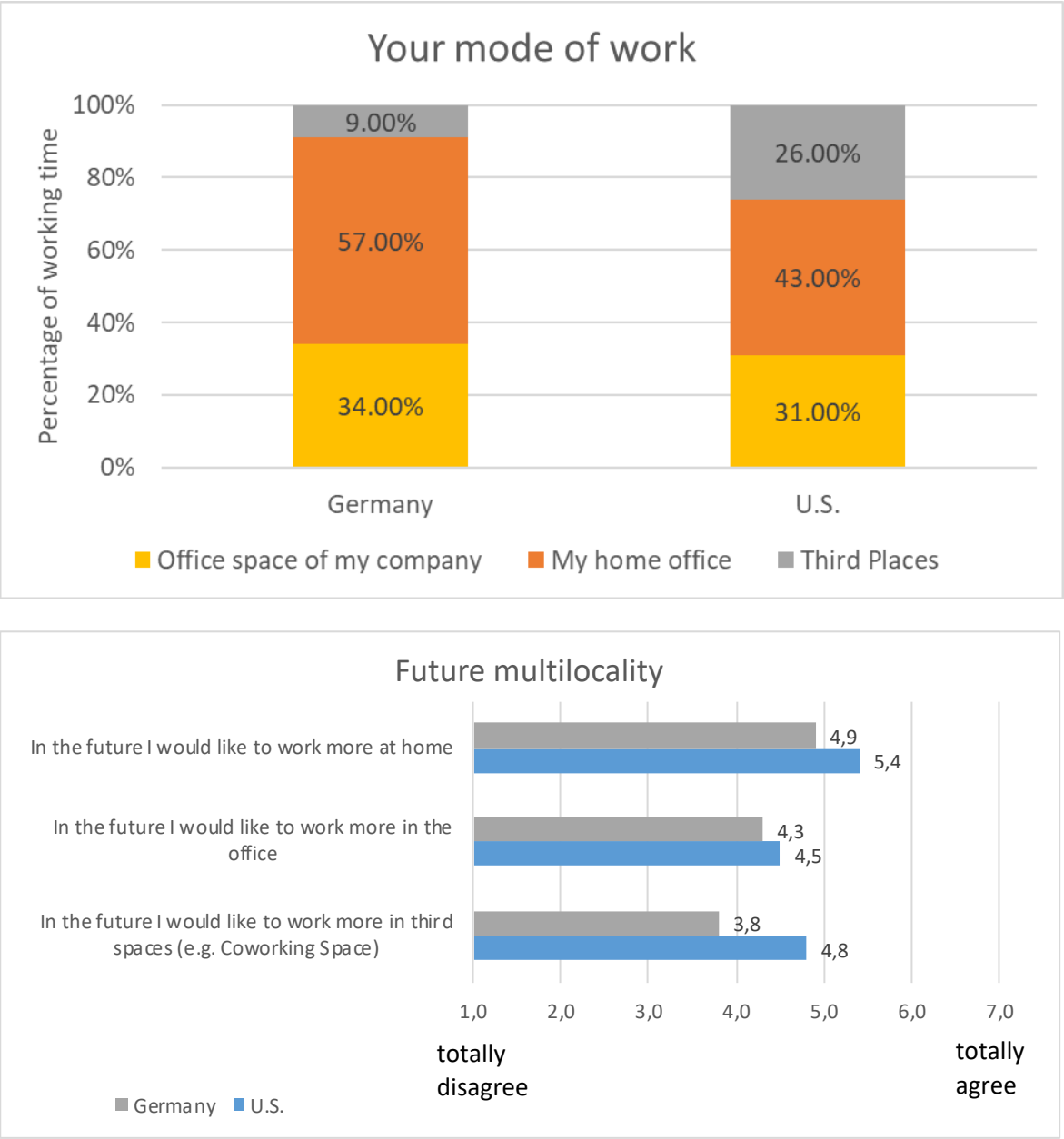


Figure 5: Share of workplace and percentage of working time in the US and Germany

3.3 What determines future multilocality and why it differs significantly between Germany and the US

Do coworking spaces substitute for the home office in Germany and for the corporate office in the US? There are some reasons for this thought. While US respondents have higher work satisfaction at home due to better spatial conditions, German respondents show a slightly higher propensity to work in the corporate office. Americans already have more prior experience working in third places. The results show that 67 per cent of the participants in the US would rather agree that they have experience working in coworking spaces, whereas only 13 per cent of the German participants have experience in coworking spaces. On the

contrary, a share of 71 per cent of the German participants (only 22 per cent of the American participants) would rather disagree that they have experience working in coworking spaces. The "Starbucks way of working" and gig economy of the US support this idea of flexible working. Thus, Americans are better able to appreciate the advantages of coworking space compared to the corporate office. These flexible and thriving workspaces, which are specialised in creativity and collaboration, take over the function of the corporate office and also enable commuting time to be saved. Another aspect of the establishment of coworking spaces in Germany that should not be underestimated, and which goes hand in hand with experience, is the freedom of employees to decide where they want to carry out their work. Thus, 69 per cent of the survey participants in the US state that they are free to decide where they perform their work. In Germany, it is 44 per cent.

These two reasons identified for the desired future multilocality can be justified from an overarching perspective of cultural peculiarity. For this purpose, the cultural dimensions according to Hofstede can be used. The dimensioning of cultures takes place within six categories: power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, long-term versus short-term orientation, and indulgence versus restraint (Hofstede, 1984). Germany and the US differ in their cultural peculiarities especially in uncertainty avoidance, long-term orientation and indulgence. The scores for these six cultural dimensions for Germany and the US are shown in Figure 6.

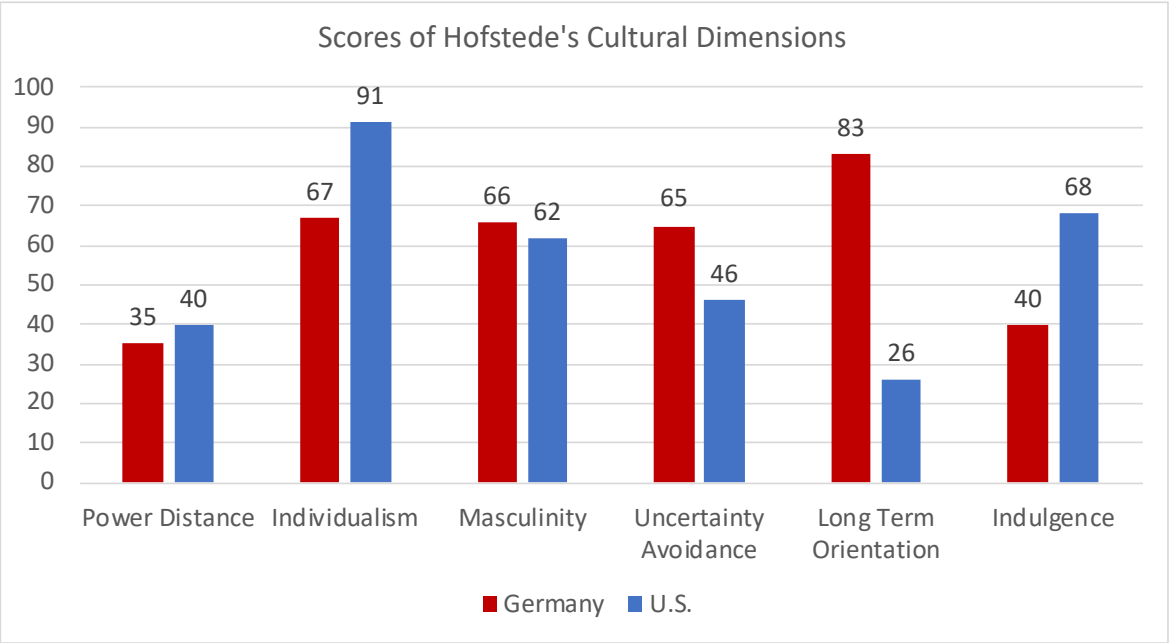


Figure 6: Scores of Hofstede's cultural dimensions (Hofstede's Insights, 2021)

In contrast to the US, Germany is a country that is strongly characterised by the avoidance of uncertainty and a long-term orientation. It is precisely these cultural peculiarities, however, that contradict hybrid and thus also flexible working, especially in third places. In contrast, the US is characterised by a more short-term orientation which accompanies with the business model of many providers of third places. A higher need for indulgence also enables the use of modern coworking spaces and explains that US participants prefer vibrant third workspaces, especially in view of the fact that American corporate office buildings might also lack modernisations compared to the German office buildings. The trend away from individual freelancers to larger companies using coworking spaces is present and increasing. This could also be due to the fact that American companies are more willing to experiment and have a lower long-term orientation than German companies, which still rely heavily on ownership and long-term leases. The empirical results, especially the affinity of participants from the US to work in coworking spaces, can thus also be substantiated on the basis of cultural dimensions.

It seems that in the US, coworking spaces tend to replace the corporate office, while in Germany they are most likely to replace the (rather smaller) homes as a place to work. We therefore assume that as German employees gain more experience in coworking spaces and have the opportunity to decide where to carry out their work, they will increasingly consider them as an alternative place to work. If coworking spaces respond with a wide variety of office configurations and offer concentration rooms, dedicated desks, but also opportunities for collaboration and face-to-face interactions, they will meet the requirements of future work.

3.4 How third places will evolve in the post-pandemic times

While coworking spaces initially emerged almost exclusively in central business district (CBD) locations, an increasing number of these flexible workplaces are being developed in more rural and residential environments, substituting for employees with less ideal working conditions at home. If coworking operators particularly focus on these future users with adverse working conditions at home, they can access a new group of users who would otherwise have worked from home. The location independence of work that leads to thriving suburban areas, which are more affordable, is changing the business model of third places toward neighbourhood-based coworking spaces that are close to the workplace at home. While employees continue to save commuting time, they have the benefits of work-life segregation, more social interaction and less loneliness in these shared work environments. The boundaries between satellite offices, coworking spaces and corporate offices are then becoming blurred, as hybrid working intends to do.

This trend is also accompanied by an increased number of employees from large companies working in these spaces. While freelancers used to be the main users, the ratio between freelancers and employees from small companies and corporations is becoming more evenly split. For example, WeWork, a widespread example of coworking space providers has over 30 per cent users from large companies.

By taking into account the efficiency scope of work from home and its implications for hybrid working, corporates need to consider how they can ideally support individual work success of their employees in order to maximise organisational outcomes. The above-mentioned study (Pfnür et al., 2021) shows the broad distribution of opportunities and risks very clearly. According to the results of the study, from the point of view of employers and thus also the national economy, labour productivity is growing by 14 per cent on average in Germany when working from home (see Figure 7).

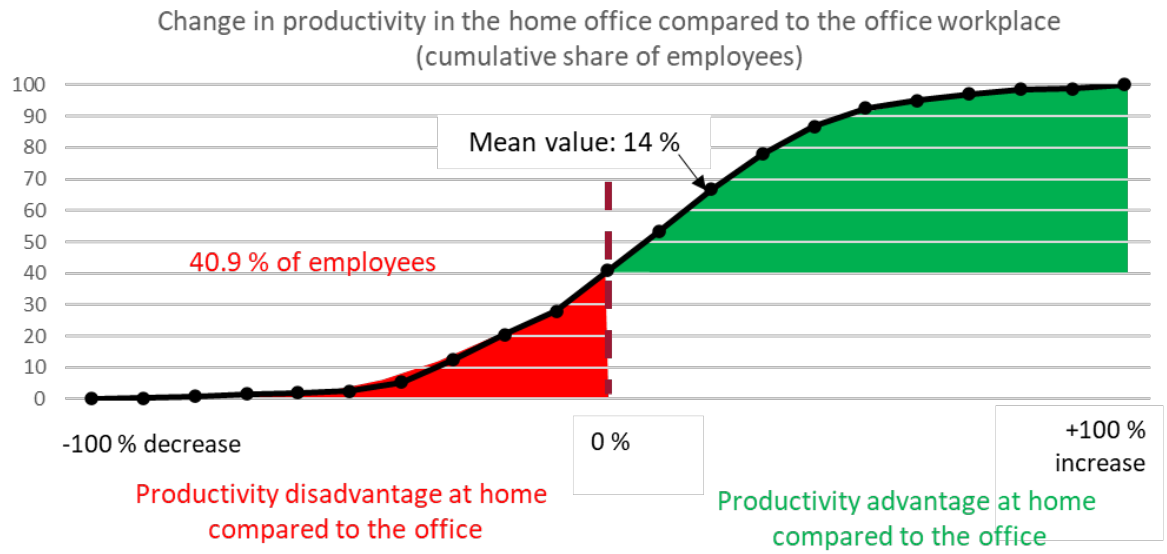


Figure 7: Productivity change from working at home, own illustration based on Pfnür et al., 2021

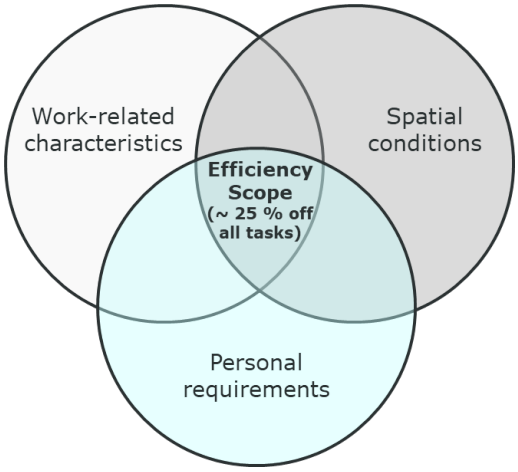
The results show a strong correlation between productivity and job satisfaction of the individual employee in home office. From this close statistical correlation of the success variables, a fundamental equality of interests between employers and employees can be derived with regard to the home office situation.

From an individual as well as an overall societal perspective, the study results show on average great opportunities for individuals to better integrate life and work. Family bonds, neighbourhood and district communities can be strengthened. There are opportunities for unattractive residential areas and city centers. On the individual level, commuting time is reduced and can be used for alternative leisure or work time. On the societal level, fewer commuting trips and traffic leads to reduced CO_2 emissions and higher air quality, especially in large cities.

Employees working from home show an exceptionally wide range of productivity, however. For example, 40 per cent of employees in home office are less productive than in the office. If this group of people or work tasks are forced to work in home office, productivity and job satisfaction would plummet, in some cases drastically, compared to work in the office. This is mainly due to an inadequate real estate situation. For example, only slightly less than two-thirds of employees at home have the necessary conditions to work properly. Personal prerequisites in the areas of socio-demographics as well as personality traits (psychographics) need to be appropriate for working at home, which is also only the case for just under two-thirds of all employees. It is important to understand, for example, that

not every personality type is predestined for this flexible work. In terms of the Big Five personality traits, the results show that conscientiousness and agreeableness are positively related with working from home.

Finally, only just under two-thirds of all work tasks fulfil the prerequisites to be done successfully from home due to organisational and technical characteristics (see Figure 8).



Correlation	Work-related characteristics	Spatial conditions	Personal requirements
Positively related	Leadership responsibility Higher job experience, high job autonomy and variety, digital affinity	Attractive urban neighbourhood, neighbourhood community, more rooms, own workroom, garden, balcony, attractive architecture, good environmental factors (daylight, fresh air, etc.)	Older and wealthier, married Big Five traits: conscientiousness and agreeable
Negatively related	Low job experience (rookie), low decision-making authority, part-time job	CBD area, apartment building, high-rise building, few rooms, no own workplace	Single, bored, stressed personality

Figure 8: Efficiency of work from home, own illustration based on Pfnür et al., 2021

In weighing up the opportunities and risks, employees and companies alike must decide:

1. Which individuals have positive personal prerequisites;
2. Which tasks can be performed by these individuals in home office; and
3. Whether the spatial conditions for efficient working at home are given.

Only if all three criteria are met work from home is the efficient workplace variant. Otherwise, the office or third places of work should be chosen as the physical location for completing tasks. So far, this is basically far less often the case than previously assumed. The empirical results indicate that this is currently the case in about 25 per cent of all task-employee combinations. Large corporations in Germany strive to roughly achieve this percentage of home office work to be the new normal in the near future. It is interesting that the 1,000 employees surveyed in Germany in the above-mentioned study stated that they had already spent about 25 percent of their working time in home office before the pandemic. If one compares these results with studies conducted among employers, there are clear upward deviations. Obviously, the number of unreported cases of home office use was considerable, perhaps because employers did not want to know about it officially or were allowed by labour law to have their teams work from home.

The new experiences during COVID-19 and working at home have shown that employees care about their working conditions and spatial factors. They have learned what kind of work works best from home, what kind of tasks work best in (good) offices, and when they prefer to work in other places like coworking spaces. With this new knowledge of hybrid working and the reshaping of interactions, knowledge work is withstanding the challenge of volatile environments and constant change. Companies are advised to carefully examine which workflows and work roles can best be assigned to the respective places. If employees are well aware of their efficiency scope and can select the appropriate work location depending on the work process, hybrid working can reach its potential.

3.5 Practical Implications

Companies are in constant need to adapt their workspaces to the changing, volatile business environment. This agile working is reflected in future ways of working hybrid and flexible. The physical workspace needs to optimally support the new demands of workers, which are ideally accompanied by less hierarchical structures, a high degree of autonomy and the possibility to work flexible in terms of time and place (Gratton, 2021). From an organisational perspective, hybrid working offers the potential to enhance organisational

success, whereas initially an intensive change management process of the organisations is required. From the organisations' perspective, it is not the individual work success of an employee at a particular work location that is of interest, but the overall organisational success. Thus, it is essential to clarify in a close exchange between employers and employees which work activities can be carried out at which workplace, which employees are suitable for hybrid working, and which organisational, legal and technical requirements must be met. Managers and corporate real estate (CRE) must understand the settings that employees have when working from home and which characteristics support the employee working from home, from the office, or a third place. We therefore provide a framework with characteristics that should be considered when evaluating the different workplaces. Table 5 gives first hints which factors to evaluate and how they vary across the workplace.

Table 5: Considerations and impact of characteristics across the different workplaces in hybrid work

	Criteria	**Home Office**	**Corporate Office**	**Third Spaces**
Personal characteristics	Relationship status	Married	Single	
	Age/Seniority	Senior professionals	Younger professionals	Young to medium professionals
	Work experience	Medium to high	Low	
	Leadership responsibility	Yes	No	
	Personality	Conscientiousness and agreeableness	All types are equally found in the office	Openness and Extraversion
	Work-Life Balance	If work-life separation not valued high	If work-life separation is valued high	If work-life separation is valued medium to high

Spatial characteristics	Work situation at home	Own work room or dedicated area with own work desk	No work room, no separate space and no quite areas	No work room, no separate space and no quite areas
	Living Situation	High standards, balcony, terrace High number of rooms	Low to medium standards Only few rooms	Low to medium standards Only few rooms
	Social interaction at home	Strong cohesion with the neighbourhood	No neighbourhood, no integration	Replaces neighbourhood cohesion, or interaction at the office
	Commuting	High commuting costs and long commuting time	Few to medium commuting costs and time	High commuting time
Work characteristics	Privacy requirements	High privacy needs	Medium privacy needs	Low to medium privacy needs
	Corporate culture	Not valued high	Valued high	Valued medium
	Task variety	High variety of tasks and requirements	Repetitive and simpler tasks	

Also, the protection of sensitive organisational data must be ensured in hybrid working. The paper illustrates the increasing awareness among employees of the importance of the physical organisation of work for their individual success at work but also for their own well-being. Hence, the office and the specific spatial design are moving more into the focus of employees. Under the premise of hybrid working and thus an increased collaborative function of the office, some CREs are no longer up to date, so that an adapted strategic orientation of CRE management could present a competitive factor in the labour markets in the coming years. This includes not only the adaption of office space, but also the provision

of third places, such as satellite offices, to offer an alternative for those employees who have not the spatial conditions to work from home. Individual office spaces adapted to hybrid working also represent added value for corporate branding and, in the long term, also for employee retention. Consequently, hybrid working offers not only the possibility of self-determined work of the employees but also of tapping additional skilled labour potential in order to generate a real competitive advantage especially when looking at the "war for Talents". Moreover, spatial boundaries of the labour market for organisations become blurred due to hybrid working. From an overall societal perspective, organisations can limit the mobility of employees by implementing hybrid working which can offer advantages from sustainability considerations but also from regional planning considerations. Last but not least, hybrid working also depends on the respective culture of the country. For example, countries that, due to their culture, tend to avoid uncertainties or strive for a long-term orientation may be significantly slower in the implementation process of hybrid working than countries that prefer short-term orientation.

In summary, hybrid working refers to all adjustments within a company that are necessary for location flexibility. This includes the diversity of the workplace in terms of spatial flexibility and the voluntary and self-determined choice of the employee where to work. Employees will adapt to these new characteristics and build a social ecosystem around their hybrid workspaces that now extends to the home and to third places. That might result in changes of the housing situation, of neighbourhoods and local accommodations. Future research agenda will tell how the housing situation adapts to these new needs. This shift is accompanied by a hybridisation where the physical workspace is combined with a digital, virtual component. Working from home will be combined with presence in the office and working from third places.

4 Article 2: Work from home im Interessenkonflikt. Empirische Analyse veränderter Arbeitsorte und praktische Implikationen

Title:	Work from home im Interessenkonflikt. Empirische Analyse veränderter Arbeitsorte und praktische Implikationen[2]
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Zusammenfassung

Die *Work-from-home*-Erfahrungen der Covid-19-Pandemie haben nicht nur die Arbeitswelten in Betrieben und Gesellschaft durcheinandergewirbelt, sondern massiven Einfluss auf die Frage genommen, wie Wissensarbeit zukünftig physisch organisiert wird und wie Leben und Arbeiten zukünftig räumlich koordiniert werden. Der Beitrag zeigt auf Basis empirischer Daten, welche Konflikte sich primär aus räumlich-immobilienwirtschaftlicher Sicht auf das *work from home* in Wirtschaft und Gesellschaft ergeben.

4.1 Problemstellung

Während der Covid-19-Pandemie konnten nahezu alle Bürobeschäftigten Erfahrungen mit der Arbeit von zu Hause aus machen. Für einen Großteil von ihnen war die Situation des Arbeitens aus der häuslichen Umgebung heraus neu, da sie zuvor regelmäßig den Weg an den Bürostandort ihres Betriebs angetreten und von dort gearbeitet hatten. Für diejenigen, die beide Arbeitsorte kennen, setzte diese neue Situation ein ständiges *mental accounting* in Gang, bei dem die Arbeit zu Hause und im Büro vergleichend gemessen und bewertet wird. Im Ergebnis stehen sowohl bisherige Büros und ihre Standorte als auch die Wohnungen nach der *Work-from-home*-Erfahrung aus Sicht der meisten Beschäftigten in einem anderen Licht da als zuvor. Zu erwarten ist, dass auf Dauer gravierende Auswirkungen auf die physische Organisation der Arbeit eintreten, auf die sowohl die individuellen Beschäftigen in ihrem Arbeitsverhalten als auch die Betriebe in ihren allgemeinen Organisations- und Managementstrukturen reagieren werden. Mittelbar sind aus veränderten räumlichen

[2] Please note that this article is written in German and therefore differs from the rest of the dissertation, which generally uses American English

Aufenthaltsorten während der Büroarbeit Auswirkungen auf die gesellschaftlichen Strukturen sowie weitere Bereiche wie die Immobilienwirtschaft, die öffentliche Infrastruktur oder die Verkehrssysteme zu erwarten. Das allgemeine Strukturwandelpotenzial des *work from home* ist deshalb über die engere Betrachtung der Arbeitswelt hinaus hoch

Im Zentrum des *work from home* stehen die Beschäftigten selbst. Deshalb soll hier mithilfe empirischer Analysen zunächst ein tieferes Verständnis des Zusammenhangs zwischen der Arbeit von zu Hause und dem Arbeitserfolg aus Sicht der Beschäftigten geschaffen werden. Die Analysen der Beschäftigtendaten bilden eine erste Basis, deren Erkenntnisse auch für die Betriebe und deren Management Hinweise auf nötige Veränderungen ihrer Arbeitswelten und des betrieblichen Immobilienmanagements geben.

4.2 The power of place: Zusammenhang zwischen Arbeitsort und Arbeitserfolg

Obwohl es unmittelbar einleuchtet, dass die räumliche Anordnung der Beschäftigten im Arbeitsprozess direkten Einfluss auf den Arbeitserfolg hat, wurde dies im Rahmen der betriebswirtschaftlichen Management- und Organisationslehre lange Zeit nur am Rande behandelt. In den einschlägigen Lehrbüchern der Management- und Organisationslehre findet sich mit Ausnahme von Krüger (1994) kaum eine Berücksichtigung dieser Aspekte.

Erst in den neueren immobilienwirtschaftlichen Untersuchungen wird die geplante Gestaltung des Arbeitsortes zu einem relevanten Thema. Die einschlägige empirische Forschung zur physischen Organisation des Büroarbeitsplatzes geht bis in die 1930er Jahre zurück. Trotzdem zeigen Appel-Meulenbroek, Clippard und Pfnür (2018) in ihrem Übersichtsbeitrag über den Stand der empirischen Forschung, dass aufgrund der außergewöhnlich hohen Komplexität der Zusammenhänge sowie der Transdisziplinarität der Forschungsansätze erst die Spitze des Eisbergs bekannt ist und noch zahlreiche weiße Flecke auf der Forschungslandkarte bestehen. Appel-Meulenbroek und Danivska (2021) haben den Stand wissenschaftlicher Theorien zum Zusammenhang von Individuen und der Bürogestaltung quer durch alle Disziplinen in einem Reader zusammengefasst.

Krupper (2013) zeigt den Zusammenhang zwischen der nutzerbasierten Bewertung von Büroimmobilien einerseits und der Zufriedenheit, Produktivität, Gesundheit, dem *organizational citizenship behavior* sowie den Fehlzeiten und der Fluktuation der Beschäftigten andererseits. Zahlreiche Untersuchungen (für eine Übersicht siehe die Arbeit

von Krupper, 2013) haben zwischenzeitlich dargelegt, dass starke Wechselwirkungen zwischen der Immobilie, der Arbeit und den sozialen und psychologischen Strukturen der Nutzer bestehen. Clippard (2020) zeigt in einem sehr umfassenden Literaturüberblick die Entwicklung vom schlichten physischen Arbeitsplatz zum modernen *open space* sowie die wachsenden wissenschaftlichen Erkenntnisse, wie dieser Entwicklungsprozess auf den Arbeitsplatz wirkt. In 600 ausgewerteten Studien unterschiedlichster Disziplinen wie beispielsweise der Psychologie, Architektur, Wirtschafts- bzw. Managementwissenschaft, Immobilienwirtschaft, Arbeitswissenschaft, dem Bauingenieurwesen und der Medizin wird ein sehr komplexes Puzzle zahlreicher Wirkungsmechanismen zwischen gebauter Umwelt und Arbeitserfolg Stück für Stück entblättert.

Der Arbeitsort nimmt ganz allgemein Einfluss auf die Verrichtung der Büroarbeit, im Besonderen besteht aber auch ein komplexer Zusammenhang zum Arbeitserfolg (Clippard, 2020). In der empirischen Messung des Arbeitserfolgs kann Erfolg einerseits objektiv beispielsweise durch Daten des Rechnungswesens oder subjektiv über Einschätzungen gemessen werden. Grundsätzlich dürften objektive Daten auch in Bezug auf Reliabilität und Validität (Hammann und Erichson, 2000) bessere Qualität liefern, allerdings sind sie im praktischen Einsatz zur Messung des Zusammenhangs von physischem Arbeitsort und Arbeitserfolg nur selten durchführbar. So bereitet die nötige persönliche Individualisierung der meisten Analysen große Probleme im Hinblick auf die Anforderungen des Datenschutzes. Ferner ist es in vielen Arbeitssituationen schwierig, objektive Messindikatoren zu finden. Nur in Ausnahmenfällen wie beispielsweise der Studie von Bloom et al. (2015) war es möglich, durch die computergestützte Aufzeichnung jedes Klicks von Callcenter-Agenten im Reisebüro objektive Erfolgsdaten zu gewinnen. In der Praxis behilft man sich deshalb zumeist mit subjektiven Einschätzungen entweder der Beschäftigten selbst oder ihrer Vorgesetzten (Krupper, 2013). Grundsätzlich kann der Erfolg anhand des Inputs, Throughputs oder Outputs oder Outcomes der Arbeit gemessen werden. Die meisten Studien messen aufgrund der höheren Güte des Messmodells den Outcome oder gleich mehrere Größen, wenn auch Input-Output-Relationen gemessen werden (Bloom et al., 2015; Appel-Meulenbroek, Clippard und Pfnür, 2018).

Während es auf der individuellen Ebene in den Studien zur Messung des Arbeitserfolgs vor allem um die Messung der Arbeitszufriedenheit geht, steht aus betrieblicher Sicht vor allem die Messgröße der Arbeitsproduktivität im Mittelpunkt (Clippard, 2020). Vergleichbar der Situation auf der individuellen Ebene, wurde auch auf der betrieblichen Ebene den Zusammenhängen von physischer Organisation der Arbeit und dem Unternehmenserfolg

sehr lange kaum Beachtung geschenkt. Erst um die 1990er Jahre herum entstanden weltweit durch die Unternehmenspraxis getriebene Konzepte für ein *Corporate Real Estate Management* (CREM) (vgl. z. B. Brown, Lapides und Rondeau, 1994).

In den letzten Jahren ist im CREM auch die Arbeit von anderen Arbeitsorten als dem Büro verstärkt in den Blickpunkt geraten. Grundsätzlich lässt sich ein großer Teil der Büroarbeit von nahezu jedem beliebigen Ort ausführen. Solange es sich dabei nicht um das eigene Zuhause der Beschäftigten handelt, wird in Anlehnung an die raumsoziologischen Arbeiten Richard Floridas (Florida, 2012) von sogenannten dritten Arbeitsorten *(third places)* gesprochen (Oldenburg, 1999). Heutzutage stellen *flexible workplaces* einen Großteil der third places dar. Einen Überblick über den Stand der *Flexible-workplace*-Forschung bietet Gauger (2021). Gauger demonstriert auch empirisch, dass dritte Arbeitsorte im Vergleich zu den Firmenbüros erheblichen Einfluss auf den Arbeitserfolg nehmen können. Im Ergebnis zeigt er, dass es kein *one best model* der Zuordnung von Arbeit zu Arbeitsorten gibt, sondern nur einen *best fit*, der zusätzlich auch durch persönliche Merkmale der Beschäftigten bestimmt wird.

Neben ihrem Büro dienten einem Teil der Beschäftigten ihre *first places*, wie Richard Florida (2012) den Wohnort nennt, als Arbeitsort. *Work from home* hat in vielen Betrieben mit der Digitalisierung bereits vor der Covid-19-Pandemie an Bedeutung gewonnen. Beispielsweise stieg nach Angaben des Branchenverbands Bitkom der Anteil der Beschäftigten, die Erfahrungen mit dem *work from home* gemacht haben, von 22 % im Jahr 2014 auf 39 % im Jahr 2018 an (Bitkom Research, 2019). Entsprechend hat das Themenfeld *work from home* auch in der Forschung international stets zunehmende Beachtung gefunden. Eine gute Übersicht bietet Bachtal (2021). Ebenso wie an *third places* hat auch die Arbeit an *first places* teils erheblichen Einfluss auf den Arbeitserfolg im Vergleich zum Büro (Bloom et al., 2015). Auch hier wiederholt sich die Erkenntnis, dass es kein *one best model* der Zuordnung von Arbeit zu Arbeitsorten, sondern unter Einbezug persönlicher Merkmale nur einen *best fit*, dessen nähere Analyse insbesondere auch die im Folgenden dargestellte empirische Studie dient.

4.3 Empirische Situation des work from home

4.3.1 Konzeption der Studie

Im Zuge der aufkommenden Covid-19-Pandemie wurden rund um die Welt *Social-distancing*-Regeln eingeführt, die die Wissensarbeit aus den Büros zu den Beschäftigten nach Hause

verlagerten. Für den Forschungsprozess ergab sich die bis dato einzigartige Gelegenheit, die Erfahrungen mit dieser *Work-from-home*-Situation empirisch zu erfassen. Auch an der TU Darmstadt wurde ein umfassendes Projektprogramm auf Basis einer breit angelegten empirischen Studie begonnen. Die Studie und ausgewählte Ergebnisse daraus sind Gegenstand des folgenden Abschnitts. Ziel dieser Studie ist es, den Einfluss der Arbeitsumgebung zu Hause auf den Arbeitserfolg der Beschäftigten zu analysieren.

Wie oben bereits dargestellt wurde, wird der Einfluss der physischen Organisation des Arbeitsorts auf den Arbeitserfolg aus Gründen der Praktikabilität zumeist durch Selbsteinschätzung der Proband*innen gemessen; so auch hier. Im Homeoffice lassen sich durch Selbsteinschätzung der Probandinnen und Probanden Messgrößen auf den unterschiedlichsten Ebenen des Arbeitsprozesses (Input, Throughput, Output, Outcome) messen. In diesem Projekt basieren die betreffenden Konstrukte auf vergleichenden Einschätzungen (Büro vs. Homeoffice) zur individuellen Arbeitszufriedenheit, zur wahrgenommenen Produktivität, zur Arbeitsleistung, zum Arbeitsaufwand, zur Ablenkung, zur Work-Life-Balance sowie zahlreichen eher mittelbaren Faktoren wie vor allem Privatsphäre, Teamzusammenhalt, Unternehmenskultur, Kreativität, Innovativität, Boreout- und Burnout-Risiken, Befindlichkeit sowie beruflichen Entwicklungsmöglichkeiten. Auch wenn aus Platzgründen nachfolgend nicht alles gezeigt werden kann, so wurden im Rahmen des empirischen Projektteils alle diese Indikatoren mit Konstrukten und den dazugehörigen Indikatoren gemessen (vgl. zu weiteren Größen des Arbeitserfolgs Pfnür, Seger und Appel-Meulenbroek, 2021). Die Berücksichtigung zahlreicher Variablen entlang des Arbeitsprozesses verbessert zwar die Qualität des Messergebnisses hinsichtlich des Arbeitserfolgs, dennoch besteht in der Subjektivität der Daten eine wichtige Limitation des Forschungskonzepts.

Limitierend auf die Studienergebnisse wirkt ferner der Zeitraum der Studiendurchführung. Die Feldphase erfolgte als Onlinebefragung in drei Befragungswellen von April bis Oktober 2020 mit durchschnittlichen Befragungszeitdauern von jeweils ca. 30 Minuten. Es ist zu erwarten, dass in diesem Zeitraum während der Covid-19-Pandemie zahlreiche Sondereinflüsse auf die allgemeine Lebenszufriedenheit der Probandinnen und Probanden aufgetreten sind. Ein Beispiel sind Störungen durch Haushaltsmitglieder, die sich im Normalfall nicht ebenfalls zu Hause aufhalten würden. Auch ist von späteren Gewöhnungseffekten an die Pandemie- sowie *Work-from-home*-Situation auszugehen, die hier zu diesem frühen Stadium noch nicht gemessen wurden. Im Studienkonzept gibt es deshalb umfangreiche Befragungsteile, mit denen die spezifischen Einflüsse der

Sondersituation in der Pandemie identifiziert, bewertet und aus den Ergebnissen bestmöglich herauskontrolliert werden. Unterm Strich lässt sich allerdings nicht ausschließen, dass die Befragungsergebnisse einerseits einen Pandemie-Bias enthalten und andererseits mögliche Gewöhnungseffekte an eine langfristige *Work-from-home*-Situation noch nicht beinhalten. Hier kann allerdings eine Wiederholung der Studie zu einem späteren Zeitpunkt für Klarheit sorgen.

Die Grundgesamtheit der Studie besteht aus Wissensarbeiter*innen mit Erfahrungen in der Büroarbeit sowie im *work from home*. Um internationale Vergleichbarkeit herstellen zu können, wurden zu Beginn der Befragung jeweils 1.000 Beschäftigte aus Deutschland und den USA befragt. Nachfolgend liegt der Schwerpunkt in diesem Beitrag auf den Befragungsergebnissen der deutschen Probandinnen und Probanden. Die Studienteilnehmer*innen entsprechen nach regionaler Verteilung sowie den demografischen Kriterien in etwa der Verteilung der Grundgesamtheit der Bürobeschäftigten (vgl. zu diesem Abgleich Pfnür et al., 2021). Die Panelmortalität beträgt in beiden Ländern über die drei Befragungswellen hinweg in Summe ca. 50 %, mit dem Resultat, dass in Deutschland 467 Probandinnen und Probanden an allen drei Befragungen teilgenommen haben.

Wo immer möglich, wurde im Fragebogen auf bereits in der empirischen Sozialforschung erfolgreich getestete Skalen zur Messung der Konstrukte zurückgegriffen. Bis auf spezielle immobilienwirtschaftliche Inhalte war das fast überall der Fall (Pfnür et al., 2021).

4.3.2 Realität des work from home

Für eine möglichst prägnante Beschreibung der Realität des *work from home* ist zunächst eine Darstellung der Arbeitszeitverteilung sowie der Aufwandsdifferenzen zur Verrichtung der Arbeit im Büro von Bedeutung. Die wichtigsten Studienergebnisse dazu lassen sich wie folgt zusammenfassen:

- Bereits *vor der Pandemie* haben die Proband*innen nach eigener Aussage durchschnittlich 25 % ihrer Arbeitszeit zu Hause verbracht. Diese Zahl ist insbesondere angesichts der Zahlen, die in deutschen Großunternehmen kursieren oder in deren Befragungen genannt werden, überraschend hoch. Vermutlich haben viele Arbeitnehmer*innen hier zu Hause gearbeitet, ohne dass die Unternehmen davon wussten oder in ihren Statistiken davon Kenntnis genommen haben. Spätestens durch die Covid-19-Pandemie haben alle Proband*innen dann Erfahrungen mit dem *work from home* gemacht.

- Nach dem unabhängig von der derzeitigen Realität *zukünftig erwünschten Anteil* an Arbeitszeit zu Hause gefragt, gaben die Proband*innen durchschnittlich knapp drei von fünf Arbeitstagen (60 %) an.
- An anderer Stelle des Fragebogens und in einem etwas breiteren Kontext der Verteilung der Arbeitszeit auf die unterschiedlichen Arbeitsorte befragt, gab der Durchschnitt der Proband*innen an, 54 % der Arbeitszeit zu Hause, 39 % im Firmenbüro und 5 % an dritten Arbeitsorten verbringen zu wollen. Die Wünsche zu den Arbeitsorten streuen allerdings erheblich. Beispielsweise würde fast ein Drittel gerne 75 % und mehr von zu Hause arbeiten.
- Korrespondierend dazu gehen deutsche Bürobeschäftigte durchschnittlich davon aus, tatsächlich auch 60 % ihrer Arbeitsaufgaben durch mobiles Arbeiten erledigen zu können.
- Der Arbeitsplatz zu Hause umfasst im Durchschnitt 15 Quadratmeter bei einer hohen Standardabweichung von zehn Quadratmetern.
- An jedem *Work-from-home*-Tag werden durchschnittlich 30 Minuten Pendelzeit im Verkehr pro Strecke eingespart. An Büro-Arbeitstagen legen 45 % der Beschäftigten diese Strecke mit dem eigenen PKW zurück, 22 % mit dem Fahrrad oder zu Fuß, 18 % mit dem ÖPNV und 10 % mit der Bahn.
- Ein ausführlicher Vergleich der Unterschiede in allen relevanten Haushaltsausgaben zeigt, dass durch das *work from home* die durchschnittlichen Kosten in Summe um 46 Euro pro Monat gestiegen sind. Verantwortlich dafür sind vor allem die Energiekostensteigerungen, die insbesondere die Verringerung der Pendelkosten überkompensieren.

4.3.3 Erfolg des work from home

Die Realität des *work from home* beeinflusst den Arbeitserfolg. Nachfolgend sollen an dieser Stelle Arbeitszufriedenheit und Produktivität als outcome-bezogene Maße des Arbeitserfolgs näher betrachtet werden:

- Die Variable der Arbeitszufriedenheit im Homeoffice beschreibt am ehesten die individuelle Sicht der Beschäftigten auf ihren Arbeitserfolg zu Hause. Zufrieden oder vollständig zufrieden mit ihrer Arbeitssituation im Homeoffice zeigen sich 53 %, wohingegen nur 28 % der Befragten diese Einschätzung in Bezug auf ihren Büroarbeitsplatz haben.

- Die durchschnittliche Produktivitätsveränderung wird mit einem Zugewinn zwischen 11 % in der ersten und 14 % in der dritten Befragungswelle eingeschätzt. In der ersten Befragungswelle gaben 34 % und in der zweiten Welle 40,9 % der Befragten an, im Homeoffice weniger produktiv zu sein. Die Standardabweichungen sind entsprechend hoch (29 % in Welle 1 und 41 % in Welle 3). Vermutlich gab es Lerneffekte im *work from home*.
- Zwischen beiden Variablen ist der Zusammenhang vergleichsweise hoch. Die Pearson-Korrelation zwischen der Zufriedenheit und Produktivität im Homeoffice ist auf dem 1-%-Niveau (2-seitig) positiv signifikant, der Korrelationskoeffizient beträgt 0,686.
- Die Work-Life-Balance im *work from home* beurteilen 45 % der Probandinnen und Probanden als positiv, 22 % sehen dieses Konstrukt für sich kritisch.

Summa summarum lässt sich festhalten, dass das *work from home* im Durchschnitt die Arbeitszufriedenheit steigert, der Erfolg über die Probandinnen und Probanden hinweg aber sehr stark streut. Personen, die Vorteile in Bezug auf die sozialpsychologischen Dimensionen Arbeitszufriedenheit und Work-Life-Balance erkennen, profitieren auch in der ökonomischen Dimension der Arbeitsproduktivität. Über die Wirkungsrichtung ist dabei aber noch keine Aussage getroffen.

Orientiert man sich an den arbeitsinput-orientierten Indikatoren, zeigen die Befragungsdaten unter anderem folgende Ergebnisse:

- Ihren Arbeitsaufwand im Homeoffice nehmen 46 % höher als im Büro wahr, 13 % stimmen dem nicht zu.
- 58 % der Befragten nehmen im *work from home* für sich selbst eine höhere Arbeitsqualität wahr, nur 17 % hingegen stimmen dieser Aussage nicht zu.
- 40 % der Befragten machen im Homeoffice kürzere Pausen als im Büro.
- Zwei Drittel der Befragten geben an, im Homeoffice teils erheblich besser erreichbar zu sein.
- Zur Messung von Motivationsverlust und Ablenkung wurde ein gemeinsames Konstrukt gebildet. Während 15 % angeben, hier Einbußen gegenüber der Büroarbeit wahrzunehmen, stimmen 56 % der Befragten dem nicht zu.
- 53 % der Befragten geben an, dass sich Berufliches und Privates durch die *Work-from-home*-Situation gegenüber der Bürotätigkeit stärker vermischen.
- 34 % der Befragten geben an, zu Hause auch gearbeitet zu haben, obwohl sie sich nicht wohlgefühlt hätten.

Alles in allem geben die Befragten im Vergleich zwischen Büro und *work from home* im Durchschnitt deutlich der eigenen Wohnung den Vorzug. Sie fühlen sich hier (63 %) insgesamt eher wohl als im Büro (48 %). Die Daten zeigen insgesamt, dass die Mitarbeiter und Mitarbeiterinnen im *work from home* durchschnittlich für einen höheren Outcome auch mehr investiert haben. In Bezug auf die Entgrenzung von Arbeit und Privatleben zeigen die Befragungsergebnisse ein geteiltes Bild.

4.3.4 Determinanten des Arbeitserfolgs im work from home

Die empirische Analyse zeigt oft signifikante und vergleichsweise hoch korrelierte Zusammenhänge zwischen den Input- und Output-Variablen des Arbeitserfolgs. Um den Zusammenhang zwischen den Variablen und dem Erfolg zu überprüfen, wurden Korrelationsanalysen durchgeführt (zu näheren Erläuterungen vgl. Pfnür et al., 2021). Die Tabelle 6 fasst die wichtigsten Ergebnisse zur Korrelation von Arbeitserfolg und Determinanten zusammen.

Tabelle 6: Zusammenhang zwischen Arbeitserfolg und Determinanten – Pearson-Korrelationskoeffizient r

Merkmale	**Zufriedenheit im Homeoffice**	**Produktivität im Homeoffice**
Personenbezogene Merkmale		
Alter	0,14**	0,19**
Anzahl Personen im Homeoffice	0,02	– 0,04
Anzahl Kinder	–0,02	–0,07
Einkommen	0,14**	0,10**
Berufserfahrung	0,16**	0,15**
Stressniveau	–0,16**	–0,02
Einsamkeitsniveau	–0,56**	–0,40**
Langeweile-Niveau im Leben	–0,36**	–0,20**
Langeweile-Niveau im Job	–0,34**	–0,18**
Digitale Stressresistenz	0,33**	0,29**
Offenheit für digitale Technologien	0,23**	0,20**
Arbeitsbezogene Merkmale		
Aufgabenvielfalt	0,231**	0,158**
Anforderungsvielfalt	0,268**	0,135**

Autonomie Entscheidungen	0,255**	0,100*
Autonomie Planung	0,255**	0,126**
Technologische Ausstattung	0,45**	0,27**
Immobilienwirtschaftliche Merkmale		
Größe der Wohnung/des Hauses	0,090	0,066
Größe des Arbeitsplatzes im Homeoffice	0,159**	0,075
Anzahl der Zimmer	0,212**	0,150**
Nachbarschaft	0,198**	0,110*
Sanierungszustand	0,147**	0,029
Bauqualität	0,180**	0,099*
Energetische Qualität	0,200**	0,152**
Inneneinrichtung	0,174**	0,077
Äußere Architektur	0,159**	0,116*
Arbeitsfördernde Eigenschaften der Immobilie	0,585**	0,418**
Empfundene Zufriedenheit mit der Wohnung allgemein	0,521**	0,261**
Anmerkung: Signifikanzniveau (2-seitiger Test): * $p < 0,05$; ** $p < 0,01$		

Aufgrund des niedrigeren Skalenniveaus wurden einige Variablen in der Korrelationsanalyse nicht berücksichtigt, die dennoch in Mittelwertvergleichen interessante Ergebnisse liefern. Unter den weiteren persönlichen Merkmalen zeigt erstaunlicher Weise das Geschlecht keinen Einfluss, weder auf die Arbeitszufriedenheit noch auf die Produktivität. Mittelwertvergleiche nach Bildungsabschluss zeigen, dass die Promovierten (Zufriedenheit 5,9 / Produktivität 4,8. Likert-Skala 1-7, 7=max.) den höchsten Arbeitserfolg im *work from home* erzielen, Realschüler hingegen einen deutlich niedrigeren (5,4 / 4,8). Im Modell der „Big Five"-Persönlichkeitsmerkmale (Rammstedt et al., 2012) gehen die Eigenschaften „verträglich" und „gewissenhaft" mit einer höheren Zufriedenheit im *work from home* einher. Für die Merkmale Offenheit, Extraversion und Neurotizismus lassen sich keine Zusammenhänge bestätigen.

Eine weitere relevante Größe unter den arbeitsbezogenen Merkmalen ist die Führungsverantwortung. Die Befragungsteilnehmer*innen mit Führungsverantwortung haben im Durchschnitt einen höheren Arbeitserfolg (Arbeitszufriedenheit 5,6 / Produktivität 4,9) gegenüber denjenigen ohne Führungsverantwortung (5,4 / 4,6).

Weitere bemerkenswerte Ergebnisse liefern auch die Mittelwertvergleiche zu den Standortfaktoren der Wohnung, die zu den immobilienwirtschaftlichen Rahmenbedingungen des *work from home* zählen. Am zufriedensten und produktivsten im Vergleich mit ihrem Büroarbeitsplatz schätzen sich diejenigen ein, die in Stadtrandlagen wohnen (Zufriedenheit 5,5 / Produktivität 5,0). Der Arbeitserfolg der Innenstadtbewohner (5,2 / 4,5) fällt demgegenüber ebenso ab, wie jener derjenigen, die auf dem Dorf oder im Grünen leben (5,4 / 4,7). In Bezug auf die Zufriedenheit bestätigen auch weitere Daten der Analyse einen Trend, nach dem der *Work-from-home*-Erfolg vom Land kommend mit der Nähe zum Zentrum bis zum Standrand zunimmt, dort einen Gipfel erreicht, und dann in innerstädtischen Wohnlagen wieder abnimmt.

Vergleicht man die Mittelwerte des Arbeitserfolgs in unterschiedlichen Wohnungsqualitäten, zeigen sich ebenfalls bemerkenswerte Unterschiede. So bewerten Proband*innen in durchschnittlichen Wohnungen den Arbeitserfolg mit 5,2 (Zufriedenheit) respektive 4,6 (Produktivität), wohingegen der Erfolg in Luxuswohnungen deutlich ansteigt (6,3 / 4,8).

Summa summarum zeigen die Ergebnisse, dass der Arbeitserfolg im *work from home* mit vielfältigen personenbezogenen, arbeitsplatzbezogenen und immobilienwirtschaftlichen Merkmalen in Zusammenhang steht. Die statistisch gesehen engsten Zusammenhänge zeigen unter den persönlichen Faktoren das Merkmal Einsamkeit, unter den arbeitsbezogenen Faktoren die technologische Ausstattung und in Bezug auf die räumlichen Faktoren die arbeitsfördernden Eigenschaften. Unter dem Begriff arbeitsfördernde Eigenschaften verbergen sich die sogenannten *Indoor Environmental Quality* Faktoren (IEQ) wie Belichtung, Raumklima, die Großzügigkeit sowie die Qualität von Sichtachsen und weitere architektonische Merkmale. Insgesamt weisen diese immobilienwirtschaftlichen Eigenschaften den engsten Zusammenhang mit den Erfolgsvariablen auf.

4.4 Praktische Implikationen aus den Perspektiven der unterschiedlichen Stakeholder

Die Studienergebnisse (zu vertieften Analysen vgl. auch Pfnür et al., 2021) haben unmittelbare Auswirkungen auf die Akteursgruppen der Arbeitswelten, die Beschäftigten und deren Betriebe. Nachfolgend werden die Implikationen der Studienergebnisse aus der Sicht dieser Stakeholdergruppen diskutiert.

4.4.1 Beschäftigte

Den größten Einfluss haben die neu gewonnen Erfahrungen im *work from home* auf die Beschäftigten. Hier gibt es klare Gewinner und Verlierer. Zu den Gewinnern gehören beispielsweise die verheirateten, älteren, erfahrenen Beschäftigten mit höherem Haushaltseinkommen, mehr persönlicher Autonomie und höherer Hierarchieebene im Unternehmen, die vom Persönlichkeitstyp her die „Big-Five"-Eigenschaften „verträglich" und „gewissenhaft" repräsentieren. Auch für die Job-Life-Integration erhöht sich der Spielraum. Hingegen gehören zu den Verlierern die ledigen, jüngeren Berufsanfängerinnen und -anfänger mit niedrigem Haushaltseinkommen, niedriger Entscheidungsbefugnis, geringer Berufserfahrung, Teilzeitbeschäftigung, die von den Persönlichkeitsmerkmalen her eher gestresst und gelangweilt sind. Gerade für die Verlierergruppe steigt das Risiko für Personen, die dem Risiko der Vereinsamung und des Boreouts ausgesetzt sind.

Der stärkste Indikator für einen positiven Arbeitserfolg der Beschäftigten ist allerdings ihre jeweilige räumliche Situation. Positiv wirken vor allem die Größe und Qualität der Wohnung, die Attraktivität der Nachbarschaft sowie Freisitze und möglichst umfangreiche Grünflächen. Negativ wirken beispielsweise Urbanität, geringe Lebensqualität des Standorts, wenige Zimmer, minderwertige Bauqualität, mangelhafte Instandhaltung und schlechte Architektur. Die immobilienwirtschaftlichen Erfolgsfaktoren korrelieren in vielen Zusammenhängen recht hoch mit den persönlichen und arbeitsbezogenen Eigenschaften. In der praktischen Anwendung ist deshalb die Wohnsituation der Beschäftigten ein guter Indikator, der mit recht hoher Trefferwahrscheinlichkeit Aussagen darüber ermöglicht, wer zu den Gewinnern und Verlierern der *Work-from-home*-Arbeitssituation gehören dürfte.

Dass *work from home* für die Beschäftigten eine uneingeschränkt freiwillige Option bleibt, ist nicht zu erwarten. Auch wenn das Homeoffice, wie es Bloom et al. (2015) fordern und auch die oben dargestellten Ergebnisse implizieren, nicht unmittelbar angeordnet wird, gibt es doch mittelbar gesellschaftliche und ökonomische Zwänge für jede*n Einzelne*n. So ist bereits jetzt gesellschaftlich eine Tendenz beobachtbar, dass ein sozialer Druck zur Arbeit im Homeoffice aufgebaut wird. In der TAZ vom 01.04.21 wird beispielsweise vom Homeoffice als Elitemodell und Statussymbol gesprochen. Auch die Organisationsstrukturen der Betriebe werden zukünftig zunehmend an die vermehrte Arbeit von zu Hause angepasst werden und somit implizit Druck auf die Beschäftigten aufbauen, von zu Hause zu arbeiten. Interessenkonflikte in Bezug auf das *work from home* zwischen den Bevölkerungsschichten sind damit vorprogrammiert.

4.4.2 Betriebe

Wie die Daten zeigen, bietet das *work from home* für die Betriebe zunächst Potenzial für ein kräftiges Produktivitätswachstum. Im Mittel geben die befragten Mitarbeiterinnen und Mitarbeiter ein Produktivitätswachstum im *work from home* von 14 % gegenüber dem Büro an. Die große Streuung dieses Werts – ein Drittel der Beschäftigten sind zu Hause teils deutlich weniger produktiv – verdeutlicht aber gleichzeitig das Risiko des Produktivitätsverlusts. Zieht man in Betracht, dass die Mitarbeiterinnen und Mitarbeiter statt der in den meisten Unternehmen angepeilten 25 % gern 60 % ihrer Arbeitszeit von zu Hause arbeiten würden, vergrößern sich die Chancen und Risiken der Produktivitätsveränderung noch deutlich. Für die Unternehmen geht es in ihrer Arbeitsplatzstrategie um ein Selektionsproblem, bei dessen Lösung einerseits diejenigen Mitarbeiterinnen und Mitarbeiter identifiziert werden, die zu Hause produktiver arbeiten können und wollen als im Büro. Andererseits gilt es, Rückschritte im Arbeitserfolg durch *work from home* zu vermeiden. Abschnitt 4.4.1 gibt zahlreiche Hinweise auf die Gewinner und Verlierer und die sich daraus ergebende Selektionsstrategie.

Das Produktivitäts-Steigerungspotenzial von durchschnittlich 14 % ist ein guter Grund für die Unternehmen, das *work from home* zukünftig auch für diejenigen Mitarbeiterinnen und Mitarbeiter attraktiver zu gestalten, die heute noch zu Hause weniger erfolgreich arbeiten als im Büro. Angesichts der Tatsache, dass die Beschäftigten im Durchschnitt mit 60 % ihrer Arbeitszeit zukünftig deutlich mehr von zu Hause arbeiten möchten, scheint es hier per se durchaus gleichgerichtete Interessen zwischen den Betrieben und ihren Belegschaften zu geben. Die Studienergebnisse zeigen, dass gewichtige Haupthindernisse in der mangelnden Eignung der Wohnung als Arbeitsort und dem mangelnden persönlichen sozialen Austausch im *work from home* bestehen. Unternehmen sollten prüfen, ob dritte Arbeitsorte diese Hinderungsgründe für die Ausweitung des *work from home* ausräumen könnten. Die Befragten geben bereits heute, da erst ein geringer Teil Erfahrungen mit dieser Arbeitsform gesammelt hat, an, im Durchschnitt 5 % ihrer Arbeitszeit an dritten Arbeitsorten zu verbringen. In den USA, wo diese Form von Arbeit bereits deutlich weiter verbreitet ist, ergab die zeit- und inhaltsgleiche Befragung, dass die Beschäftigten sogar wünschten, 38 % ihrer Gesamtarbeitszeit an dritten Arbeitsorten zu verbringen. Offensichtlich liegt in der über das *work from home* hinausgehenden multilokalen Arbeit noch großes Potenzial, das in Deutschland mangels Erfahrung noch nicht erschlossen ist. Die Frage nach dem effizienten Modell multilokaler Arbeit ist derzeit offensichtlich noch nicht geklärt. Vor allem fehlt es an datengetriebener Forschung, die den Zusammenhang von Arbeitsort und Arbeitserfolg besser erklärt.

Aus gesamtorganisatorischer Sicht ist der Zusammenhang zwischen betrieblichem Erfolg und der physischen Organisation der Arbeit noch weit komplexer. Die immobiliaren Ressourcen der Betriebe stehen in einem vielschichtigen Wirkungsgeflecht mit dem Unternehmenserfolg (Pfnür, Seger und Appel-Meulenbroek, 2021). Dabei ist die Produktivität der einzelnen Mitarbeiterinnen und Mitarbeiter, auf die die bisherige Analyse beschränkt war, nur ein kleiner Teil. Insbesondere schaffen Immobilien die Voraussetzung für die Effizienz in der Zusammenarbeit in Arbeitsgruppen und in Arbeitsprozessen. Arbeiten zukünftig dauerhaft einzelne Mitarbeiterinnen und Mitarbeiter von zu Hause, gerät sowohl die Effizienz von Teamzusammenhängen als auch des gesamten Arbeitsplatzkonzepts in Gefahr.

Auf der Hierarchieebene der Geschäftseinheit bilden Immobilien die Voraussetzungen für strategische Flexibilität sowie die Attraktivität des Betriebs an den Arbeitsmärkten. Multilokale Arbeitsorte im Allgemeinen und das *work from home* im Besonderen haben auf beide Zusammenhänge großen Einfluss. Zum einen erfordert der aktuell starke Strukturwandel von Wirtschaft und Gesellschaft eine groß angelegte Transformation der betrieblichen Immobilienbestände (Pfnür, 2019). *Work from home* schafft hier ein neues Instrument, das neue Arbeitsplätze sehr flexibel zur Verfügung stellt. Zum anderen zeigen die Ergebnisse dieser Studie, dass ein Großteil der Beschäftigten gern mehr von zu Hause arbeiten würde. Es ist deshalb zu erwarten, dass mit liberalen *Work-from-home*-Regelungen die Attraktivität der Betriebe an den Arbeitsmärkten steigt.

In den Betrieben insgesamt ist zeitgleich ein Trend zu beobachten, dass die Immobilien als *corporate branding* und Managementinstrument zunehmend wichtiger werden. In vielen Unternehmen stellt das *corporate design* sehr stark auf die Immobilien ab. Mit zunehmender Dematerialisierung der Produktions- und Produktwelten der Betriebe nimmt die Bedeutung der Immobilie für die Gestaltung der Identität des Betriebs zu. Als Orte der Begegnung – hier wird auch vom betrieblichen Lagerfeuer gesprochen – dienen Immobilien zunehmend der Lenkung von Kommunikation. Immobilien dienen über die Wirkung von Größen, Lage und Gestaltung seit jeher der Demonstration und Etablierung von Machtstrukturen innerhalb und zwischen Organisationen (Pfnür, Seger und Appel-Meulenbroek, 2021). Beispielsweise konnten Vorgesetzte Mitarbeiterinnen und Mitarbeiter gegenüber ihre Macht durch das Herbeizitieren im Büro unmittelbar zum Ausdruck bringen und Top-Entscheider wie Steve Jobs durch den Bau einer aus dem Weltraum sichtbaren Konzernzentrale ihren einzigartigen Status manifestieren. Mit zunehmendem *work from home* fallen all diese Funktionen von Immobilien für das *corporate branding* und als Managementtool weg. Für die Unternehmen

stellt sich die bislang ungeklärte Frage, ob und gegebenenfalls wie diese Funktionen der betrieblichen Immobilien für das Management aufgefangen werden können. Je eher Entscheidungsträger ein Vakuum erwarten, desto größer werden die Vorbehalte gegen die Ausdehnung multilokaler Arbeit im Allgemeinen und des *work from home* im Besonderen. Alles in allem zeigt dieser Abschnitt, dass die *Work-from-home*-Diskussion auch hohes Potenzial aufweist für innerbetriebliche Interessenkonflikte auf den Ebenen des Konzernvorstands, der strategischen Geschäftseinheiten der Arbeitsgruppen und einzelner Mitarbeiterinnen und Mitarbeiter.

4.5 Ausblick

Zusammenfassend lässt sich festhalten, dass durch eine deutliche Zunahme des *work from home* wirtschaftlich und gesellschaftlich in Summe große Potenziale wie auch Risiken entstehen. Die größte Herausforderung für die Arbeitswelt der Zukunft, vor allem für die Betriebe, besteht darin, die Chancen des *work from home* zu nutzen, ohne die Risiken einzugehen. Die Frage lautet, wie es gelingen kann, eine Arbeitsortstrategie zu entwickeln, die die individuellen Anforderungen der Einzelnen mit den organisatorischen Zwängen des Managements verbindet. Durch gezielte Change-Management-Prozesse sowie durch Einsatz der Digitalisierung können die Grenzen arbeitsbezogener Erfolgsfaktoren des *work from home* zukünftig weiter zugunsten der Arbeit von zu Hause verschoben werden. Individuelle Coachings verschieben die Grenzen auf der persönlichen Ebene, und der gezielte Einsatz von *coworking spaces* und anderen *third places* hilft all denjenigen, deren räumliche Voraussetzungen zu Hause nicht passend sind, dennoch von den wesentlichen Arbeitserfolgsvorteilen des Homeoffice zu profitieren. In den Veränderungsprozessen des *work from home* geht es nicht nur um die Veränderung der Arbeitswelten. Immobilien sind Lebensraum. Maßgebliche Veränderungen der Flächennutzung setzen sich einerseits in Strukturwandelprozessen auf der Ebene der Quartiere, Städte und Regionen ebenso fort, wie sich gesellschaftliche und ökonomische Strukturen verändern (Pfnür und Wagner, 2018). Es bleibt folgenden Studien vorbehalten, die Konsequenzen des *work from home* insbesondere für die Stadtzentren, die Stadtränder sowie den ländlichen Raum zu identifizieren.

5 Article 3: Work from home: bane or blessing? Implications for corporate real estate strategies

Title:	Work from home: bane or blessing? Implications for corporate real estate strategies[3]
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Abstract

Technological progress and developments in the economy and society are constantly changing the way we work. The ongoing COVID-19 pandemic is accelerating the move towards multilocal working: knowledge workers worldwide have been forced to gain experience of working from home. Based on this experience, they are now in a position to weigh up different places of work and articulate desires for the distribution of working time between home workplace, third places and office.

Previous studies have shown that working from home can have positive effects for corporates in the form of productivity increases. However, it has so far remained open which employees exactly are successful at different workplaces. The aim of the study is to identify clusters with their own workplace distribution based on personal, work-related and real estate characteristics, and to investigate whether the desire for specific workplace distribution promises success.

Identification of the subgroups is done by conducting a hierarchical cluster analysis that includes previously identified personal, work-related and real estate characteristics. The evaluation and interpretation of the cluster solution is based on the desired workplace distribution and identified work success variables. Data from a survey of 2,000 German and US knowledge workers is taken into account.

The results of the survey suggest that knowledge workers in Germany and the US have developed a good sense of the workplace in which they can work successfully. At the same time, the decision-makers in the corporates have to decide carefully who should work at

[3] Please note that this article is written in British English and therefore differs from the rest of the dissertation, which generally uses American English.

which workplace with a view to the corporate's success. It is also clear that as work becomes more multilocational, real estate resources must play an important role in creating a corporate culture and identity.

Zusammenfassung

Technischer Fortschritt sowie Entwicklungen in Wirtschaft und Gesellschaft verändern die Art des Arbeitens fortlaufend. Die anhaltende Covid-19-Pandemie beschleunigt die Entwicklung hin zu multilokalem Arbeiten: Wissensarbeiter weltweit waren dazu gezwungen, Erfahrung mit dem „Work from Home" zu sammeln. Diese sind nun in der Lage, aufgrund dieser Erfahrungen über die verschiedenen Arbeitsorte abzuwägen und Wünsche an die Verteilung der Arbeitszeit auf Homeoffice, dritte Orte und Büro zu artikulieren.

Vorangegangene Studien zeigten, dass die Arbeit von zu Hause für Unternehmen positive Auswirkungen in Form von Produktivitätssteigerungen haben kann. Dabei blieb bisher offen, welche Mitarbeiter genau an den verschiedenen Arbeitsorten erfolgreich sind. Ziel der Studie ist es, aufgrund persönlicher, arbeitsbezogener und immobilienbezogener Merkmale Cluster mit eigener Arbeitsortverteilung zu identifizieren und zu untersuchen, ob der Wunsch nach der spezifischen Arbeitsortverteilung Erfolg verspricht.

Die Identifikation der Subgruppen erfolgt anhand der Durchführung einer hierarchischen Clusteranalyse unter Einbezug zuvor identifizierter persönlicher, arbeitsbezogener und immobiliarer Eigenschaften. Die Bewertung und Interpretation der Clusterlösung erfolgt anhand der gewünschten Arbeitsortverteilung und identifizierter Arbeitserfolgsvariablen. Dabei finden Daten aus einer Umfrage unter 2.000 deutschen und US-amerikanischen Wissensarbeitern Berücksichtigung.

Die Ergebnisse der Untersuchung legen nahe, dass Wissensarbeiter in Deutschland und den USA ein gutes Gespür dafür entwickelt haben, an welchem Arbeitsort sie erfolgreich arbeiten können. Zugleich müssen die Entscheider in den Unternehmen im Hinblick auf den Unternehmenserfolg mit Bedacht entscheiden, wer an welchem Arbeitsort tätig sein soll. Außerdem wird deutlich, dass die immobiliaren Ressourcen bei zunehmender Multilokalität der Arbeit eine wichtige Rolle beim Schaffen einer Unternehmenskultur und -identität einnehmen müssen.

5.1 Introduction

Even before the onset of the COVID-19 pandemic and the associated spread of working from home, knowledge workers worked from different places than the office in recent years. Whereas work was previously carried out mainly using corporate premises, the so-called "second place", the use of third places,[4] such as coworking spaces, has recently also become more widespread in Germany (Bundesverband Coworking Spaces Deutschland, 2020). With the onset of the COVID-19 pandemic, work from home was used to an unprecedented extent in order to comply with the required contact restrictions. Work that was traditionally done in the office can now be done in three different places (Gillen, 2019). Initial studies indicate that due to the new awareness of employees for the place of work and the advantages of the concepts recognised at corporate-level, all three places of work will continue to retain a significant share in the future spatial distribution of work. It can be assumed that in future, knowledge workers will increasingly weigh-up the location at which they would like to work while taking into account their productivity, job satisfaction and necessity (Pfnür et al., 2021).

On the organisational side, productivity gains have recently been observed as a result of working remotely from home. Pfnür et al. (2021) show an average 14% increase in productivity through work from home in Germany. However, around 40% of the respondents also stated that they could not perceive any productivity gains or were even less productive working at home than in the office. It can be assumed that employees want to increasingly work from home or from third places (Kniffin et al., 2021; Ancillo, del Val Núñez and Gavrila, 2021) even though these workplaces do not seem suitable from an organisational point of view. For companies, this poses the task of concretely shaping the multilocality of work, also in order to be able to leverage the potentials. But there are a number of unanswered questions. It is still unclear which employees work more successfully at home than in the office. The distribution of working time between the office, home office and third locations cannot yet be quantified either, although this would result in a concrete need for adaptation on the part of the company, for example, through quantitative and qualitative space planning. Furthermore, it must be examined whether the desired distribution of employees' workplaces also promises work success and is compatible with the company's goals. This can lead to a conflict of objectives between individual wishes and the overriding corporate goal.

[4] The definition of third places as public places of social coexistence and intensive communication away from one's own home (first place) and workplace (second place) goes back to Oldenburg and Brissett (1982). Oldenburg and Brissett also observed that third places are used for work. In this study, this includes not only cafés, restaurants, lounges in train stations or airports, but also coworking spaces. Morisson (2019) referring to Oldenburg and Brissett, defines coworking spaces as a "combination of the second [of labour] and third place".

After all, previous studies have shown, for example, that not all jobs can be done from home (Dingel and Neiman, 2020).

The aim of this paper is to provide a basis for decision-making on the described challenges facing human resources (HRM) and corporate real estate management (CREM). With the help of multivariate analysis methods, subgroups are identified who, based on their personal, work-related and real estate characteristics, will prefer certain workplaces in the future. Finally, the paper assesses whether the desired workplace distribution promises work success for the individual employee and derives management recommendations from the analysis.

The identification of subgroups is carried out by applying a hierarchical cluster analysis. In addition to other variables, factors identified in a previously conducted exploratory factor analysis are taken into account in the analysis. Because previous studies have shown that work success depends on personal, work-related and real estate characteristics of the knowledge workers (Krupper, 2015), these determinants are also used in this analysis. The classification and interpretation of the results is based on the given workplace distribution and on further variables on work success at different workplaces identified in a second exploratory factor analysis. The following section examines the theoretical foundation of the change in the working environment, the resulting challenges for corporate management and the influence of individual determinants on workplace preference. This is followed by a description of the data analysis.

5.2 Theoretical background

5.2.1 Change in the work environment

Changes in the working environment at different workplaces have been driven particularly by technological change. Harris (2015) describes three drivers that are expressions of the development: (1) the organisational adaptation of corporates serves the implementation of collaborative working in order to react continuously to innovation; (2) new requirement profiles for employees, with a demand for technologically affine knowledge workers, which is an expression of the change in the workforce along with the desire within the workforce for flexible working; and (3) technological developments ensure that employees can work smoothly in different locations according to their preferences.

To understand why working from home or third places is attractive to corporates and their employees, it is also necessary to further investigate the benefits of mobile working and teleworking. Even though these terms refer to different forms of work (Bundesministerium

für Familie, Senioren, Frauen und Jugend, 2017; 111th United States Congress, 2010), the following part of the study will discuss research results on the different forms of work. Although this study is primarily concerned with work from home, telework and mobile work as well as hybrid work and coworking describe multilocal working away from the office and can thus provide important indications and conclusions in this context. Tremblay and Thomsin (2012) have identified greater autonomy, professional and personal development of employees, and a better work-life balance with reduced stress as important benefits of mobile working. In addition, flexibility in daily planning, better organisation of work and reduced commuting times enable a more efficient organisation of the working day. According to Morgan (2004), working away from the office also has advantages from the employee's point of view by breaking down geographical barriers in the choice of occupation. In addition, he emphasises the cost advantages to be gained from reduced commuting.

In the past, the change in workplace preferences among knowledge workers could be seen in the increase and differentiation of coworking spaces. Thus, special offers for rural areas emerged in cooperation with public institutions or through church organisations (Werther, 2021). Nevertheless, a quantitative increase in supply can also be observed (Gauger, Strych and Pfnür, 2021). The changing proportion of German knowledge workers who do some of their work from home is also evidence of an ongoing balancing process (Statistisches Bundesamt, 2021). In the US, a growing trend can be observed: in 2004, 15% of employees regularly worked from home (U.S. Bureau of Labor Statistics, 2005); in 2017/18, 25% of employees did so (U.S. Bureau of Labor Statistics, 2019). The OECD (2020) reported that in 2015, working from home or at a third place was particularly prevalent in knowledge-intensive occupations and among highly qualified employees.

With the emergence of the COVID-19 pandemic in 2020, a large number of employees changed their place of work and, henceforth, worked from home. The experience of switching to work from home was not exclusively positive. In the short term, both productivity losses from the corporate's point of view and difficulties on the part of the workforce occurred. For example, the lack of experience with mobile working, the non-existence of the necessary infrastructure, motivational problems and difficulties in organising the working day in a family environment showed that working from home did not prove suitable for everyone (Pfnür et al., 2021; Werther et al., 2021a; OECD, 2020; Milasi, González-Vázquez and Fernández-Macías, 2021; Parker, Horowitz and Minkin, 2020).

Thus, many employees, especially those who had previous experience of working from home, found the transition to the home workplace comparatively easier (Milasi, González-Vázquez

and Fernández-Macías, 2021). Many employees were able to experience the previously described advantages for the first time and learned to appreciate flexibility, a better work-life balance, or the advantages of saved commuting time (Parker, Horowitz and Minkin, 2020). Corporates and employees experienced a digitalisation boost and prejudices against working from other locations were reduced due to positive experiences. Overall, it was recognised that remote working works and could be an alternative even after the pandemic (Kleinert et al., 2021; Hofmann, Piele and Piele, 2020). There is widespread agreement that the experience will also serve as a catalyst towards multilocal ways of working from a corporate perspective (OECD, 2020).

Because the disadvantages of working from home should not be overlooked and because the place of work as described is not suitable for some knowledge workers, an unbalanced switch to solely the home workplace is not expected. Rather, third places, especially coworking spaces, could also be winners of the accelerated development. These could represent a compromise between working from home and office for knowledge workers who lack the prerequisites for successful work at home and yet still desire more flexibility. Thus, a hybrid landscape consisting of all three workplaces could emerge in the future (Mayerhoffer, 2021; Werther et al., 2021a). The acceleration also includes the transformation of corporate spaces, which was already initiated before the pandemic, into places of cooperation, exchange and representation (Boland et al., 2020).

5.2.2 Opportunities and challenges of multilocality of work for corporates

For corporates and the various management disciplines, such as HRM and CREM, work from home presents both opportunities and challenges. For example, in addition to cost benefits and productivity gains, there are also benefits from increased customer service due to wider working hours of the employees, greater geographic proximity of employees to the corporate's customers, increased agility in responding to emerging challenges and opportunities and the recruitment of new employees from an enlarged talent pool (Morgan, 2004). According to Miller (2014), corporates can only achieve the higher workplace occupancy rates they seek for efficiency reasons by using standardised, non-fixed office space and enabling flexible working, including third places and work from home. Thus, workforce multilocality can also provide answers to other challenges.

New demands from employees and corporates are also reflected in the future planning of real estate resources. The change in the workforce, which also goes hand-in-hand with

increased employee demands, is countered with measures to remain attractive as a corporate for sought-after employees and to ensure high productivity of highly paid employees. This is also to be achieved by providing the right real estate resource with regard to flexibility and serving the desire for mobile working (Harris, 2015). According to the findings of Nanayakkara, Wilkinson and Ghosh, (2021), workplace consultants and designers believe future offices "would be technology driven, community oriented, sustainability, health and wellbeing focused, smaller in size with satellite offices, such as co-working and office spaces". Also, according to Harris (2015), the office workplace in the future should primarily be a place of collaboration and exchange. In this context, the equipment in these spaces will become increasingly important. Khanna, van der Voordt and Koppels (2013) show that corporates are already using their real estate resources in the adaptation process to convey their corporate culture.

5.2.3 The determinants of employees' workplace preference

The influence of personal, work-related or real estate characteristics on the workplace preference of knowledge workers has already been investigated by various studies in the past. Table 7 provides an overview of selected studies.

Table 7: Impact of personal, work-related and real estate characteristics on workplace preference

	Authors	Investigated impact of individual determinants on workplace preference
Personal characteristics	Pfnür et al. (2021)	Investigation of the dependence of satisfaction and productivity when working from home on socio-demographic characteristics (age, work experience, income, gender, number of children, relationship status, level of education, occupational stress, loneliness at the home workplace, private and occupational boredom) among German respondents.
	Parker, Horowitz and Minkin (2020)	Investigation of differences in productivity at home between old and young respondents. Mothers perceive greater difficulty in combining work and home life. Women more often express the desire to work from home permanently after the pandemic has subsided.
	Horigian, Schmidt and Feaster (2021)	Demonstration of an increase in loneliness, anxiety and depression as a result of the lockdown in the wake of the COVID–19 pandemic in the US.

	Appel-Meulenbroek et al. (2021); Clifton, Füzi and Loudon (2022)	Motives for working in third places, such as coworking spaces: isolation when working from home, desire for a sense of belonging and generally the desire for social interaction.
	Capdevila (2013); Spinuzzi (2012); Waters-Lynch et al. (2016)	Concentration of coworking space users, for example, in self-employment and freelance work.
Work-related characteristics	Pfnür et al. (2021)	Investigation of the dependence of satisfaction and productivity when working from home on the number of work from home days, part-time employment, variety of tasks and demands, and autonomy of planning and decision-making among German respondents.
	Dutcher (2012)	Demonstration that routine tasks can be done more productively in the office environment compared to creative tasks.
	OECD (2020)	Evidence that highly skilled employees are more likely to be able to cope with working independently and do demanding work in first or third places.
	Clifton, Füzi and Loudon (2022); Werther et al. (2021b)	Coworking spaces offer an environment for creative problem solving and can thus be a driver for innovation.
	Parker, Horowitz and Minkin (2020); OECD (2020)	Mobile working is not suitable for knowledge workers whose work cannot be done outside the corporate office, at least to some extent. This is especially true for low-skilled workers.
	Tremblay and Thomsin (2012); Pabilonia and Vernon (2020)	Influence on the choice of workplace by limiting the autonomy of knowledge workers due to the need for a high proportion of presence in the office for team meetings or with the client, i.e., collaboration.
	Spreitzer, Bacevice and Garrett (2015); Robelski et al. (2019); Tremblay and Thomsin (2012)	Motives for working in third places, such as coworking spaces: deliberate, measured restriction of autonomy, for example, in order to be able to organise one's self and work better or to have a structured framework for everyday work.
	Mokhtarian and Bagley (2000)	In a comparison of the three workplaces, the home workplace promises the highest work-related autonomy while the office workplace is lowest.
	Appel-Meulenbroek et al. (2021); Clifton, Füzi and Loudon (2022)	Motives for working in third places, such as coworking spaces: possibility of networking in coworking spaces also to win new jobs.

Real estate characteristics	Pfnür et al. (2021)	Investigation of the dependence of satisfaction and productivity in the home workplace on real estate determinants (location factors, building- and housing-related factors as well as workplace-related factors) among German respondents.
	Parker, Horowitz and Loudon (2020)	Real estate disadvantages due to a possibly inadequately equipped workplace.
	Morgan (2004); Tremblay and Thomsin (2012); Stiles and Smart (2021)	Location advantages through the elimination of commuting times or the possibility of better integration of business trips when working from home. The location advantages described can also be transferred to work in third places.
	Robelski et al. (2019); Appel-Meulenbroek et al. (2021)	Motives for working in third places, such as coworking spaces: better working environment with better equipment than at the home workplace. This is expressed both as a possibly more ergonomic equipment of the workplace compared to the home workplace and in the offer of infrastructural space services by the coworking operator.
	Clifton, Füzi and Loudon (2022); Werther et al. (2021a); Appel-Meulenbroek et al. (2021)	Motives for working in third places, such as coworking spaces: coworking spaces are a representative place for young corporates and self-employed people for their external image. Users also benefit from the comparatively low real estate-related costs and high real estate flexibility associated with coworking spaces.
	Frontczak et al. (2012); Kent et al. (2021); Kwon et al. (2019)	Investigations into the influence of the indoor environment quality factors (extent of building space, noise level, visual privacy, cleanliness and maintenance).
	Danielsson and Bodin (2009); Kwon and Remøy (2020)	Investigation of the influence of office layout. Employees perceive higher satisfaction with a cellular structure compared to combi, open and flexible offices.

5.3 Methodology and concept of the study

The data on which the statistical analysis is based were collected by the Department of Real Estate and Construction Management at the Technical University (TU) of Darmstadt as part of a research project on work from home. The data were collected by using an online survey among German and American knowledge workers as a longitudinal study with surveys in June, August and October 2020. The characteristics and items taken into account in the

analyses were surveyed on metric, simple ordinal or 5- or 7-point ordinal Likert scales. With regard to the Likert scales, a high level of proficiency always indicates a high level of agreement on the part of the respondent while a low score represents a disapproving statement. Regarding the variable household income, it should be noted that respondents were asked to report their income in six salary levels from 0 to > €5,000. The first five levels are divided into steps of €1,000 each. The last step includes all salaries above that. For example, a respondent who indicated level 3 has a net income between €2,001 and €3,000.

Out of a total of 2,000 respondents, 1,159 respondents took part in all three survey waves. Due to the items included and data cleaning, 494 respondents (246 German, 248 US-American) are included in the analysis.

Exploratory factor analyses (EFA) were applied to condense the items collected on Likert scales into factors. Exploratory factor analysis serves to uncover structures within data and to combine individual overlapping variables into factors. This is done by examining the correlation of different items. The factors determined can be used instead of the variables originally investigated. The method is thus particularly well suited to structuring and reducing data. Various extraction methods can be used. The rotation of the solution increases the interpretability of the results (Backhaus et al., 2018). Here, two exploratory factor analyses were carried out. The first analysis serves to derive input factors, which are further used to perform the cluster analysis. The second factor analysis serves to determine factors that describe the success of the respondents at different places of work. They are used to interpret and discuss the cluster results. Both analyses were carried out according to the same principle using the method of principal axis factor analysis and VARIMAX rotation. The number of factors to be considered was determined based on the Kaiser criterion (eigenvalue> 1) (Backhaus et al., 2018; Kaiser, 1960) and corresponding content considerations. In order to maintain the original scale level of the items, the factor scores were formed by averaging the items to be combined according to the factor analysis (DiStefano, Zhu and Mîndrilã, 2009). The standard tests carried out to assess the suitability of the items and the correlation matrix for carrying out an exploratory factor analysis using the MSA criterion according to Kaiser, Meyer and Olkin indicate high suitability of the approach: 0.904 (input factors) and 0.775 (work success factors) at matrix-level and between 0.744 and 0.951 among the items of the input factors, and between 0.662 and 0.866 among the items of the work success factors at item level (Backhaus et al., 2018; Kaiser and Rice, 1974). An overview of the determined factors and associated items is given in Appendix A: A1.

The identification of groups of respondents is done by conducting two cluster analyses: one for German respondents and one for US respondents. The aim of cluster analysis is to identify subgroups from a group of study participants on the basis of their characteristics. The respondents classified in the various groups should be as homogeneous as possible in terms of their characteristics, but the groups should be as heterogeneous as possible in relation to each other. Cluster analysis and the various methods associated with it belong to the explorative procedures. The analysis is divided into three steps: similarity determination, fusion using the selected fusion algorithm and determination of the number of clusters (Backhaus et al., 2018). In this study, the previously identified input factors as well as the variables age, work experience, net household income and commuting time between the corporate office and home are used for clustering. Table 8 provides an overview of the variables taken into account in the cluster analysis and their scales.

Table 8: Overview of the variables considered in the cluster analysis

	Variable	Scale	Measurement
Personal	Age	metric	
	Work experience	metric	
	Household income	ordinal	
	Perceived stress with regard to the profession exercised	5-point-Likert (ordinal)	determined by EFA
	Perceived loneliness at home workplace	5-point-Likert (ordinal)	determined by EFA
	Perceived boredom in private life and job	7-point-Likert (ordinal)	determined by EFA
Work-related	Variety of demands and tasks in the job	7-point-Likert (ordinal)	determined by EFA
	Planning and decision-making autonomy at work	7-point-Likert (ordinal)	determined by EFA
Real estate-related	Technical equipment of the home workplace	7-point-Likert (ordinal)	determined by EFA
	Real estate quality and suitability of the home workplace	7-point-Likert (ordinal)	determined by EFA
	Commuting time	metric	
	Demands on environmental factors in the corporate office	7-point-Likert (ordinal)	determined by EFA
	Demands on equipment in the corporate office	7-point-Likert (ordinal)	determined by EFA

Similarity between two respondents is determined using squared Euclidean distance. Before the actual analysis is carried out, outliers among the respondents are identified for both countries using the single-linkage method. The exclusion is based on a graphical check of the dendrogram. This procedure has already been successfully proven in the past (Backhaus

et al., 2018). Six knowledge workers are excluded from further analysis. As a fusion algorithm, Ward's method is applied, which has been widely used in practice (Backhaus et al., 2018). Respondents are grouped together in such a way that the dispersion within the groups is increased as little as possible. Thus, the method outputs lead to homogeneous clusters (Backhaus et al., 2018). The determination of the optimal number of clusters can be based on content considerations or on statistical calculations (stopping rules). Milligan and Cooper give an overview of the different methods and assess their suitability. Accordingly, Mojena's test also delivers comparatively good results (Milligan and Cooper, 1985). This test compares standardised fusion coefficients ãi based on the coefficients of the fusion overview with a given critical value. If the value is exceeded for the first time, then this is an indicator that the optimal cluster number has been reached with the cluster number of the previous unification stage. Following recommendations from the literature and in order to keep the number of clusters issued within a reasonable range in terms of content, the critical value in this study is set at 2.75 (Backhaus et al., 2018; Milligan and Cooper, 1985). Before conducting the cluster analysis, the input variables are standardised by dividing them with the width of the value range due to different value ranges. This is to prevent individual characteristics from having a disproportionately large impact on the distance measurement between two respondents (Miligan and Cooper, 1988).

5.4 Results

5.4.1 Descriptive statistics

The following explanations refer to 243 German and 245 US-American respondents who were taken into account in the final cluster allocation after the outlier adjustment, resulting in a total number of observations of n = 488. The desired future workplace distribution of German knowledge workers shown in Table 9 differs from that of the American respondents (Table 10) primarily with regard to the share of third places. Their share is more than twice as high in the US.

Table 9: Descriptive statistics of the distribution of desired places of work among German respondents

share in %	$\bar{x}$	s
Work from home	54.6	28.6
Third places	6.2	14.0
Corporate office	39.2	28.0

Table 10: Descriptive statistics of the distribution of desired workplaces of US-American respondents

Share in %	$\bar{x}$	s
Work from home	52.1	29.9
Third places	13.4	21.2
Corporate office	34.5	26.2

Table 11 (German respondents) and Table 12 (US respondents) present the descriptive statistics of the characteristics used for clustering. With regard to the personal characteristics, it is noticeable that the American respondents have on average around 4.0 years more professional experience. In addition, the net household income is higher on average. The perception of boredom among German respondents is subject to smaller fluctuations. The work-related characteristics of occupational autonomy and diversity are on average higher in the US. The same applies to the home workplace-related characteristics of the suitability of the home workplace and its technical equipment. The US respondents' demands on equipment in the office are also higher than those of their German counterparts.

Table 11: Descriptive statistics of the input variables of German respondents

Variable	$\bar{x}$	Min	Max	s
Age (years)	36.3	18.0	65.0	10.1
Work experience (years)	11.0	0.0	35.0	8.9
Household income	3.5	1.0	6.0	1.3
Perceived stress with regard to the profession exercised	2.7	1.0	4.7	0.9
Perceived loneliness at home workplace	2.5	1.0	5.0	1.0
Perceived boredom in private life and job	2.8	1.0	5.8	1.2
Variety of demands and tasks in the job	5.1	1.0	7.0	1.0
Planning and decision-making autonomy at work	4.9	1.7	7.0	1.2
Technical equipment of the home workplace	5.7	2.3	7.0	1.1
Real estate quality and suitability of the home workplace	5.2	2.0	7.0	1.0
Commuting time (minutes)	25.8	0.0	60.0	14.8
Demands on environmental factors in the corporate office	5.4	3.5	7.0	0.9
Demands on equipment in the corporate office	3.7	1.0	7.0	1.2

Table 12: Descriptive statistics of the input variables of US-American respondents

Variable	$\bar{x}$	Min	Max	s
Age (years)	38.1	20.0	66.0	9.7
Work experience (years)	15.0	1.0	36.0	9.5
Household income	4.7	1.0	6.0	1.4
Perceived stress with regard to the profession exercised	2.6	1.0	5.0	1.0
Perceived loneliness at home workplace	2.5	1.0	5.0	1.1
Perceived boredom in private life and job	2.8	1.0	6.5	1.6
Variety of demands and tasks in the job	5.6	1.0	7.0	1.1

Planning and decision-making autonomy at work	5.4	1.3	7.0	1.1
Technical equipment of the home workplace	6.2	3.0	7.0	0.9
Real estate quality and suitability of the home workplace	5.6	1.6	7.0	1.0
Commuting time (minutes)	24.5	1.0	60.0	13.6
Demands on environmental factors in the corporate office	5.6	3.3	7.0	0.8
Demands on equipment in the corporate office	4.2	1.0	7.0	1.5

With regard to the factors measuring work success at the various workplaces (Table 13 and Table 14), it is particularly striking that job satisfaction at the home workplace and in the corporate office is on average lower in Germany than in the US. Motivation and focus at the home workplace, on the other hand, are higher in Germany than in the US.

Table 13: Descriptive statistics of the work success variable of German respondents

Variable	$\bar{x}$	Min	Max	s
Job satisfaction working from home	5.3	1.0	7.0	1.3
Productivity working from home compared to the office	4.5	1.0	7.0	1.7
Availability at home	4.5	1.0	7.0	1.2
Motivation and focus working from home	4.4	1.2	7.0	1.3
Job satisfaction in the corporate office	4.7	1.0	7.0	1.2

Table 14: Descriptive statistics of the work success variable of US-American respondents

Variable	$\bar{x}$	Min	Max	s
Job satisfaction working from home	5.8	1.0	7.0	1.1
Productivity working from home compared to the office	4.8	1.0	7.0	1.7
Availability at home	4.7	1.0	7.0	1.2
Motivation and focus working from home	3.9	1.0	7.0	1.5
Job satisfaction in the corporate office	5.4	2.3	7.0	1.0

The description of the clusters obtained from the analysis is carried out in descending order according to the level of the desired work from home share and separately for Germany and the US.

In total, seven clusters per country were delineated based on personal, work-related and real estate characteristics. Table 15 shows the proportions of the different places of work in the clusters.

Table 15: Workplace distribution of the different clusters

	Cluster	n	Work from Home (%)	Third Places (%)	Corporate Office (%)
German clusters	Senior employees	30	65.5	5.9	28.6
	Skilled workers	22	64.5	5.2	30.3
	Senior managers	14	60.4	3.9	35.7
	Academics	47	54.6	5.2	40.3
	Young professionals	61	53.5	10.0	36.5
	Decision-makers of tomorrow	32	47.5	4.0	48.4
	Under-challenged	37	45.7	5.1	49.2
US clusters	Senior managers	30	70.5	5.0	24.5
	Senior specialists	35	65.0	1.3	33.7
	American dreamers	26	59.6	7.3	33.1
	Nine-to-five clerks	38	54.5	8.3	37.2
	Coworking affine	30	52.6	13.1	34.3
	Office affine	39	46.4	8.8	44.7
	Coworking youngsters	47	29.3	39.1	31.6

Table 16 lists the work success variables of the individual clusters.

Table 16: Work success variables of the different clusters

	Cluster	Job satisfaction working from home	Productivity working from home compared to the office	Availability at home	Motivation and focus working from home	Job satisfaction in the corporate office
German clusters	Senior employees	6.2	5.1	4.5	5.2	4.7
	Skilled workers	5.6	4.8	4.1	5.0	4.7
	Senior managers	5.6	4.2	4.5	4.6	4.2
	Academics	5.9	5.0	4.9	4.8	5.2
	Young professionals	5.1	4.6	4.5	3.8	4.3
	Decision-makers of tomorrow	5.0	3.8	4.3	4.1	5.1
	Under-challenged	3.9	3.6	4.3	3.8	4.7
US clusters	Senior managers	6.3	5.1	4.7	4.8	5.6
	Senior specialists	6.2	4.8	4.6	4.4	5.3
	American dreamers	6.4	5.3	4.7	4.2	5.7
	Nine-to-five clerks	5.5	4.1	4.2	3.8	5.2
	Coworking affine	4.6	4.6	4.4	3.4	4.8
	Office affine	6.0	4.2	4.3	4.5	5.6
	Coworking youngsters	5.7	5.6	5.5	2.7	5.8

Appendix A: A2 provides an overview of the average expression of personal, work-related and real estate characteristics of the individual clusters. In the following section, the identified clusters of both countries are described in detail. In particular, the characteristics and success variables for which the clusters have a particularly high/low profile are highlighted. Network diagrams are used for a better understanding. In these, the personal (age, professional experience, income, professional stress, perceived loneliness at the home workplace and professional and private boredom), work-related (occupational diversity and autonomy) and real estate-related (technical equipment of the home workplace and suitability of the workplace at home, commuting time and demands on the environmental factors as well as on the technical equipment in the office) characteristics are plotted in a clockwise direction. The bar charts below show the desired work location distribution of the cluster members. In addition, where appropriate for better classification, further variables are discussed that were collected in the context of the surveys but were not taken into account in the cluster analysis.

5.4.2 German clusters

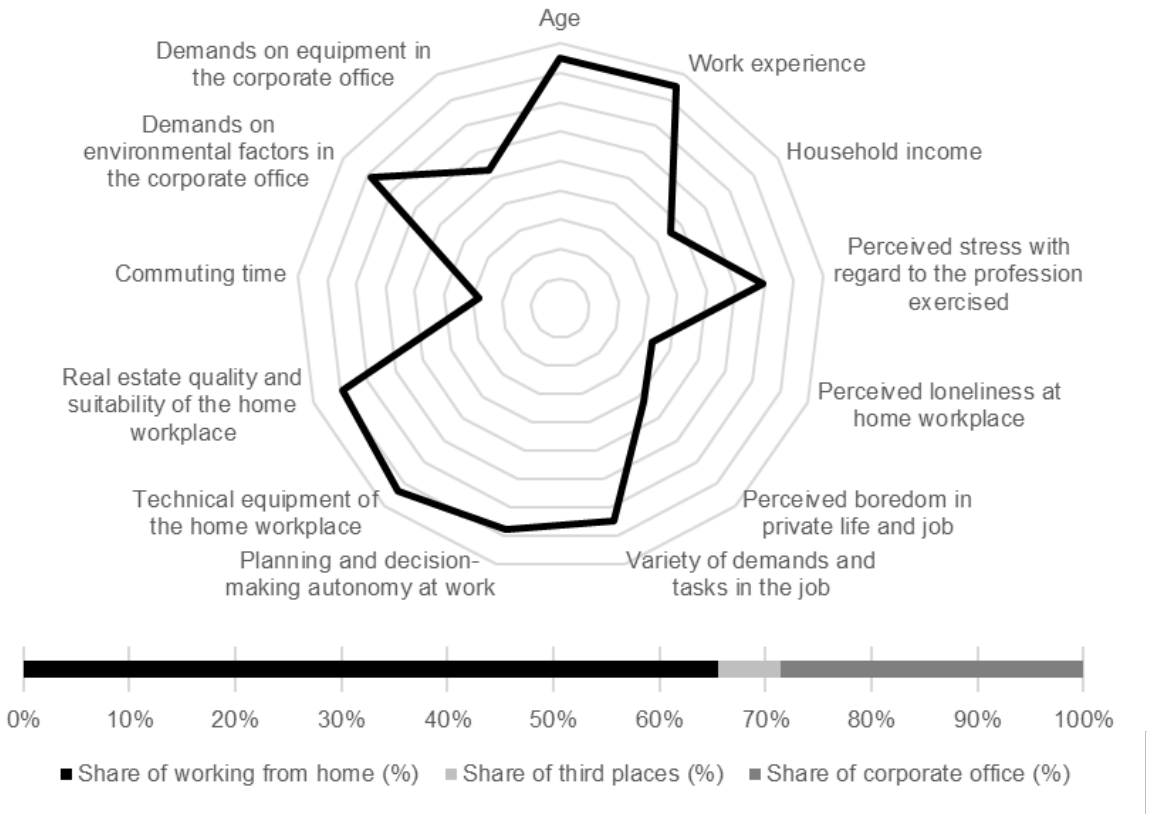

Figure 9: Senior employees (Germany) cluster characteristics

The cluster of *senior employees* has the highest share of working from home in the future (Table 15).

Among the personal characteristics, high age and high professional experience stand out while the household income of the cluster members is particularly low. In addition, only a low level of loneliness and boredom can be observed. The home workplace shows high suitability for working from home regarding quality and equipment. Commuting time of the cluster members is the second lowest among German clusters (Figure 9).

Cluster members indicated high job satisfaction, productivity and motivation in the home workplace and, compared to the other German clusters, gave the highest values in all three categories (Table 16).

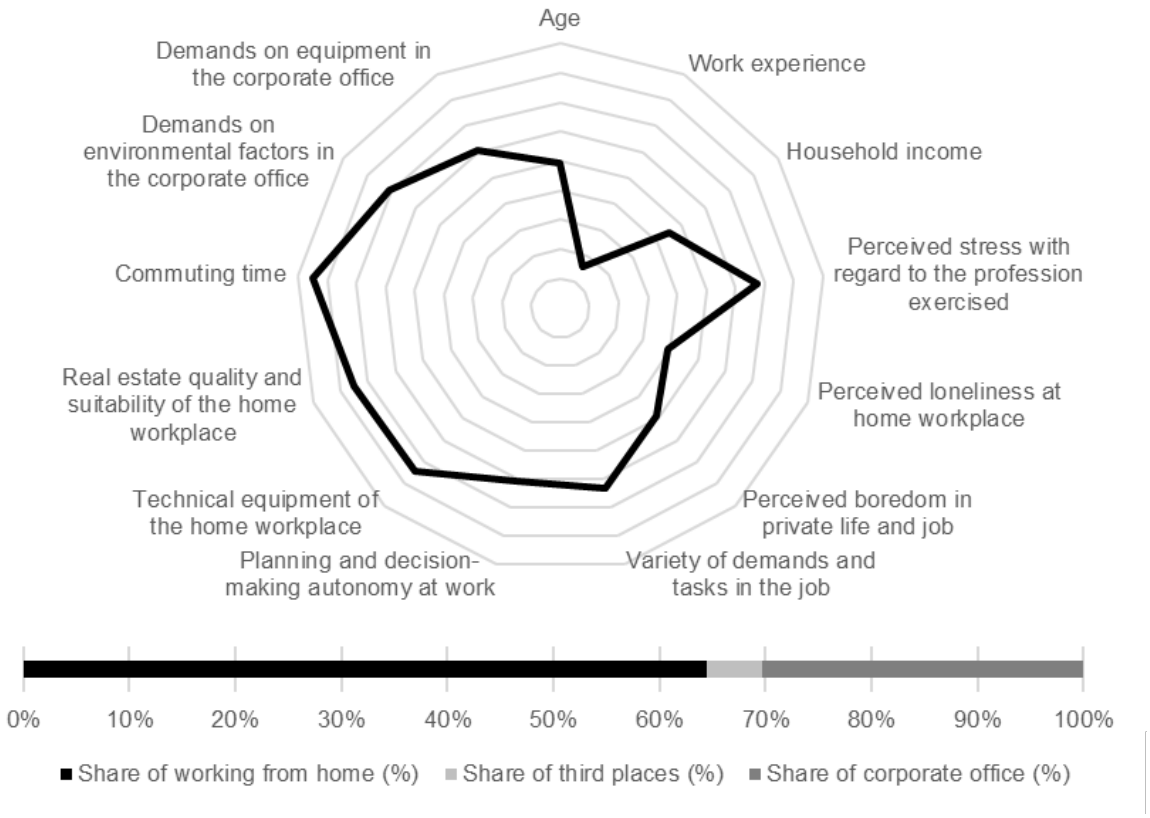

Figure 10: Skilled workers (Germany) cluster characteristics

Like the *senior employees*, the *skilled workers* want to spend around two-thirds of their working time at home (Table 15).

Among the personal characteristics, the low income and low level of loneliness at the home workplace stand out. In comparison, the cluster members only indicated low levels of work-

related autonomy and diversity. The *skilled workers* indicated the highest commuting time and report only low demands on the real estate resource in the office (see Figure 10).

Among the work success factors, the comparatively high productivity at home, the low additional availability compared to working in the office and the high ability to motivate and focus at the home workplace stand out (see Table 16).

Among the other characteristics surveyed, the comparatively low level of education and the low position in the corporate hierarchy stand out.

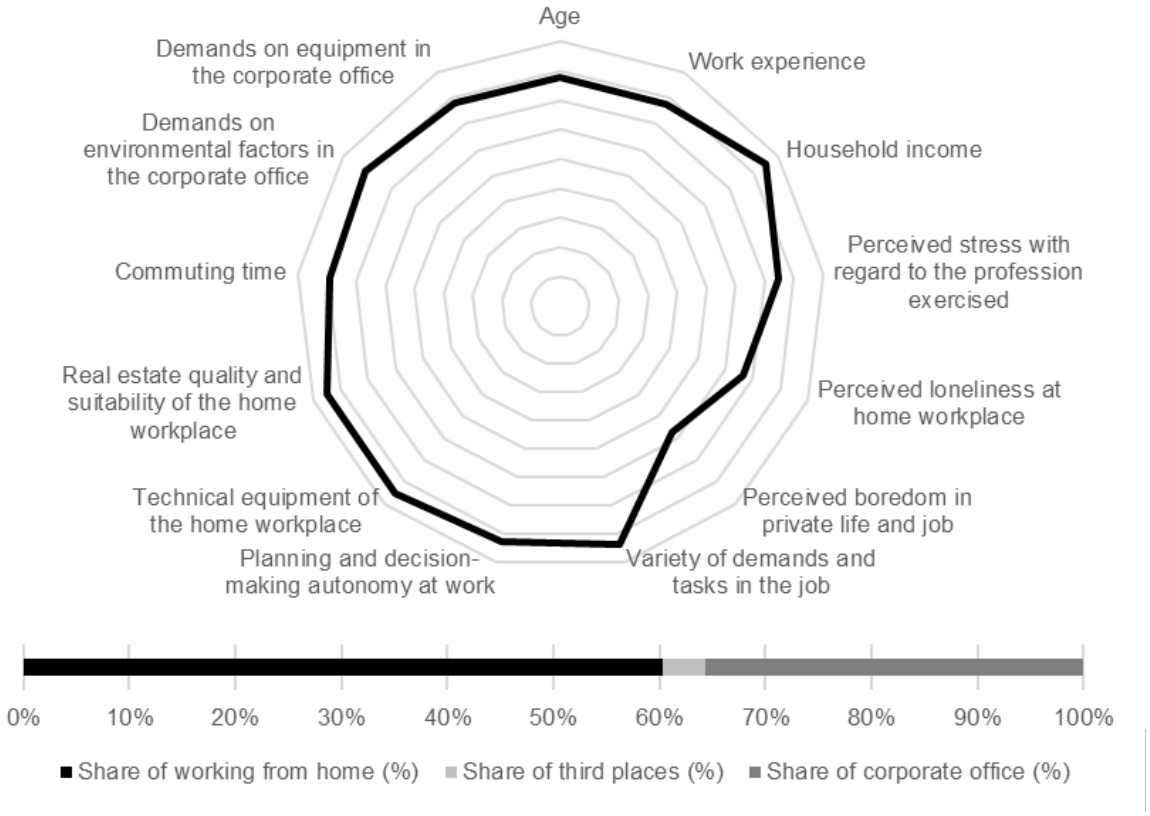

Figure 11: Senior managers (Germany) cluster characteristics

The cluster of *senior managers* would like to spend around 60% of their working time at home while the office share is growing to 35% (see Table 15).

Among the personal characteristics of the cluster members, the second highest age and second highest work experience after the *senior employees* stand out. The cluster's income is the highest of all German groups. The work-related characteristics point to demanding jobs with a wide variety of tasks and a high degree of professional autonomy.

The characteristics related to the home workplace show the highest technical equipment of the workplace and the best suitability of the home for work from home. The commuting time to work is the second highest among German respondents (see Figure 11).

Among the work success factors, below-average productivity gains stand out for working from home. Satisfaction in the office is the lowest of all German clusters (see Table 16).

Senior managers have the highest level of education, the longest working hours and the highest position in the company.

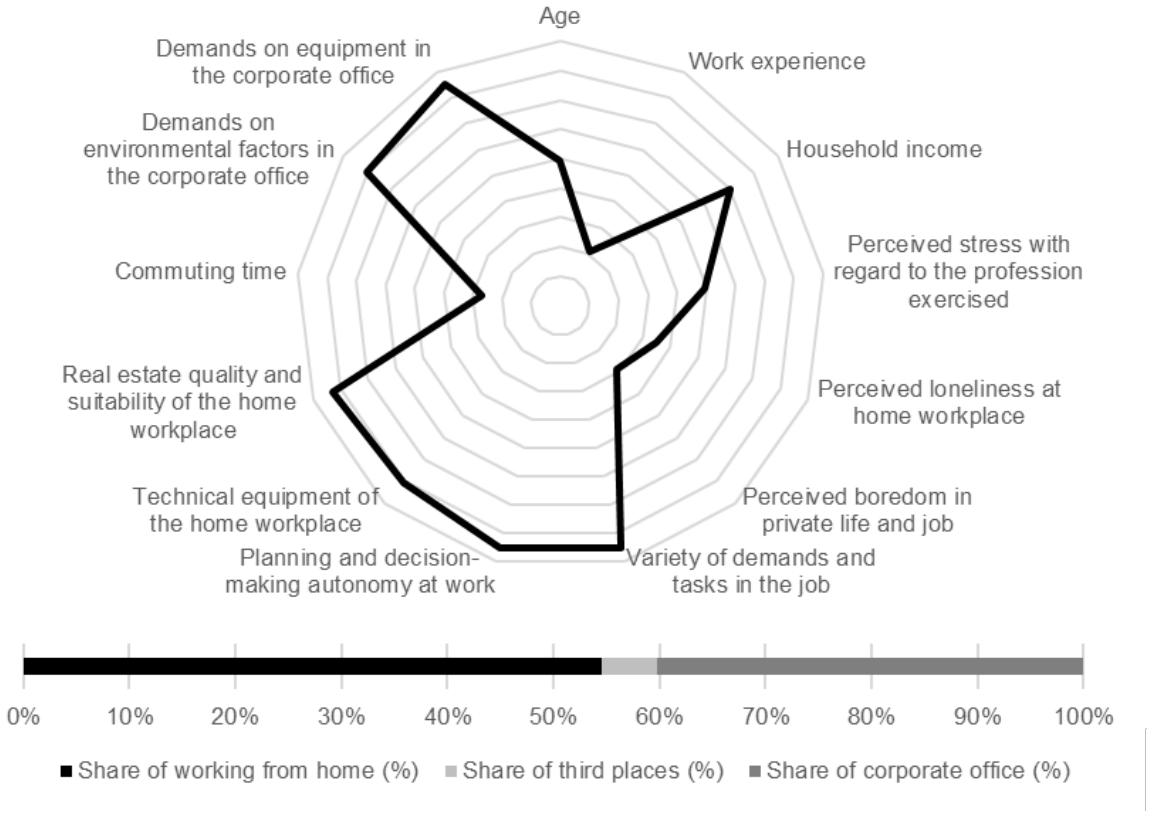

Figure 12: Academics (Germany) cluster characteristics

The *Academics* cluster wants to work from home around 55% of the time. The office share is over 40% for the first time (see Table 15).

Academics have the second highest income of all German clusters. In addition, they reported the lowest levels of occupational stress, loneliness at home and boredom in their professional and private lives. The jobs they hold are characterised by the highest measured variety of tasks and demands as well as the highest professional autonomy. The cluster members indicated that the home is particularly well-suited for work from home. At the same time,

commuting times are particularly low. *Academics* place the highest demands on the equipment of the office workplace (see Figure 12).

The work success factors show high satisfaction and productivity at home. At the same time, cluster members are exposed to increased availability at the home workplace. Satisfaction with the office workplace is the highest among German respondents (see Table 16).

Academics have the second highest level of education after *senior managers*.

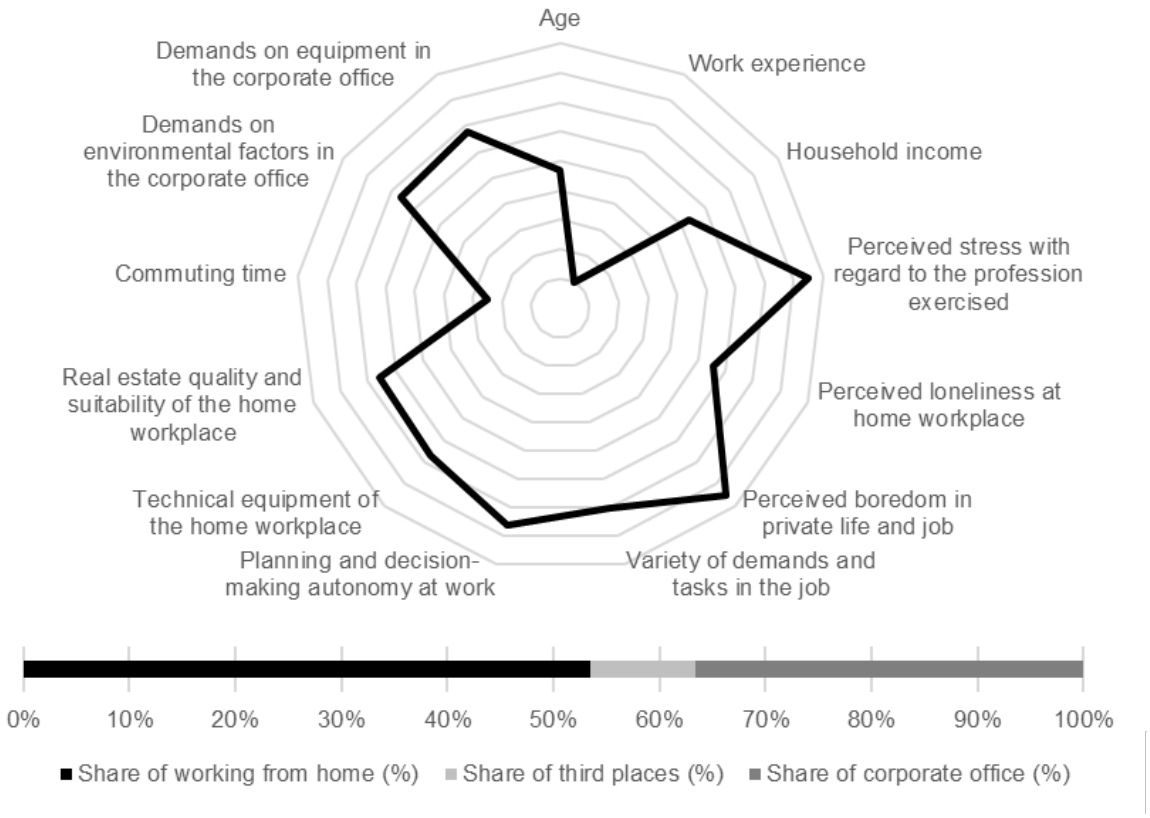

Figure 13: Young professionals (Germany) cluster characteristics

Young professionals want to spend around 54% of their time at their home workplace. They are the German cluster with the highest share of third locations in the distribution of workplaces. The share accounts for 10% of working time or half a day per week (see Table 15).

Respondents reported the lowest age and work experience. Among the personal characteristics, the highest level of occupational stress and occupational and private boredom stand out. Among the real estate characteristics, the below-average suitability of the home office and the comparatively low level of technical equipment stand out. At the

same time, the respondents indicated the lowest commuting time and articulated only low demands on the environmental factors in the office (see Figure 13).

Job satisfaction both at home, but even more so in the office, is below average. In addition, respondents indicated the lowest motivation and most distractions at home (see Table 16).

The *Young professionals* are the cluster with the lowest number of children at home and the second smallest flats.

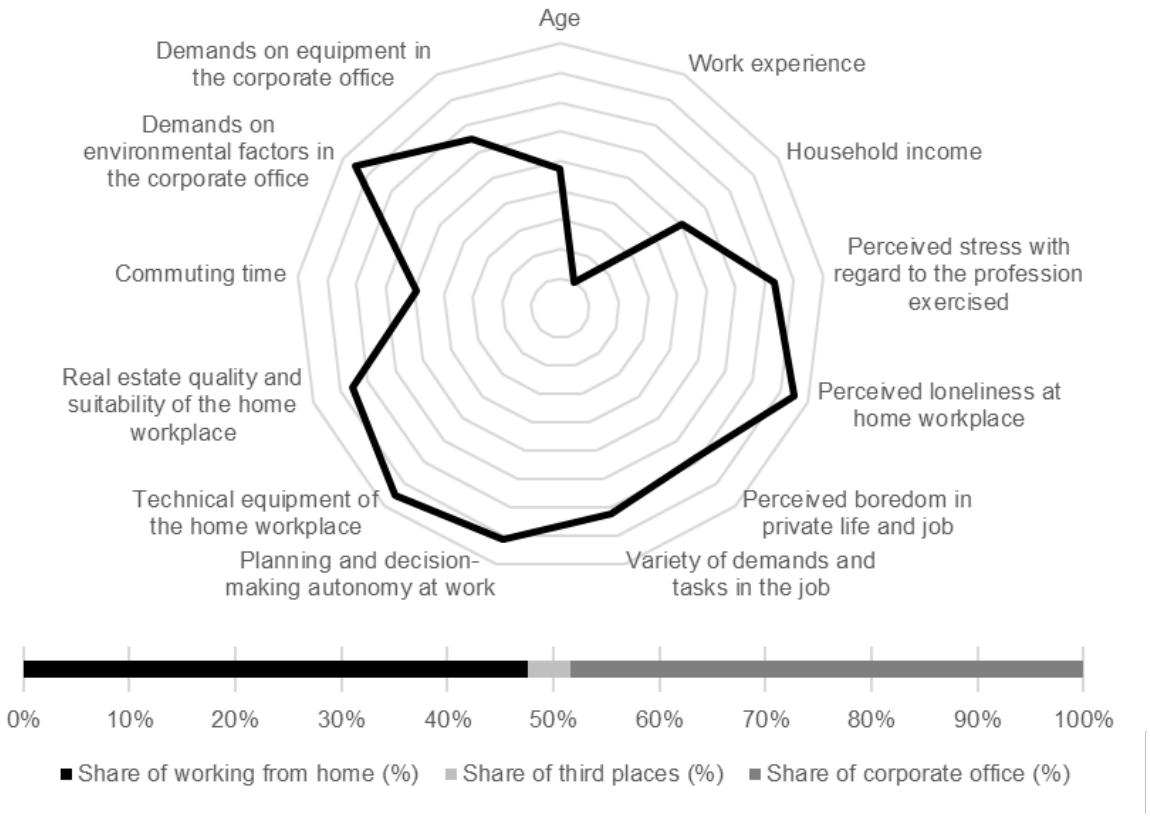

Figure 14: Decision-makers of tomorrow (Germany) cluster characteristics

The cluster of *decision-makers of tomorrow* would like to work in equal parts in the office and from home. For the first time, the share of office (48.5%) outweighs the share of work from home (47.5%) (see Table 15).

Like the *young professionals*, the *decision-makers of tomorrow* also indicated a low age and little professional experience. Compared to the *young professionals*, however, they are less affected by job stress and boredom in their professional and private lives. They indicated the highest loneliness of all German respondents at home. Cluster members already have above-average planning and decision-making autonomy. Among the property-related

characteristics, the high technical equipment of the home workplace and the highest demand of all German knowledge workers for the environmental factors in the office stand out (see Figure 14).

The work success factors indicate a below-average suitability of respondents for work from home. Satisfaction as well as productivity and motivation at home are below average among respondents. Satisfaction at the office is the second highest of all German clusters (see Table 16).

The *decision-makers of tomorrow* have the third highest level of education.

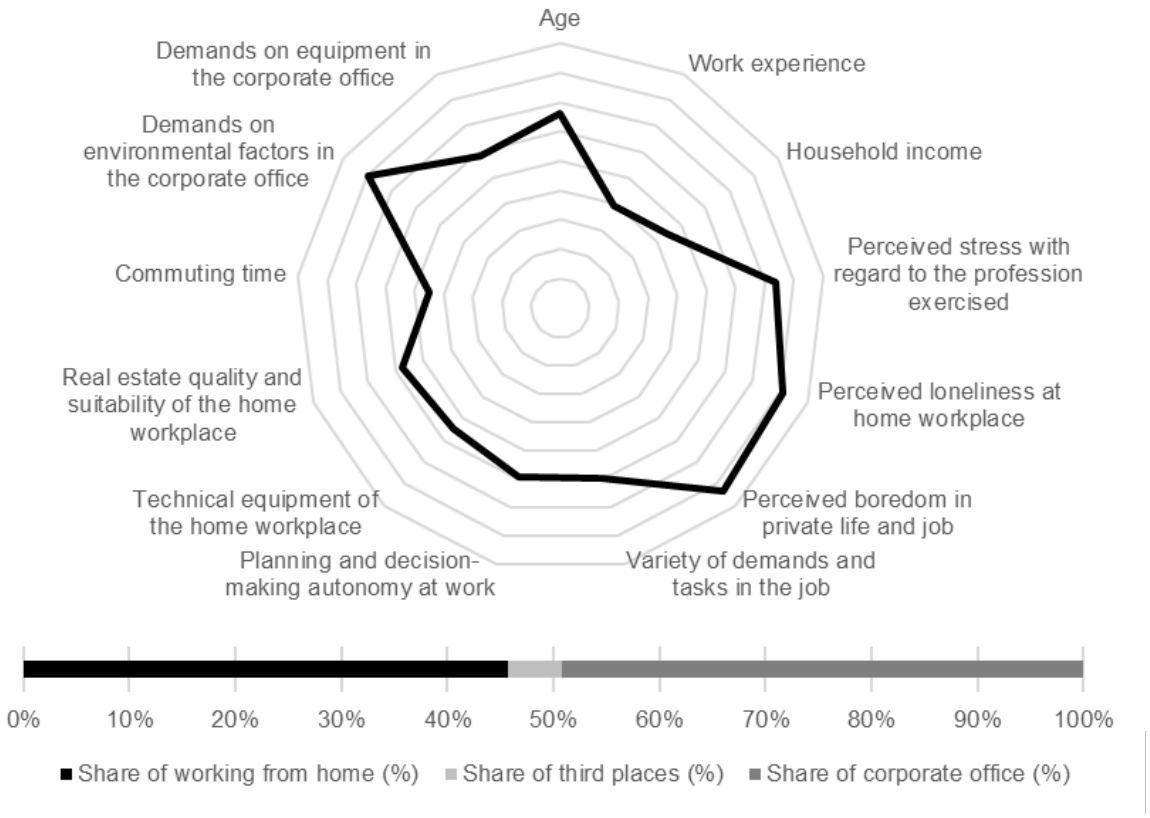

Figure 15: Under-challenged (Germany) cluster characteristics

The *under-challenged* cluster would like to spend 49% of working time in the office and 46% at home (see Table 15).

The *under-challenged* group has the lowest household income of all clusters. In addition, the respondents are affected by comparatively high loneliness at the home workplace and professional and private boredom. The work-related characteristics, i.e., work autonomy and variety, have the lowest levels of all German clusters. The technical equipment of the home workplace and the suitability of the home for work from home also have the lowest values among German respondents (see Figure 15).

The cluster members indicated the lowest job satisfaction, productivity, motivation and ability to focus at the home workplace (see Table 16).

The *under-challenged* have the least modern office workplace of all German respondents.

5.4.3 US-American clusters

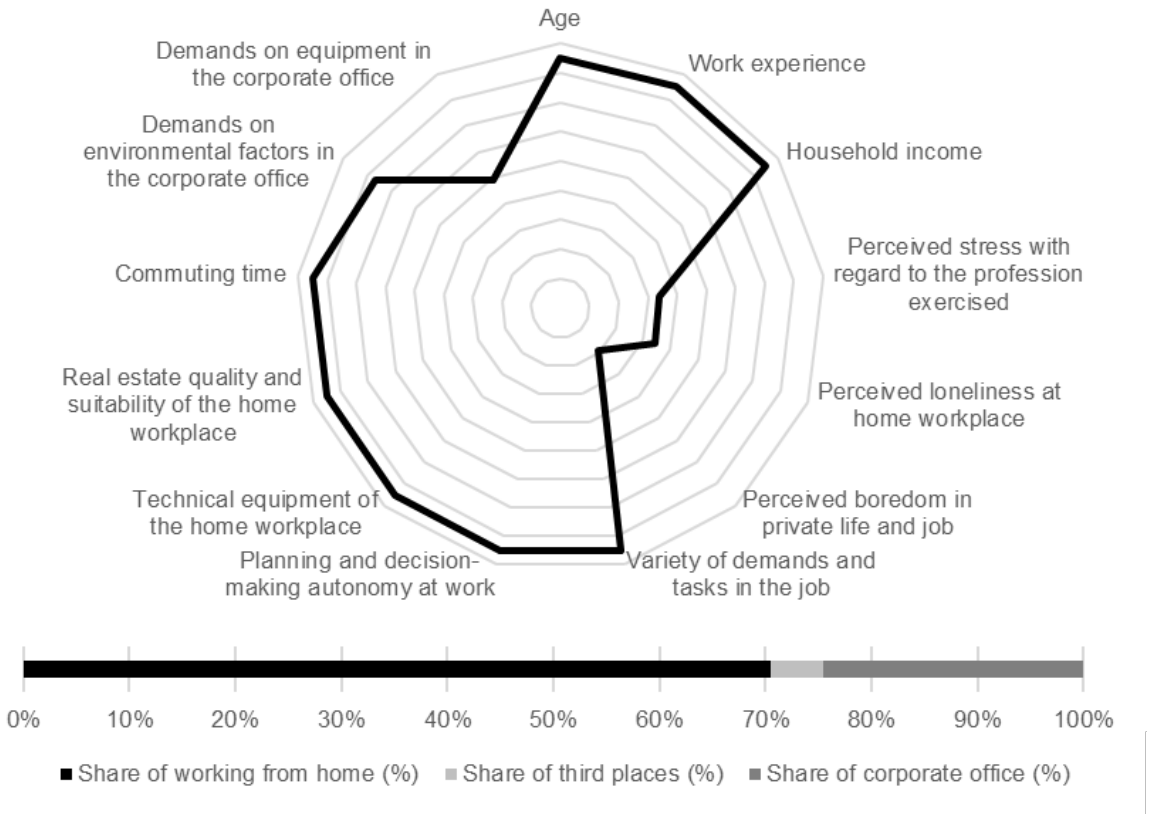

Figure 16: Senior managers (US) cluster characteristics

The cluster of *senior managers* wants to spend 70% of their working time at home (see Table 15).

The cluster includes the oldest and most experienced respondents. *Senior managers* also have the highest income among American respondents. The level of job stress, loneliness at home and boredom in personal and professional life is particularly low while the work-related characteristics of job diversity and autonomy are high. With regard to the technical equipment of the home workplace, the real estate suitability of the apartment for work from home, and the commuting time, the cluster has the highest characteristics of the US clusters. The demands on office equipment are comparatively low (see Figure 16).

Job satisfaction and productivity at the home workplace are above average. With regard to motivation to work from home, the highest value of all US clusters was measured (see Table 16).

The cluster includes the respondents with the highest level of education and the highest position in their companies.

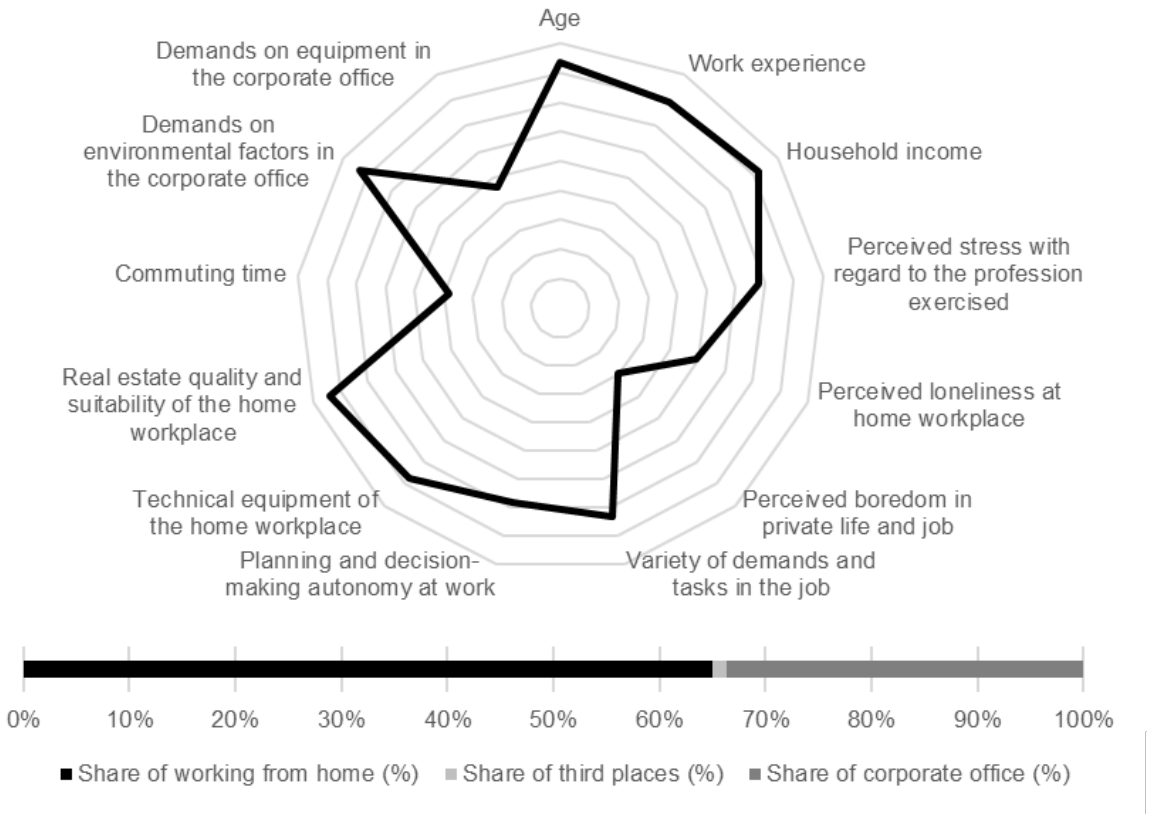

Figure 17: Senior specialists (US) cluster characteristics

Senior specialists want to spend two-thirds of their working time at home and one-third of their working time in the office (see Table 15).

The *senior specialist* cluster is the second oldest and second most experienced American cluster. They also have a comparatively high salary. Among the real estate characteristics, the high suitability of housing for work from home is notable. Commuting times are comparatively low and the demands on the environmental factors in the office are comparatively high. The demands on the equipment are very low (see Figure 17).

The *senior specialists* indicated a high level of job satisfaction at home. Motivation and the ability to concentrate at the home workplace as well as satisfaction in the office are also above average (see Table 16).

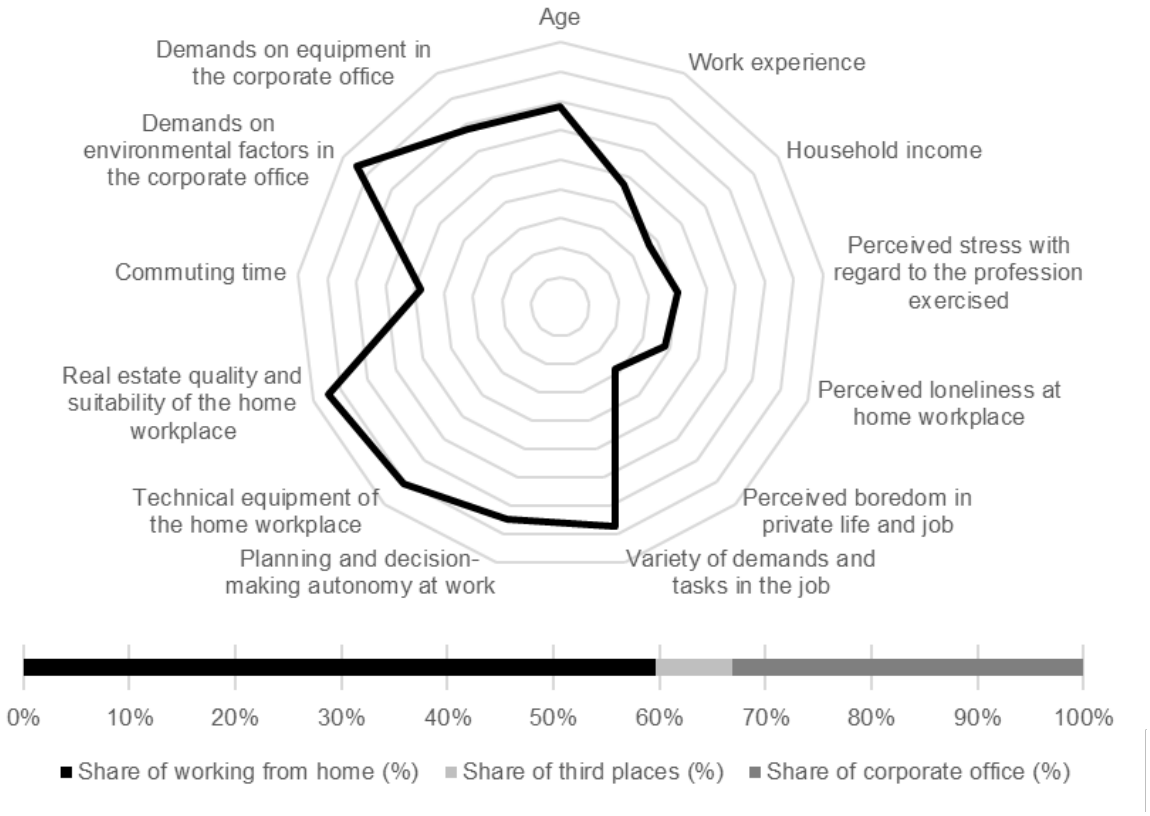

Figure 18: American dreamers (US) cluster characteristics

The *American dreamers* group wants to spend 60% of their working time at home and one-third of their time in the office (see Table 15).

American dreamers have the lowest income of all American clusters. Perceived job stress and loneliness at home are particularly low. With regard to the real estate characteristics, the high suitability of the home workplace and the high demands on the office are noticeable (see Figure 18).

The *American dreamers* indicated the highest satisfaction of all US clusters at the home workplace. Productivity at the first place is also high. In addition, job satisfaction in the office is the second highest of all clusters (see Table 16).

Among the other variables not taken into account statistically, it stands out that the *American dreamers* have the second lowest level of education and at the same time the longest average working hours.

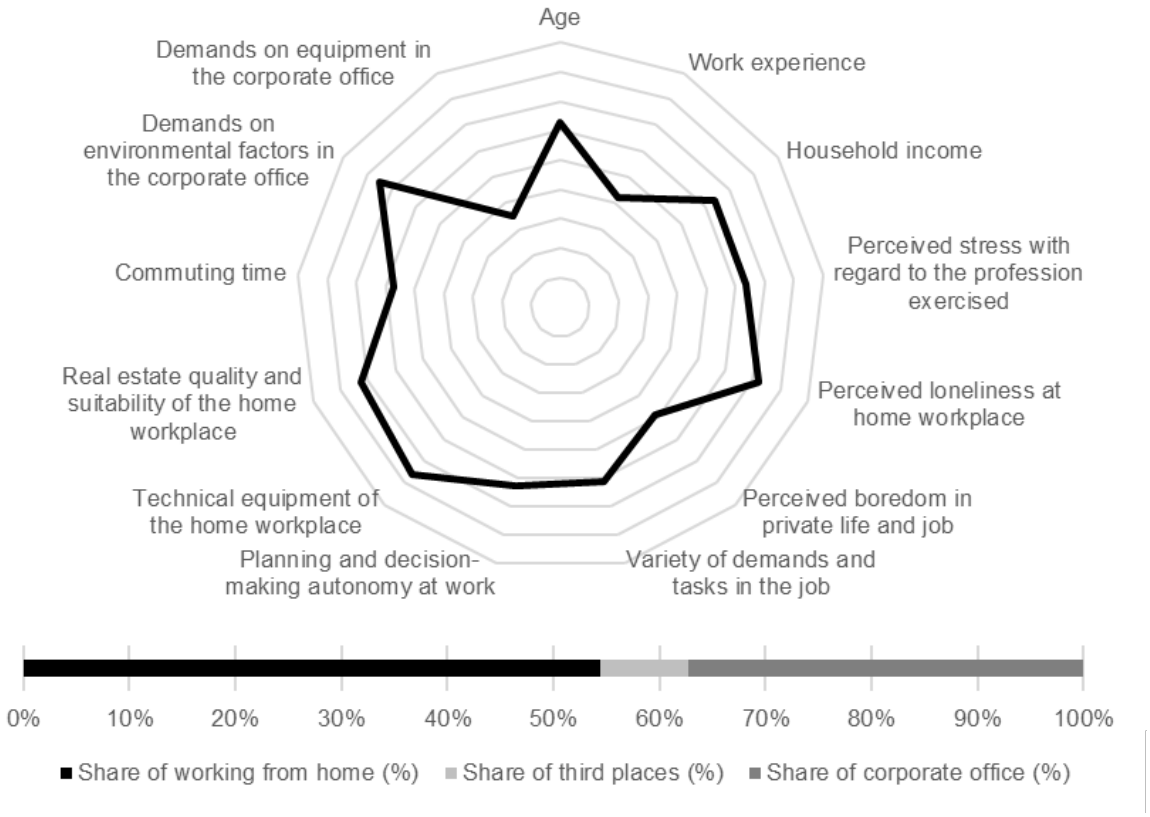

Figure 19: Nine-to-five clerks (US) cluster characteristics

The *nine-to-five clerks* want to work from home 55% of the time and 37% in the office (see Table 15).

The cluster members have the second highest perception of loneliness at home and a comparatively high level of professional and private boredom. Professional diversity and autonomy are only marginally pronounced. With regard to the suitability of the home for work from home, the respondents gave the second lowest value of all American clusters. The demands on the equipment of the office workplace are the lowest of all American respondents (see Figure 19).

Cluster members indicated the second lowest level of job satisfaction in the home workplace. Productivity compared to the office workplace is the lowest of all American clusters. However, respondents did not report increased availability at home, such as reduced break

times, overtime or working despite being unwell, (see Table 16) and reported an average working time.

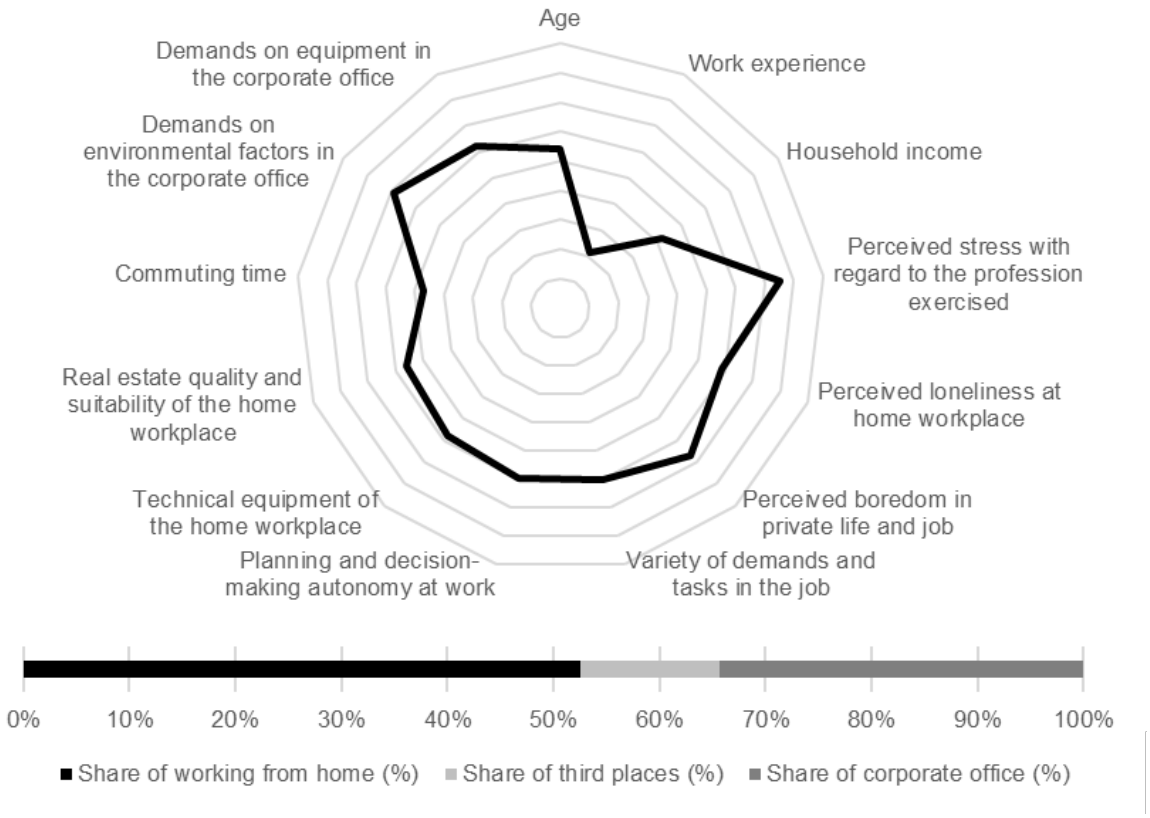

Figure 20: Coworking affine (US) cluster characteristics

The *coworking affine* have the second largest share of coworking time among American employees. They want to spend 13% of their time in third places. More than half of the time they want to work at home and about one-third in the office (see Table 15).

The cluster members are comparatively young and inexperienced. The income of the respondents is the second lowest among American clusters and the cluster members experience the second highest professional stress and professional and private boredom. Loneliness at home is also comparatively high. The work-related characteristics of professional autonomy and diversity of tasks and requirements are the least pronounced in the American comparison. The respondents indicated the lowest level of technical equipment and suitability of the home workplace with regard to the property characteristics. The demands on the environmental factors in the office are also the lowest of all American knowledge workers (see Figure 20).

Among the American clusters, those with an affinity for coworking are those with the lowest satisfaction both at home and in the office (see Table 16).

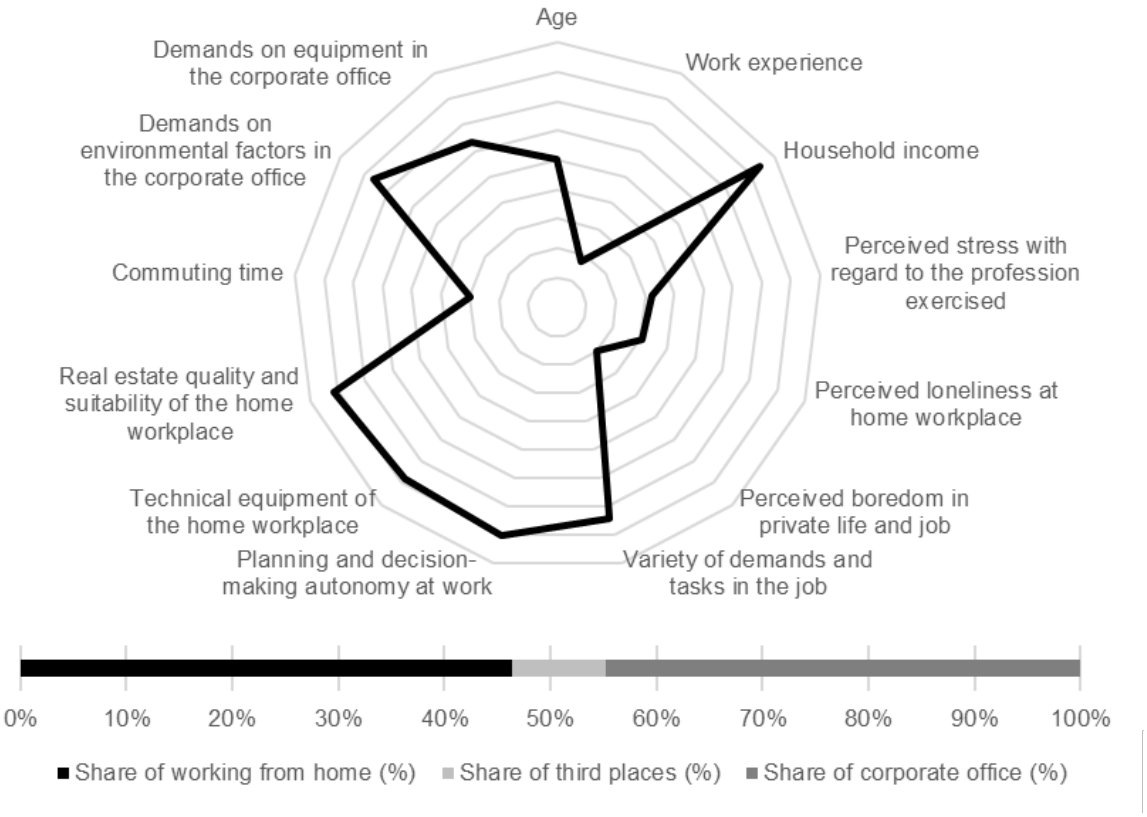

Figure 21: Office affine (US) cluster characteristics

The distribution of working places of the *office affine* shows that they want to spend the largest proportion of their time in the office compared to other respondents, 45% of their working time at the second place and 46% working from home (see Table 15).

The *office affine* cluster includes the youngest and second least experienced respondents. Their income, on the other hand, is particularly high. The cluster members indicated the lowest affliction of professional stress and loneliness at the home workplace. Professional and personal boredom is the second lowest of all American clusters. Among the work-related characteristics, the high level of autonomy in planning and decision-making should be emphasised. Among the real estate characteristics, only commuting time stands out, the lowest of all US respondents (see Figure 21).

The cluster of the *office affine* stated the second lowest productivity at home. At the same time, motivation at home is the highest of all American respondents (see Table 16).

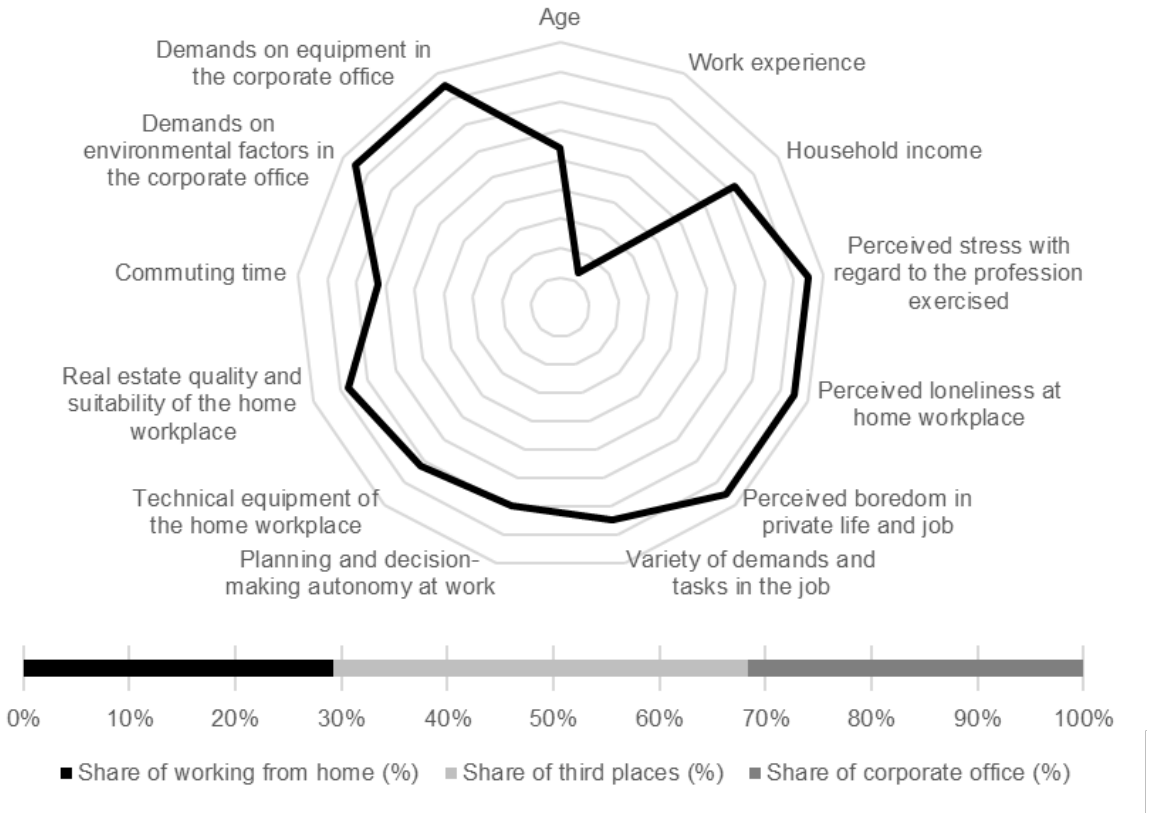

Figure 22: Coworking youngsters (US) cluster characteristics

The *coworking youngsters* want to spend the largest share of their working time (39%) at third locations. The rest of the time is divided equally between the other two locations (see Table 15).

The respondents are comparatively young and the most inexperienced knowledge workers. Perceived occupational stress, loneliness at home and occupational and private boredom have the highest values across clusters. Among the real estate characteristics, the second highest commuting time and the highest demands on the company office stand out both in terms of environmental factors and equipment (see Figure 22).

The cluster of *coworking youngsters* indicated the highest productivity at home. At the same time, the motivation to work and the ability to concentrate at the first place is the lowest among the American clusters. Cluster members face increased availability. Job satisfaction in the office is the highest among US knowledge workers (see Table 16).

The *coworking youngsters* have a high level of education and hold comparatively high positions in their company.

5.5 Discussion

5.5.1 Cluster formation

The clustering of German knowledge workers can be explained based on various developmental strands. With regard to personal characteristics, for example, it can be observed that with a stronger psychographic impact of stress at work, loneliness when working from home and boredom in work and private life, a decreasing share of the home workplace in the desired distribution of workplaces is seen (see clusters *young professionals*, *decision-makers of tomorrow* and *under-challenged*). With regard to the factors age, work experience and household income as well as the work-related factors, no clear trend can be discerned.

Regarding real estate characteristics, it is clearly recognisable that clusters with high suitability of the home workplace (*senior managers* and *senior employees* as well as *academics*) have the highest share of working from home, whereas, in particular, the two clusters with the lowest suitability of the home workplace (*young professionals* and *under-challenged*) prefer to spend less working time at home. In terms of commuting time, the clusters with by far the longest commuting time (*skilled workers* and *senior managers*) have the second/third largest shares working from home in the future. With regard to the demands on the real estate resource in the corporate office, no clear trend can be discerned.

The work success factors also explain the choice of workplace of the individual clusters. Thus, in the clusters with the highest work from home share, high levels of satisfaction in the home workplace, a good level of motivation as well as productivity advantages in working from home can be observed (*senior employees* and *skilled workers*). In the following clusters, decreasing satisfaction at home, motivation problems and productivity losses at home increase the share of the office and third places. (*senior managers* and *young professionals*) and finally predominate in the remaining clusters (*decision-makers of tomorrow* and *under-challenged*). The cluster of *academics* stands out among the other clusters as the cluster members report above-average success factors in both workplaces. The employees seem to be able to work successfully at all locations and are, therefore, in the middle of all clusters in terms of the proportion of work from home.

Clustering in the US follows similar principles. Among the personal characteristics, there is a tendency that older knowledge workers want to work from home more often. In the US as well, it can be observed that an overall higher psychographic impact of occupational stress, loneliness at home and occupational and private boredom is accompanied by a declining proportion of work from home. *Senior managers* and *American dreamers*, the clusters with

the highest and third highest work from home share, respectively, reported only low psychographic strain. At the same time, the burden is particularly high among the cluster of *coworking affine* and *coworking youngsters*. Here, third places seem to offer a good working environment where they can escape loneliness and boredom (Appel-Meulenbroek et al., 2021; Clifton, Füzi and Loudon, 2022). An exception is the cluster of office affine. This cluster has a low level of psychographic stress but has the highest share of working in the office in the future. The cluster members apparently do not flee to the office to escape psychographic stress.

Among the work-related characteristics, it stands out that the clusters with the highest share of working from home have high levels of work-related autonomy and diversity (*senior managers*, *senior specialists* and *American dreamers*) (OECD, 2020).

With regard to commuting time, it is noticeable that high commuting times are mostly associated with the desire to work in third places (*coworking youngsters*) or at home (*senior managers*). Low commuting times are associated with higher shares of work in the office (*office affine*). In the US, it can also be observed that high suitability of the home workplace goes hand-in-hand with a stronger desire to work at home (*senior managers*, *senior specialists* and *American dreamers*). With regard to the demands on the office, no clear trend can be discerned. The cluster with the highest demands is the *coworking youngsters*. The office affine cluster is a general exception in the interpretation of property characteristics: it has formulated both an average suitability of the home workplace and an average requirement for the company office. Obviously, the respondents find good working conditions in the office so that the desired proportion of the place of work is high. At the same time, satisfaction with the office is only average. It could probably be increased by upgrading the corporate space.

With regard to the work success factors, the trend can be seen that US knowledge workers tend to work from home if their job satisfaction at the home workplace is high. If satisfaction shifts to the office workplace, then its share and that of third places also increase. The cluster with the lowest satisfaction in the office on the other hand shows an affinity for coworking.

5.5.2 Comparison between Germany and the US

It was already evident from the comparison of mean values across all respondents in the two countries that third places play a greater role in the US than in Germany. This is also reflected in the cluster results. While there is no cluster in Germany that relies on third places to work,

there is one cluster in the US that already prefers third places as their main workplace and another cluster that has an affinity for working at third places. In Germany, third places do not even serve to compensate for long commuting times. The substitution of unsuitable office or home workplace has not taken place yet. In the US, on the other hand, the results of the analysis suggest that coworking, for example, is used to escape of unsuitable home workplace or office or compensate long commuting. US respondents have recognised that high demands on the real estate resource are served in third places. In addition, respondents are consciously looking for a suitable psychographic environment. Apparently, the development towards conscious multilocality of work is already further advanced in the US. German respondents have not yet recognised the advantages of third places of work due to a lack of experience with the place of work. This is in line with the observations of Echterhoff et al. (2018) who observed a low diversity of coworking offers in Germany and called for a further development of the coworking model in order to increase the acceptance of coworking as a place to work.

Furthermore, a higher importance of the office can be seen for German than for US knowledge workers. Five of the German clusters intend to spend around two days or more (> 35%), in the corporate office (79% of all German respondents). Among the US clusters, only respondents from two clusters indicated this (31%). The importance of the corporate office in Germany is underlined by the cluster of *tomorrow's decision-makers*. These young people, who apparently already have good jobs, want to bear responsibility and also want to do so in the future, rely on the office. Apparently, they see the office as an opportunity to present themselves and to convince the decision-makers of today, the *senior managers*, of their quality. *Tomorrow's decision-makers* want to be noticed today and they see the corporate office as the stage on which they can present themselves. In the US, on the other hand, there is a cluster that has clearly recognised the advantages of the office. Consequently, it can be deduced that compared to Germany, in the US there is already a better awareness of the various workplaces and the advantages and disadvantages they offer.

5.5.3 Management implications

Listen to your employees

The cluster results clearly show that employees are able to assess for themselves which workplaces are suitable for them. Even if, for example, third places play a subordinate role among German respondents and US-Americans already seem to have a clearer picture of the

preferences of the different places of work, they are nevertheless able to differentiate between work and their associated success based on their own characteristics at the home workplace and in the office. Knowledge workers in both countries predominantly prefer workplaces in the future where they can work successfully. The distribution of workplaces also appears to be mostly suitable due to personal, work-related and real estate characteristics. For CREM, this means that the employees of their corporates are the first point of contact for planning the real estate resource. Engaging in dialogue with employees about their workplace preference seems inevitable in the future. The demands articulated by employees can be the basis for the development of real estate strategies.

Decide wisely

Even if knowledge workers are well able to decide on an individual level where they want to work successfully, it makes little sense to comply with these wishes without restrictions. Corporates are social entities, and value creation and innovation come from exchanges with one another. The individual goals of the individual respondents cannot be achieved by unreflectively fulfilling all demands either. This becomes clear with the cluster of the *decision-makers of tomorrow*: they prefer to do large parts of their work in the office in order to present themselves to today's decision-makers and to be noticed. They want to recommend themselves for future tasks. At the same time, *senior managers*, whose job would be to evaluate and train their successors, want to spend most of their working time at home. It becomes clear that the achievement of the individual goals of the first-mentioned group as well as the corporate's goal of developing and retaining qualified workers in the long term appear questionable if each employee is free to decide to what extent they want to work at different workplaces. Finally, a perceived stagnation of ambitious employees threatens corporates with a brain-drain in the form of migration to other corporates, where the *decision-makers of tomorrow* may assume better development options.

The challenge for HRM and CREM is to optimise the operational space structure while maximising the satisfaction of the needs articulated by the employees and taking into account the business impact contexts such as the need for cooperation and exchange.

Use the culture-creating effect of corporate real estate

The survey results clearly show that the future of the working environment is multilocal. As described above, this brings not only advantages but also issues that need to be moderated. If work takes place less in the office in the future and employees are better able to cope in third places and in the home workplace, then this will have an impact on the entire

corporate. Not only must smooth and effective work be ensured, but the social component of the corporate must also be preserved in the future. Identification and togetherness can only flourish with difficulty in the home workplace and in third places where employees work in spatial isolation. This makes it all the more important in the future to use corporate real estate in a way that fosters culture. In the time that employees will spend together in their teams at the corporate headquarters, the corporate culture can be communicated. Real estate can provide important impulses for this and transport the desired messages internally and externally.

Use multilocality for your purposes

As described above, real estate is becoming increasingly important for communication with corporate stakeholders. At the same time, the expected multilocality of work itself, which is desired by large parts of knowledge workers and which decisively emphasises the importance of real estate, can be used to serve one's own corporate purposes. In doing so, the focus should not be placed solely on leveraging presumed cost-saving potentials. Rather, the conscious offer of working from home or third places provided by the corporate can also be an instrument for employee acquisition or development. If an employee has the desire to work from home or in a third place and does not find the offer in his or her own corporate, then this could be an argument for changing jobs to a corporate that works in a more hybrid fashion. At the same time, both the German and the US results show that it is, above all, particularly deserving employees who are attracted to the home workplace. Against this background, work from home and work from third places can not only serve to meet real estate needs, but can also be seen as a sign of appreciation as a new status symbol as part of the incentive offer in the war for talents.

Shape the multilocal needs and desires of your employees

The German cluster of the *under-challenged* illustrates the opportunities regarding third places of work. The *under-challenged* do not show a high level of satisfaction in either the office or the home workplace. Neither place of work seems to be suitable for the cluster members. The manifestations of professional and private boredom as well as loneliness, and the low suitability of the home workplace indicate that parts of the work could be successfully carried out in third places. However, coworking spaces do not seem to play a role and this is observed in all clusters of German respondents. The *young professionals* show a certain interest in working at third locations and at the same time show low suitability of the home workplace. Here lies an opportunity for the corporates. By offering coworking spaces close to employees' homes, high commuting times could be compensated and suitable

work environments can be used. As the US clusters show, coworking could serve as a substitute for the office or for work from home and, thus, increase employees' job satisfaction if it is more accepted by the employees. For this to happen, unmet needs must be identified and met. The design of multilocality for employees is, therefore, a valuable key for corporates to manage satisfaction, productivity and costs.

The same old tune of qualitative space adjustment in the portfolio

As the previous sections and other studies show, there is considerable need for real estate adaptation on the part of the corporate sector (Pfnür, 2020). Work from home plays an important role in all clusters and it is to be expected that it will be used to a considerable extent in the future (Barrero, Bloom and Davis, 2021; Pfnür et al., 2021). From a corporate's point of view, this is an all-important sign as it shows what employees seem to think of the corporate's space. At the same time, further developments in the US show that corporate offices will continue to have justification for existence that goes beyond mere representation. They continue to play an equal role among the various offerings if, in comparison to these, satisfactory and productive work is possible at the location. Overall, it may be necessary to adjust the quality of the space rather than the quantity. Coworking spaces could make up a larger share of the available space. To maximize the benefits of the real estate resource through the enhancement of exchange and cooperation and as a medium of communication both internally and externally, business space must be of a high quality.

Meeting multilocality only works through exchange

Finally, due to the extensive pressure to adapt on the part of the corporates, it should be noted that the change towards a multilocal working world can only succeed in cooperation with all real estate industry players. Such profound changes have an impact on everyone: project developers, investors, the housing industry, urban planning and many more. Increasing multilocality of work changes the demands on the real estate industry as a whole and is a visible sign of the ongoing transformation process. As such, it should continue to be taken into account in future planning.

5.6 Limitations and future research

This paper provides important recommendations for CREM and HRM on how to deal with increasing multilocality of work. However, because the results are based only on surveys of German and US knowledge workers, the findings may not be transferable to other countries. Further research could examine whether the results are transferable and, thus, make an

important contribution to the real estate management of multinational corporations. Furthermore, the results could be reviewed after the pandemic – during which the data were collected and which undoubtedly influenced the results – has subsided in order to exclude possible influences of the special situation. In addition, future studies could take into account various other factors to give weight to the factors in terms of their relevance for multilocality. To further sharpen our understanding of the factors influencing multilocality of work, it could also be investigated to what extent the results can be replicated in individual industries or whether industry-specific workplace distributions can be identified. Finally, specific designs of corporate workspaces could also be included in the analysis in order to determine their influence.

6 Article 4: The power of place: The impact of real estate on work success when working from home

Title:	The power of place: The impact of real estate on work success when working from home
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Abstract

Work success of knowledge workers is of utmost importance for organizational performance. Nowadays, knowledge work is widely performed from outside the corporate office and remote work practices are increasingly becoming a new standard among knowledge workers. Researchers and practitioners are interested in the factors that influence productivity in the workplace at home when working from there. This study applies the Job Demands-Resources model to investigate the effect of real estate parameters on productivity when working from home. Furthermore, the study analyzes holistically the relative importance of physical, organizational, and socio-psychological parameters on employees' work success. For that purpose, data from n = 502 knowledge workers from Germany and the United States are examined with partial least squares structural equation modelling (PLS-SEM). The results show a significant positive relationship between real estate parameters and knowledge workers' satisfaction and between satisfaction and productivity when working at home. In detail, the housing conditions, the workplace environment, and the indoor environmental quality factors play a significant role. Furthermore, the results show that organizational resources have hardly any effect on satisfaction apart from skill variety. In contrast, socio-psychological demands have a strongly positive effect on burnout. Surprisingly, burnout itself has a significantly positive effect on productivity. In conclusion, this study empirically shows the decisive effect of real estate parameters on work success of knowledge workers working from home.

6.1 Introduction

The organization of work, especially the spatial distribution of work, is subject to dynamic changes. The introduction of Information and Communication Technologies (ICT) causes a higher degree of flexibility in terms of where and when to work (Olson and Primps, 1984; Baruch and Nicholson, 1997; Krantz-Kentkrantz, 2019). Thus, location independence of work gains more recognition (Nilles, 1997). Even before the COVID-19 pandemic, the increase in the proportion of employees working from home was evident (Krantz-Kentkrantz, 2019). However, due to the COVID-19 pandemic, work from everywhere and especially work from home has been established for millions of employees worldwide (Ozkazanc-Pan, 2019). Yet, the potential for jobs that can be done from home is comparatively high. Empirical studies estimate, for example, that 25-30% of private-sector employees in Germany can work from home (Kagerl and Starzetz, 2023), whereas 37-41% of jobs in the United States can be done from home (Dingel and Neiman, 2020). Practitioners and researchers commonly agree that work from home will be very much part of a post-pandemic economy (Bloom, 2020; Contreras, Baykal, and Abid, 2020; Pfnür et al., 2021).

The relevant literature provides evidence that work from home may have an impact on individual, organizational, and social levels although the boundaries between these different levels are often blurred (Pérez Pérez, Martínez Sánchez, and Pilar de Luis Carnicer, 2003). On an individual level, an increase of general satisfaction and productivity is associated as benefits of working from home (Mann and Holdsworth, 2003; Pérez Pérez, Martínez Sánchez, and Pilar de Luis Carnicer, 2003; Mello, 2007; Golden, 2009; Tremblay and Thomsin, 2012; Almarzooqi and Alaamer, 2020; Kagerl and Starzetz, 2023; Flassak et al., 2023). However, working from home has seen a significant increase in mental health problems of stress like burnout, which is understood to be a long-term consequence (Mann and Holdsworth, 2003; Bakker, Demerouti, and Sanz-Vergel, 2014). Various research disciplines investigate separately on factors influencing work success at home. Studies examine broadly the impact of socio-psychological and organizational parameters on work success from home (Lim and Teo, 2000; Hill et al., 2010; Sardeshmukh, Sharma, and Golden, 2012; Nakrošienė, Bučiūnienė, and Goštautaitė, 2019; Mello, 2007; Bhuiyan et al., 2020). Work success can be described as the interaction of employee attitudes and work outcomes (Yalabik et al., 2013). Employee attitudes are reflected through several sources, e.g., satisfaction or burnout (Judge et al., 2001; Rich, Lepine, and Crawford, 2010; Yalabik et al., 2013). Additionally, one of the most common work outcome factors is productivity (Yalabik et al., 2013) as the ratio of output and the resources used to achieve it (Brinkerhoff and Dressler, 1990; Aronoff and Kaplan, 1995).

Krupper (2015) investigates the relationship between real estate, organizational, and socio-psychological parameters on productivity of employees in the office. Furthermore, several studies show that for the workplace at home the same parameters have an impact on work behavior (Sallis, Owen, and Fisher, 2015; Munir et al., 2021; Weber et al., 2022). An experiment by Bloom et al. (2015) is the first to compare the two work locations. They look at employees working at the office and employees working from home, and reveal that working from home can lead to higher levels of performance and improved work satisfaction compared to working at the office. As the only difference between these two groups is the location of work, it must be assumed that real estate parameters at home play a decisive role in explaining higher degrees of work performance.

With regard to work from home, very few studies investigate holistically the impact of different parameters on individual conditions of employees and further on organizational outcomes (Weber et al., 2022). Especially, the role of physical parameters at home, such as real estate conditions, regarding work success in the home office is still rarely investigated. Also, organizations are keen to know how personal requirements of working environments at home can support work success and whether employees are equally suited to work from home.

Therefore, this study aims to make two contributions. First, the study examines the significance of physical resources on work success of employees working from home. In this study, physical resources are exclusively reflected by real estate parameters. Work success is reflected through productivity, satisfaction, and burnout, and influenced by the personal requirements of employees working at home. Personal requirements in this study are real estate, organizational, and socio-psychological parameters. Second, the study analyzes the relative importance of those real estate, organizational, and socio-psychological parameters on productivity of employees working at home. For that purpose, the Job Demands-Resources model (JD-R) (Demerouti et al., 2001; Bakker and Demerouti, 2007) is applied. Based on a quantitative survey conducted among knowledge workers in Germany and the United States of America, partial least squares structural equation modelling (PLS-SEM) is used for the analysis.

6.2 Theoretical background and derivation of hypotheses

6.2.1 The Job Demands–Resources model and its suitability for the analysis of work from home

Psychological, social, physical, and organizational parameters have an impact on the conditions of employees and the organizational outcomes (Bakker and Demerouti, 2007). However, these parameters and their impact depend on the specific workplace. The lack of robust empirical research and evidence makes it necessary to holistically investigate on the impact of physical, organizational, and socio-psychological parameters on work success at home. Therefore, this study applies the JD-R model to measure the influence on two important employee attitudes, satisfaction and burnout, and the work outcome productivity when working from home.

The JD-R model combines the two independent research traditions of stress and motivation for describing the interaction of work-related resources (e.g., criteria of human work design) and demands (e.g., environmental stressors). Initially, it was designed to understand burnout and was later supplemented to understand the process of motivation as well (Demerouti et al., 2001; Bakker and Demerouti, 2007). The JD-R model considers the main implications of the Conservation of Resources theory (Hobfoll, 1989, 2001; Hobfoll et al., 2018) and responds to the criticisms of many other work organization models, such as the Demand-Control model (Karasek, 1979) or the Effort-Reward Imbalance model (Siegrist, 1996), by a broader conceptualization. With a comprehensive empirical base and conformations of the JD-R model, its applicability to a variety of different occupational groups is demonstrated (e.g., Bakker et al., 2003; Xanthopoulou et al., 2007). The JD-R model states several propositions. Core of the model is that all occupations share common factors. These factors affect human well-being, work behavior, and success, and can be distinguished into two general categories: job demands and job resources (Demerouti et al., 2001; Bakker et al., 2003; Bakker and Demerouti, 2007). A high level of job demands leads to burnout, which in turn can decrease productivity (Demerouti et al., 2001; Bakker and Demerouti, 2007; Lesener, Gusy, and Wolter, 2019). On the contrary, a high number of job resources leads to an increase in satisfaction and, thus, to a rise of productivity (Demerouti et al., 2001; Bakker and Demerouti, 2007; Lesener, Gusy, and Wolter, 2019). In addition, an interaction between job demands and job resources is postulated (Bakker and Demerouti, 2017). This means that job resources buffer the impact of job demands. Even if every occupation has its own risk factors, these two universal categories serve as rationale for the transferability (also called “flexibility”) of the model because all demands and resources of

various occupational settings can be clustered into either one of the two categories (Bakker and Demerouti, 2007).

Job demands and job resources have in common that they relate to physical, psychological, social and/or organizational aspects of the job (Demerouti et al., 2001). Krupper (2015) uses similar aspects of the job and shows their impact on productivity when working at the office. Regarding work from home, several studies postulate an impact of physical, socio-psychological, and organizational parameters on work behavior (Weber et al., 2022). Based on the definitional delineation of job demands and job resources and the previously mentioned studies, the JD-R model provides a valid basis for addressing the contributions of this study. Figure 23 illustrates the resources and demands included in this study.

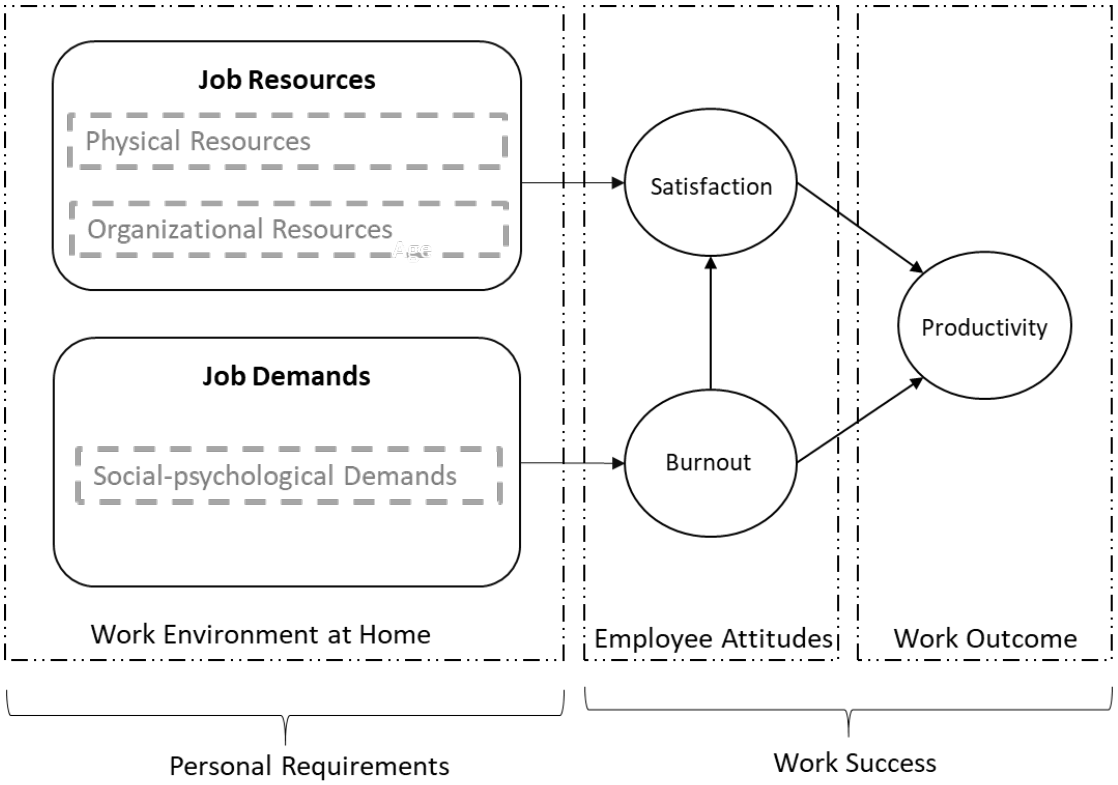

Figure 23: Interplay of physical, organizational, and socio-psychological parameters, and their influence on employee attitudes and work outcomes in the home office

Physical and organizational resources as well as socio-psychological demands are based on independent literature from different research disciplines, and are merged into a holistic model in the following remarks, which thereafter will be analyzed empirically. The development of this framework and the hypothesis will be discussed in detail in the following

paragraphs. A conscious selection of resources and demands for the applied research model is necessary and results in a combination of 12 characteristics. In their sum, they holistically investigate the impact of the home office workplace on individual conditions of employees and organizational outcomes. All characteristics are assigned to one of the two categories, either demands or resources (according to proposition one of the JD-R model). The order of hypothesis developed is performed from left to right according to the direction of effect in the research model.

All five socio-psychological aspects, isolation, family-work interference, boredom as well as age and household size are classified as job demands in this study, because all represent aspects that require mental effort and carry psychological costs (Demerouti et al., 2001). The resources include physical and organizational aspects. Indoor Environmental Quality, housing conditions, workplace environment, decision-making and work scheduling autonomy as well as task and skill variety are chosen because they are either aspects of workplace environment whose presence is associated with an enhanced ability to reach higher levels of work engagement (Roskams et al., 2021) or an aspect of the job that is functional in achieving work goals or stimulating personal growth and development (Demerouti et al., 2001).

6.2.2 Physical job resources and their impact on satisfaction when working from home

To achieve the first research objective of investigating the importance of physical parameters on work success of home office workers, in this study, physical resources are represented by three main characteristics of the workplace at home. In the same way that Indoor Environmental Quality is considered influential in offices, it is also regarded for the home workplace. In addition, the housing conditions and workplace environment at home are included. Thus, the three physical resources selected specifically represent the real estate-related aspects.

Indoor Environmental Quality (IEQ) is measured with thermal comfort (Maarleveld, Volker, and van der Voordt, 2009; Danielsson and Bodin, 2009; Haynes, 2008), air, and light (Krupper, 2015; Haynes, 2008). Al-Omari and Okasheh (2017) show a relationship between temperature, noise, and light and employee satisfaction. Satisfaction and productivity can be increased by good lighting conditions (Ceylan, Dul, and Aytac, 2008; Zuhaib et al., 2018). Improving IEQ embraces the possibility to enhance satisfaction and productivity (Al-Omari and Okasheh, 2017; Toyinbo, 2019). When working from home, there is the possibility to

configure thermal conditions individually to make an air exchange according to one's own feeling and to make the lighting conditions specific to the work. Hence, when working from home, employees are hardly dependent on the needs of other employees. Thus, it is postulated that:

H1: The more pronounced Indoor Environmental Qualities at home, the higher satisfaction.

Møller-Jensen et al. (2008) show that certain aspects of a residential property (e.g., the location) influence the propensity to telework. In principle, this suggests a connection between *housing conditions* and productivity when working from home, which is emphasized by the fact that a comfortable housing situation can lead to a higher acceptance of working from home (Ahlers, Mierich, and Zucco, 2021). Housing conditions can be categorized as follows: characteristics of the property, neighborhood, and the occupants of the property themselves (Galster and Hesser, 1981). A different and more detailed categorization subdivides the impacts on housing conditions into subjective-physical, objective-physical, subjective-social, and objective-social perceptions (Amérigo & Aragonés, 1990). In this study, housing conditions describe the subjective-physical perception of the property as a whole, the location, the planning concept, the quality of the construction, and the economy of the housing situation (Amérigo and Aragonés 1990, 1997; Haynes, 2007; Maarleveld, Volker, and van der Voordt, 2009). Accordingly, housing conditions can not only serve as an important prerequisite for the acceptance of working from home, but can also contribute much more to being satisfied and, as a result, being able to work productively at home. It is thus postulated that:

H2: The more pronounced the housing conditions at home, the higher satisfaction.

The *workplace environment* describes everything that exists around the employee's workplace and has an impact on performance (De Croon et al., 2005; Al-Omari and Okasheh, 2017). In this study, the workplace environment refers to the workplace at home and to the subjective perception of it. In more detail, the workplace environment at home includes the support of equipment or furniture for work in general (Haynes, 2007; Maarleveld, Volker, and van der Voordt, 2009). Regardless of the specific workplace, it is documented that an inappropriate workplace environment has a negative impact on employees (Bailey and Kurland, 2002). Empirical studies with regard to the workplace at home show a positive

relationship between the workplace environment and satisfaction (Nakrošienė, Bučiūnienė, and Goštautaitė, 2019). Thus, it is postulated that:

H3: The more pronounced the workplace environment at home, the higher satisfaction.

For the second research objective, an analysis of the relative importance of physical, organizational, and socio-psychological parameters on work success of employees working at home is carried out. The organizational and socio-psychological parameters included are explained below.

6.2.3 Organizational job resources and their impact on satisfaction when working from home

On the individual level, the most important type of organizational resources is human. Therefore, two essential resources are included in the model, autonomy and variety, which both influence humans in the home office. In addition to the autonomy to make decisions and to schedule the completion of tasks independently, it is also assumed that the presence of task and skill variety contributes to an individual working successfully at home.

Work autonomy has probably received the most attention of all organizational job resources (Shalley and Gilson, 2004). Hackman and Oldham (1975:161) define autonomy as "the degree to which the job provides substantial freedom, independence and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out." According to this definition, autonomy can be classified into *work scheduling autonomy* and *decision-making autonomy*. In this study, work scheduling autonomy refers to the allocation of working time of an employee while decision-making autonomy refers to the determination of how their work is done. In general, there is empirical evidence that both types of autonomy are positively related to satisfaction (Loher et al., 1985). In more detail and with regard to work from home, work scheduling autonomy and decision-making autonomy can lead to a higher level of satisfaction and, thus, enhance productivity (Hackman, 1980; Lim and Teo, 2000; Hill et al., 2010; Nakrošienė, Bučiūnienė, and Goštautaitė, 2019). Therefore, a positive relationship between work scheduling autonomy and decision-making autonomy and satisfaction is suggested. It is thus postulated that:

H4: The more pronounced decision-making autonomy when working from home, the higher satisfaction.

H5: The more pronounced work scheduling autonomy when working from home, the higher satisfaction.

Task Variety describes the multitude of tasks associated with a certain job and, therefore, job complexity, which is one of the core job resources with an impact on satisfaction and productivity (Kopelman, 1985; Fried and Ferris, 1987; Oldham and Cummings, 1996). If jobs are complex and require a lot of different tasks, then employees are more likely to focus all their attention and effort on their jobs. Simpler and more routinized jobs do not lead to a higher degree of employee satisfaction (Shalley and Gillson, 2004). A positive relationship between task variety and satisfaction is documented (Hackman and Oldham, 1975). The physical distance to colleagues when working from home and the lack of informal exchange require communication with other colleagues, especially when the job requires a high density of different tasks. Thus, employees with a variety of different tasks are more involved in organizational processes. It is thus postulated that:

H6: The more pronounced task variety when working from home, the higher satisfaction.

Skill variety describes the amount of skills a person needs to be able to do a job (Hackman, 1980). The lack of spontaneous help from colleagues or missed work equipment by hand complicates work from home (Kellner, Albrecht, and Löffl, 2020). In addition, with all the distractions around in one's own premises it might be more difficult to complete monotonous tasks satisfactorily. Nevertheless, a meta-analysis by Humphrey, Nahrgang, and Morgeson (2007) shows that skill variety is positively related to satisfaction. In order to cope with the lack of spontaneous help from colleagues and missing work equipment, employees need special skills to work from home. Skill variety can counteract these circumstances when working from home. It is thus postulated that:

H7: The more pronounced skill variety when working from home, the higher satisfaction.

6.2.4 Socio-psychological job demands and their impact on burnout when working from home

In addition to the workplace characteristics assumed to be resources of the home office, the workplace at home also has several demands. This study's research model takes into account the special socio-psychological circumstances that a workplace at home in particular entails.

Thus, in addition to isolation and family-work interference, boredom as well as age and household size are included.

Isolation is one of the main reasons for low rates of working from home before the COVID-19 pandemic (Nakrošienė, Bučiūnienė, and Goštautaitė, 2019). Thereby, isolation can be subdivided into physical, professional, and/or social isolation. Physical isolation describes that employees carry out their work activities in a work environment that is separated from the work environment of their colleagues (Bartel, Wrzesniewski, and Wiesenfeld, 2012). Professional isolation, on the other hand, depicts reduced career opportunities due to reduced networking, learning, and informal mentoring (Cooper and Kurland, 2002). Social isolation refers to an individual's feeling of lack of inclusion or connectedness within their work environment (Bentley et al., 2016). Hereby, social isolation is often cited as a drawback of telework or, more specifically, of working from home (Baruch and Nicholson, 1997; Bailey and Kurland, 2002; Mann and Holdsworth, 2003; Mello, 2007; Nakrošienė, Bučiūnienė, and Goštautaitė, 2019). In this study, isolation depicts the subjective feeling of loneliness when working from home. Studies identify that isolation leads to loneliness when working from home (Wang et al., 2021) and that loneliness and the lack of social interaction are the most common reasons why employees want to work at the office (Bloom et al., 2015). While some studies show a mediating role of isolation on burnout (Stephenson and Bauer, 2010), other studies emphasize a link between loneliness (and therefore isolation) and burnout, and suggest that greater human connection at work is a solution to solve burnout problems (Seppala and King, 2017). Furthermore, a direct impact between isolation and burnout is shown (Bauer and Silver, 2018). It is thus postulated that:

H8: The more pronounced isolation when working from home, the higher the perception of burnout.

Family-Work interference describes a form of inter-role conflict based on role stress theory (Grzywacz and Demerouti, 2013). Role conflict is identified as a predictor of burnout (Alarcon, 2011). When working from home, the boundaries between work location and private life can be blurred (Wang et al., 2021). Greenhaus and Beutell (1985) describe three types of family-work conflicts as time-based, strain-based, and behavior-based. All three could be experienced by employees working from home. While people who go to work in the office and then spend their free time in their private rooms, people in their role as employees suddenly find themselves in the home office, i.e., the environment in which they normally perform their role as a family member, partner, or parent. Time-based, strain-

based, and behavior-based conflicts mean that a clear separation of roles becomes more difficult. Literature also states that frequent distractions and interruptions by cross-domain roles lead to greater experiences of exhaustion (Kreiner, Hollensbe, and Sheep, 2009; Golden, 2012) and that a relationship between stressful events in personal life and burnout exists (Hakanen and Bakker, 2017). It is thus postulated that:

H9: The more pronounced family-work interference when working from home, the higher the perception of burnout.

Boredom at work is still largely unexplored although it has received some attention in recent years (van Hooff and van Hooft, 2014; Sousa and Neves, 2021). Mikulas and Vodanovich (1993:3) describe boredom at work as "a state of relatively low arousal and dissatisfaction, which is attributed to an inadequately stimulating situation." Boredom at work can lead to higher levels of depressive complaints and anxiety (van Hooff and van Hooft, 2014; Lee and Zelman, 2019) as well as less job satisfaction and organizational commitment (Reijseger et al., 2013). Frustration, restlessness, and loneliness are often linked with boredom (Harasymchuk and Fehr, 2010). Sousa and Neves (2021) illustrate the impact of boredom at work on burnout and emotional exhaustion. As the work environment at home tends to offer less variety and less interaction with colleagues, boredom at the home office could be particularly pronounced. It is thus postulated that:

H10: The more pronounced boredom when working from home the higher the perception of burnout.

Numerous research studies identify *age* as a possible factor related to employee burnout. However, the study situation regarding the impact of age on burnout is not entirely clear. While some studies conclude no impact of age on burnout (Coetzee, Maree, and Smit, 2019), within the frame of a meta-analysis, Brewer and Shapard (2004) show a small negative correlation between the age of an employee and emotional exhaustion in at least some fields of the United States. Ahola et al. (2008) argue that the impact of age on burnout differs in different age groups and among genders. This is emphasized by the fact that age and burnout follow a non-linear relationship (Marchand, Blanc, and Beauregard, 2018). With regard to working from home, a study by Hayes et al. (2021) emphasizes this non-linear relationship and indicates that age has a significant impact on stress and burnout as challenges like communication, collaboration, and time management with colleagues via technology arise.

Moreover, older employees are more prone to techno-stressors even though aging is connected with the development of coping skills (Hauk, Göritz, and Krumm, 2019). Thus, older employees are more likely to suffer from techno-stressors that can, in turn, lead to burnout. It is thus postulated that:

H11: The more pronounced a person's age, the higher the perception of burnout when working from home.

Previous studies have shown how frequent distractions and interruptions in the office negatively influence employees' well-being and especially exhaustion (Kreiner, Hollensbe, and Sheep, 2009; Kellner, Albrecht, and Löffl, 2020). Hence, studies have examined the impact of different types of distractions and interruptions when working from home. Bergefurt et al. (2021) describe a major impact of workspace distractions on stress levels. The number of people in the work setting at home significantly enhances the distraction level, which in turn enhances stress (Bergefurt et al., 2021). Furthermore, the number of people at home (*household size*) is negatively associated with the decision to work from a different place than the office. It is thus postulated that:

H12: The more pronounced household size, the higher the perception of burnout when working from home.

6.2.5 The interaction between burnout, satisfaction, and productivity

To measure work success according to the JD-R model, two parallel processes are modelled. As a health impairment process (Demerouti et al., 2001; Bakker and Demerouti, 2007; Lesener, Gusy, and Wolter, 2019), the influence of job demands on burnout is depicted. The motivation process, on the other hand, is represented by the impact of job resources on satisfaction. Thus, following the structure of the JD-R model (Bakker and Demerouti, 2017), full mediation by the two mediator variables burnout and satisfaction is assumed and the influence of the workplace characteristics of the home office on the outcome variable productivity is analyzed.

Burnout can occur as a long-term consequence of stress. Such stress is caused by situational and individual factors (Bakker, Demerouti, and Sanz-Vergel, 2014). This study builds on Hakanen et al. and relates the health impairment process to burnout (e.g., Hakanen, Bakker, and Schaufeli, 2006; Hakanen, Schaufeli, and Ahola, 2008; Crawford, LePine, and Rich, 2010). Burnout is the most important predictor of low levels of job satisfaction (Lu and

Gursoy, 2016). In addition, a negative causal relationship between burnout and satisfaction is found by a number of studies (Wolpin, Burke, and Greenglas, 1991; Baruch-Feldman et al., 2002; Ybema, Smulders, and Bongers, 2010). With regard to work from home, Mann and Holdsworth (2003) argue that employees working from home experience significantly more mental health symptoms of stress than office workers.

Satisfaction includes aspects of job and work satisfaction with additional dimensions, like satisfaction with life overall, or an employee's financial situation (Siddiqui, 2015). In contrast to this study, many studies only use one rather than more concepts of satisfaction combined. The use of the multi-faceted construct, subsumed under the generic term "satisfaction," is explained through the fact that in the home office, work and private life are intricately linked, and an isolated consideration of pure job satisfaction does not reflect the emotional status of employees that is of interest. Additionally, research about the correlation between satisfaction and productivity could be stronger if the operationalization of satisfaction were to include more than pure job satisfaction (Cropanzano and Wright, 2001). In research on telecommuters, DuBrin (1991) shows a positive influence of satisfaction on productivity. Similar findings are the results of the "Happy-Productive Worker Thesis" (Landy, 1989), revisited by Zelenski, Murphy, and Jenkins (2008).

Productivity represents the ratio of the output achieved and the resources used to achieve it (Brinkerhoff and Dressler, 1990; Aronoff and Kaplan, 1995). Productivity can be increased in several ways. In this study, productivity increase considers improved effectiveness, which is characterized by an increase in output with unchanged input. In contrast to satisfaction, the construct of productivity is deliberately related to the home office situation as this outcome variable characterizes the specific output under study. Concluding, it is postulated that:

H13: Burnout is negatively related to satisfaction.

H14: Satisfaction is positively related to productivity.

H15: Burnout is negatively related to productivity.

Figure 24 illustrates the research model with all 15 hypotheses.

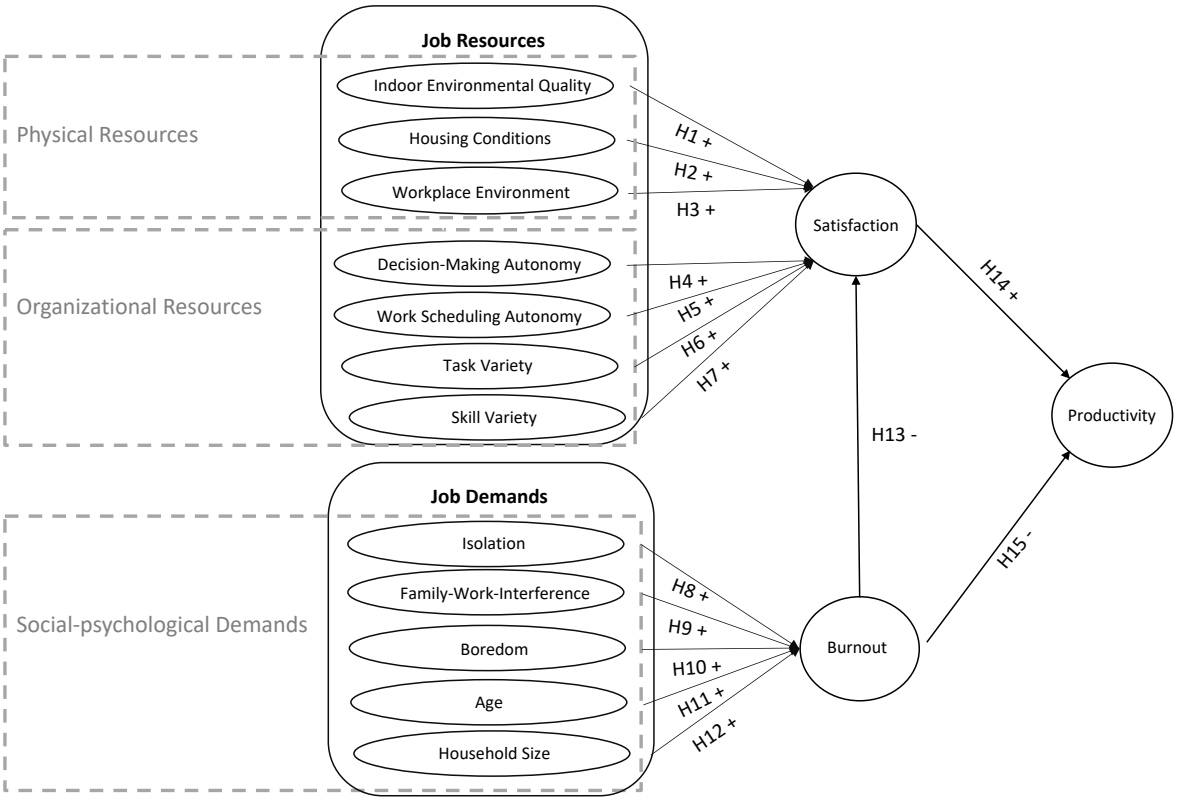

Figure 24: Research model

6.3 Methodology

The analysis of this study is based on primary data gathered by conducting an online survey. The online survey is generated in LamaPoll and distributed via Clickworker in Germany and Mechanical Turk (MTurk) in the United States, two sampling platforms with increasing popularity in research. They generate fast and reliable responses with quality comparable to responses obtained from more traditional sampling methods (Brawley and Pury, 2016; Follmer, Sperling, and Suen, 2017; Lutz, 2015). In order to avoid common-method bias within a measurement occasion, it is recommended to introduce time lags between the measurement of independent and dependent constructs (Ployhart and Vandenberg, 2010; Maxwell and Cole, 2007; Mitchell and James, 2001; Podsakoff et al., 2003). Hereby, the challenge occurs to ensure that time lags are not too short or too long (Mitchell and James, 2001). Following this, the items to measure job demands and job resources were gathered in June 2020, and the items to measure burnout, satisfaction, and productivity were gathered in August 2020. The respective participants were incentivized and identified within the different survey waves with an associated ID.

The survey addressed 2,000 office and knowledge workers who perform at least part of their activities from home[5] during the COVID-19 pandemic in Germany, Switzerland, Austria, and the United States. The analysis focuses on the work from home situation. For this reason, it is relevant that the respondents have experience at this place of work. Still, they do not necessarily have to work there exclusively to be able to evaluate the effects of the various influences on their work success. Data cleaning took place in three steps using IBM SPSS Statistics (Sarstedt and Mooi, 2014). First, all surveys answered in less than seven minutes were excluded. In the second step, missing values and single outliers were sorted out. In addition, for the present study, survey responses were only included if the respondent's current living country was either Germany ($N = 318$) or the United States ($N = 184$). The resultant sample size $N = 502$ exceeds two estimates of minimum sample size requirements ("ten times rule of thumb" by Hair, Ringle, and Sarstedt (2011) and statistical power tables documented in Hair et al. (2021)) and ensures a sufficient level of statistical power. This study uses PLS-SEM to analyze the relationships within the research model. In contrast to the more traditional CB-SEM, this research model focusses on prediction and theory development (Richter et al., 2016) to understand the increasing complexity by exploring theoretical extensions (Hair et al., 2019) of the JD-R theory. The statistical power of PLS is always greater than or equal to that of CB-SEM given a measurement model with sufficient quality and more than 100 observations to achieve acceptable statistical power (Reinartz, Haenlein, and Henseler, 2009; Goodhue, Lewis, and Thompson, 2012; Sarstedt, Ringle, and Hair, 2017). In addition, research shows that PLS-SEM provides solutions when other methods do not converge nor obtain valid results (Reinartz, Haenlein, and Henseler, 2009; Henseler et al., 2014; Sarstedt et al., 2016). Given all of these considerations, the PLS-SEM approach is beneficial for this study. The analysis follows the guidelines of Hair et al. (2021) and Hair et al. (2019) and the software SmartPLS 3 is used (Ringle, Wende and Becker, 2015). In chapter 0, all criteria evaluated refer to reflective measurement models. Only this type of construct measurement is used in the research model. When using the bootstrapping procedure to derive *p*-values and bias-corrected and accelerated (BCa) confidence interval and examine significance and relevance of coefficients, the settings are as follow, with full bootstrapping using 10,000 subsamples (Streukens and Leroi-Werelds, 2016).

[5] Only participants with at least half a day of work from home per week were considered. On average, 4.5 days were worked at home.

6.3.1 Operationalization and data sample

Items were combined from existing survey instruments as far as possible. A detailed list of items with associated sources can be found in Appendix B:B1. A five/seven-point Likert scale was used for all items to measure perceived fit. Age and household size were scaled metrically. The Likert scales chosen in the survey provide metric data for the analysis. Table 17 reports the sample's employee characteristics.

Table 17: Sample descriptive statistics

Demographic Characteristics	*Frequency (N = 502)*	*Percentage (%)*
Gender		
Male	**314**	**62.5**
Female	187	37.3
Diverse gender	1	0.2
Age		
18–20	7	1.4
21–39	**308**	**61.3**
40–55	147	29.3
56–68	40	8
Relationship Status		
Divorced	15	3.0
Married	**220**	**43.8**
Relation	140	27.9
Single	119	23.7
Widowed	2	0.4
N/A	6	1.2
Level of Education		
Hauptschule	17	3.4
Realschule	82	16.3
Higher School Certificate (Abitur)	91	18.1
Master Craftsmen	18	3.6
Bachelor	**143**	**28.5**
Master	141	28.1
Promotion	10	2.0
Professional Status		
Employee	**441**	**87.8**
Self-employed	41	8.2
Civil servant	10	2.0
Freelancer	10	2.0
Position		
Entrepreneur/Freelancer	38	7.6
Managing director	8	1.6
Management	170	33.9
Project leader	46	9.2
Employee	**219**	**43.6**
Temporary staff	7	1.4
Apprentice	4	0.8
Intern	1	0.2
Other	9	1.8

Managerial Responsibility		
Yes	208	41.4
No	**294**	**58.6**

Note: Maximum values per demographic are printed in **bold**

6.4 Results

6.4.1 Measurement models

The PLS-SEM algorithm "first obtains the measurement model results, which are the relationships between the constructs and their indicator variables" (Hair et al., 2021:120). A desirable value for reflective specified construct's indicator loadings, their outer loadings, is 0.708. The exceeding values (see Table 18) indicate that the constructs explain more than 50% of the indicator loading variance (Sarstedt, Ringle, and Hair, 2017) and demonstrates a satisfactory degree of reliability (Chin, 2010).

Table 18: Indicator loadings, mean values, and standard deviation

	Outer Loadings	*Mean Values*	*Standard Deviation*
Physical Aspects			
Indoor Environmental Quality			
IEQ_1	0.699	5.691	1.313
IEQ_2	0.828	5.729	1.233
IEQ_3	0.755	4.998	1.485
IEQ_4	0.755	5.468	1.337
Housing Conditions			
HC_1	0.782	5.508	1.343
HC_2	0.883	5.518	1.350
HC_3	0.900	5.496	1.367
HC_4	0.774	5.582	1.312
HC_5	0.846	5.321	1.334
HC_6	0.798	5.195	1.450
HC_7	0.785	5.303	1.400
Workplace Environment			
WE_1	0.815	5.173	1.452
WE_2	0.862	4.757	1.486
WE_3	0.838	4.789	1.519
WE_4	0.876	4.865	1.452
Organizational Aspects			
Decision-making Autonomy			
DM_1	0.899	5.203	1.412
DM_2	0.927	5.197	1.419
DM_3	0.930	5.072	1.516
Work Scheduling Autonomy			
WS_1	0.888	5.102	1.564
WS_2	0.906	5.179	1.504

WS_3	0.915	5.149	1.496
Task Variety			
TV_1	0.861	5.074	1.382
TV_2	0.887	5.147	1.404
TV_3	0.867	5.311	1.322
TV_4	0.905	5.094	1.402
Skill Variety			
SV_1	0.885	5.333	1.279
SV_2	0.889	5.369	1.266
SV_3	0.860	5.183	1.405
SV_4	0.857	5.207	1.430
Socio-psychological Aspects			
Isolation			
Iso_1	0.921	2.373	1.195
Iso_2	0.938	2.460	1.208
Iso_3	0.832	2.795	1.225
Family–Work Interference			
FWI_1	0.932	3.376	1.513
FWI_2	0.870	3.259	1.569
FWI_3	0.948	3.659	1.705
Boredom			
Bor_1	0.902	2.880	1.764
Bor_2	0.911	2.956	1.801
Bor_3	0.835	2.637	1.744
Bor_4	0.904	3.135	1.885
Age			
Age_1	1.000	37.863	10.785
Household Size			
HS_1	1.000	2.624	1.272
Full Mediators			
Satisfaction			
Satis_1	0.769	5.287	1.341
Satis_2	0.698	5.462	1.363
Satis_3	0.790	5.177	1.281
Satis_4	0.749	4.643	1.395
Burnout			
Burn_1	0.906	2.717	1.006
Burn_2	0.917	2.556	1.035
Burn_3	0.911	2.783	1.059
Target Variables			
Productivity			
Prod_1	0.889	5.034	1.498
Prod_2	0.924	4.980	1.512
Prod_3	0.932	5.012	1.524
Prod_4	0.777	4.882	1.597

Note: All items are measured on a seven-point Likert scale with 1 = totally disagree to 7 = totally agree, except from burnout and isolation with 1 = never to 5 = frequently, and age and household size are metric.

Internal consistency reliability is tested with Cronbach's α, composite reliability, and ρA. In general, higher values indicate higher reliability and vary between zero and one for all three measures (Hair et al., 2021). Results of the analysis (see Table 19) show for all constructs, excluding the two single-items, values between 0.7 and 0.95, which is a recommended value range for satisfactory to good results, and the items are identified as valid measures of the constructs.

The convergent validity of each construct is measured with the average variance extracted (AVE). For all constructs of the research model, excluding the two single-items (see Table 19), the AVE metric for all items associated with their construct is above 0.50, indicating that the construct explains at least 50% of the variance of its items (Chin, 1998a; Hair et al., 2019).

Table 19: Internal consistency reliability and covergent validity

	Internal Consistency			*Convergent Validity*
	Cronbach's α	ρ_A	*Composite Reliability*	*AVE*
Indoor Environmental Quality	0.758	0.765	0.846	0.579
Housing Conditions	0.921	0.923	0.937	0.681
Workplace Environment	0.870	0.872	0.911	0.719
Decision-making Autonomy	0.908	0.910	0.942	0.844
Work Scheduling Autonomy	0.887	0.897	0.930	0.815
Task Variety	0.903	0.905	0.932	0.775
Skill Variety	0.897	0.909	0.927	0.762
Isolation	0.880	0.896	0.926	0.807
Family-Work Interference	0.907	0.950	0.941	0.842
Boredom	0.911	0.915	0.937	0.789
Burnout	0.898	0.899	0.936	0.831
Satisfaction	0.747	0.759	0.839	0.566
Productivity	0.904	0.915	0.933	0.779

The assessment of discriminant validity finalized the analysis of the reflective measured constructs. The analysis shows how strongly constructs differ empirically from one another. The heterotrait–monotrait (HTMT) ratio of the correlations is evaluated with a threshold value of 0.9 (Henseler, Ringle, and Sarstedt, 2015). There is no indication of violation of assumptions (see Table 20). Values for the upper bound of the 95% bias-corrected and accelerated confidence interval should be equal to or lower than 0.850 to indicate significant results.

Table 20: HTMT ratios

HTMT	Age	Decison Making	Burnout	Family-Work Interference	Household Size	Indoor Environmental Quality	Isolation	Productivity	Skill Variety	Housing Conditions	Task Variety	Boredom	Work Scheduling	Workplace Environment	Satisfaction
Age															
Decison Making	0.094														
	CI95=0.186														
Burnout	0.144	0.163													
	CI95=0.230	CI95=0.259													
Family-Work Interference	0.048	0.313	0.286												
	CI95=0.129	CI95=0.408	CI95=0.385												
Household Size	0.049	0.056	0.149	0.123											
	CI95=0.135	CI95=0.124	CI95=0.236	CI95=0.205											
Indoor Environmental Quality	0.248	0.365	0.279	0.308	0.042										
	CI95=0.339	CI95=0.471	CI95=0.374	CI95=0.412	CI95=0.066										
Isolation	0.123	0.091	0.447	0.040	0.051	0.274									
	CI95=0.208	CI95=0.168	CI95=0.530	CI95=0.059	CI95=0.096	CI95=0.370									
Productivity	0.084	0.241	0.111	0.301	0.112	0.363	0.233								
	CI95=0.171	CI95=0.343	CI95=0.193	CI95=0.407	CI95=0.198	CI95=0.474	CI95=0.331								
Skill Variety	0.123	0.570	0.149	0.269	0.039	0.430	0.082	0.267							
	CI95=0.211	CI95=0.658	CI95=0.249	CI95=0.369	CI95=0.093	CI95=0.539	CI95=0.144	CI95=0.374							
Housing Conditions	0.112	0.314	0.277	0.325	0.084	0.686	0.269	0.342	0.333						
	CI95=0.209	CI95=0.411	CI95=0.364	CI95=0.423	CI95=0.158	CI95=0.762	CI95=0.361	CI95=0.443	CI95=0.434						
Task Variety	0.075	0.498	0.113	0.285	0.095	0.367	0.061	0.273	0.842	0.340					
	CI95=0.161	CI95=0.589	CI95=0.215	CI95=0.383	CI95=0.183	CI95=0.468	CI95=0.085	CI95=0.374	CI95=0.896	CI95=0.436					
Boredom	0.227	0.238	0.618	0.226	0.061	0.347	0.480	0.179	0.320	0.317	0.295				
	CI95=0.304	CI95=0.324	CI95=0.689	CI95=0.315	CI95=0.139	CI95=0.450	CI95=0.560	CI95=0.269	CI95=0.409	CI95=0.410	CI95=0.385				
Work Scheduling	0.060	0.804	0.173	0.274	0.057	0.338	0.078	0.261	0.475	0.283	0.382	0.209			
	CI95=0.148	CI95=0.865	CI95=0.273	CI95=0.372	CI95=0.139	CI95=0.445	CI95=0.150	CI95=0.360	CI95=0.565	CI95=0.381	CI95=0.477	CI95=0.298			
Workplace Environment	0.096	0.349	0.184	0.436	0.163	0.694	0.222	0.470	0.351	0.767	0.369	0.216	0.300		
	CI95=0.191	CI95=0.437	CI95=0.289	CI95=0.528	CI95=0.250	CI95=0.759	CI95=0.318	CI95=0.557	CI95=0.443	CI95=0.820	CI95=0.456	CI95=0.313	CI95=0.396		
Satisfaction	0.131	0.405	0.427	0.601	0.150	0.703	0.344	0.583	0.479	0.767	0.425	0.485	0.379	0.732	
	CI95=0.199	CI95=0.503	CI95=0.521	CI95=0.680	CI95=0.242	CI95=0.783	CI95=0.437	CI95=0.668	CI95=0.580	CI95=0.831	CI95=0.522	CI95=0.573	CI95=0.477	CI95=0.797	

Note: CI95 presents the upper bound of the 95 % bias-corrected and accelerated confidence interval.

6.4.2 Structural model

The PLS-SEM evaluation process continues with the structural model (Hair, Ringle, and Sarstedt, 2013) since the quality of the measurement model evaluation results is satisfactory. To avoid undetected collinearity, which could bias the regression results, variance inflation factor (VIF) values are evaluated. The test of collinearity between the constructs (see Table 21) shows for the structural model VIF values below 3.33. Thus, there is no indication for biased results because no undetected collinearity was found between the structural model coefficients (Diamantopoulos and Siguaw, 2006).

Table 21: VIF values

	Burnout	Productivity	Satisfaction
Indoor Environment Quality			1.749
Housing Conditions			2.170
Workplace Environment			2.173
Decision-making Autonomy			2.412
Work Scheduling Autonomy			2.135
Task Variety			2.435
Skill Variety			2.690
Isolation	1.239		
Family-Work Interference	1.074		
Boredom	1.346		
Age	1.051		
Household Size	1.023		
Satisfaction		1.138	
Burnout		1.138	1.092
Productivity			

The variance explained in each of the endogenous constructs, taking into consideration a coefficient of determination of the model's in-sample explanatory and predictive power R^2, the results (see Table 22) show weak to moderate results (Henseler, Ringle, and Sinkovics, 2009; Hair, Ringle, and Sarstedt, 2011; Shmueli and Koppius, 2011; Rigdon, 2012; Dolce, Esposito Vinzi, and Lauro, 2017).

Table 22: R^2 values

	R^2
Satisfaction	0.541
Burnout	0.338
Productivity	0.262

The statistical relevance and significance of the path coefficients is assessed with respect to the hypothesized relationships between the constructs (structural pathways), where the path coefficients have standardized values between minus one and plus one (Hair et al., 2019). The research model has 15 path coefficients, 12 of which have a positive value and suggest a positive relationship (see Table 23). Three path coefficients indicate a negative relationship. The results show significant coefficients on a 1% level and 5% level, and no significant path coefficients. According to the path coefficients and their significance, H1–H3, H7–H10, and H12–H15 can be confirmed (see Figure 25). The path coefficient between burnout and productivity (H15) is significant but surprisingly positive, against the hypothesis assumption. The values presented show that the model set up meets the quality criteria of the structural model. Thus, the results can be evaluated with valid content.

Table 23: Path coefficients

Hypothesis	*Hypothesized Path*	*Path Coefficient*	*Confidence Intervals [2.5%, 97.5%]*
Satisfaction			
H1	Indoor Environment Quality to Satisfaction	0.127***	[0.040; 0.209]
H2	Housing Conditions to Satisfaction	0.321***	[0.221; 0.419]
H3	Workplace Environment to Satisfaction	0.224***	[0.130; 0.138]
H4	Decision-making to Satisfaction	0.010	[-0.084; 0.110]
H5	Work Schedule to Satisfaction	0.044	[-0.054; 0.140]

H6	Task Variety to Satisfaction	-0.010	[-0.094; 0.070]
H7	Skill Variety to Satisfaction	0.138***	[0.054; 0.233]
H13	Burnout to Satisfaction	-0.174***	[-0.173; -0.102]
Burnout			
H8	Isolation to Burnout	0.207***	[0.126; 0.286]
H9	Family-Work Interference to Burnout	0.186***	[0.103; 0.271]
H10	Boredom to Burnout	0.423***	[0.333; 0.507]
H11	Age to Burnout	-0.006	[-0.082; 0.068]
H12	Household Size to Burnout	0.130***	[0.060; 0.196]
Productivity			
H14	Satisfaction to Productivity	0.536***	[0.457; 0.611]
H15	Burnout to Productivity	0.089**	[0.002; 0.179]

Note: ***Significant at 0.01 level (2-sided); **significant at 0.05 level (2-sided); *significant at 0.1 level (2-sided)

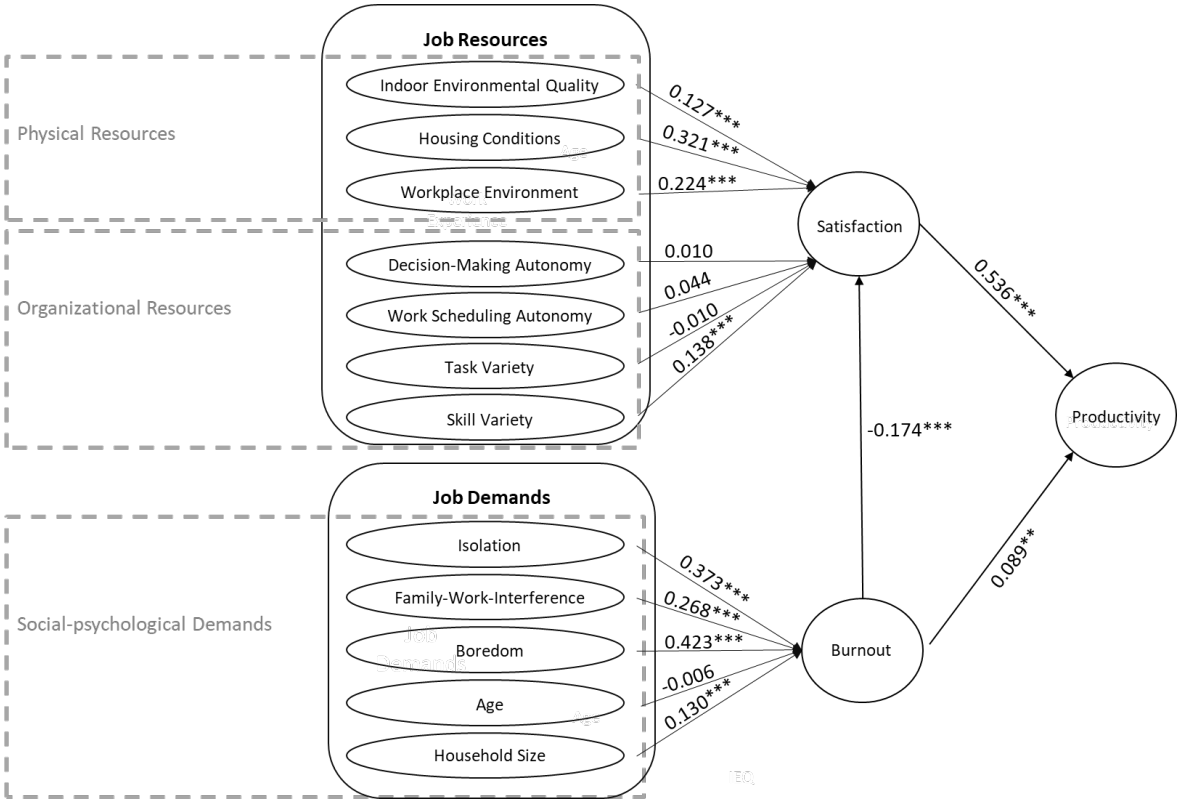

Figure 25: Research model and structural model results

6.5 Discussion

6.5.1 Theoretical implications

This study has two primary purposes: (1) to examine the relationship between physical resources and work success at home and (2) to investigate the relative importance of real estate, organizational, and socio-psychological parameters on productivity of employees working from home when considering satisfaction and burnout as full mediating effects.

This study provides first empirical evidence that physical resources at home enhance satisfaction of employees working from home. All physical resources have a statistically significant positive relationship to satisfaction. Thus, H1-H3 can be confirmed. Hereby, housing conditions ($\beta = .32$, $p < .01$) play a decisive role in explaining satisfaction as the path coefficient is the strongest positive coefficient of all physical resources. As the subjective-physical perception is considered, it is likely that housing features like the location, the planning concept, or the quality of the construction enhance satisfaction when working from home. Additionally, the workplace environment ($\beta = .22$, $p < .01$) at home and Indoor Environmental Quality factors ($\beta = .13$, $p < .01$) have a significant positive effect on satisfaction when working from home. While Bailey and Kurland (2002) argue that an inappropriate workplace environment may have a negative impact on employees in general, Nakrošienė, Bučiūnienė, and Goštautaitė (2019) document a positive relationship between the workplace environment at home and satisfaction. The latter is confirmed in this study. In this context, equipment and furniture are decisive for the workplace environment at home. Indoor Environmental Quality factors on the other hand lead to higher satisfaction due to the individual configurability of noise, air, and light (Toyinbo, 2019; Gauger, Voll, and Pfnür, 2022; Weber and Gatersleben, 2021). These individual configurations enable employees to work with an individualized indoor environment quality according to their well-being. Because the three selected physical resources in this study specifically represent the real estate-related aspects, the impact of real estate on the success of home-based work is clearly highlighted.

Second, the findings also allow us to draw conclusions about the relative importance of real estate, organizational, and socio-psychological parameters with respect to work success at home. Compared to real estate resources, organizational resources play a comparatively minor role in explaining satisfaction. Only skill variety ($\beta = .14$, $p < .01$) has a significant positive effect on satisfaction. Thus, H7 can be confirmed while H4-H6 must be denied. Real estate resources appear to significantly outweigh organizational resources when working from home considering satisfaction. On the other hand, all socio-psychological demands

apart from age exhibit a statistically significant positive relationship to burnout. Thus, H8-H10 and H12 can be confirmed, whereas H11 must be denied. Boredom ($\beta = .42$, $p < .01$) plays a specifically decisive role in explaining burnout as the path coefficient is the strongest positive coefficient of all socio-psychological demands. Sousa and Neves (2021) already show a positive link between boredom at work and burnout. Boredom is often connected to feelings like frustration, restlessness, and loneliness (Harasymchuk and Fehr, 2010), which in turn may enhance levels of depressive complaints and anxiety (van Hooff and van Hooft, 2014; Lee and Zelman, 2019). Boredom when working from home can therefore lead to a spiral, which in consequence could result in high degrees of burnout. Furthermore, isolation ($\beta = .37$, $p < .01$) is positively related to burnout. The lack of social interaction is the most common reason why employees want to work at the office (Bloom et al., 2015; Nakrošienė, Bučiūnienė, and Goštautaitė, 2019). Hence, the postulated direct impact of isolation on burnout is confirmed (Bauer and Silver, 2018). As social isolation is one of the most commonly cited drawbacks of working from home (Lim and Teo, 2000; Mann and Holdsworth, 2003), the risk of social isolation for a large proportion of employees and, thus, the risk of developing burnout symptoms occurs. In addition, family-work interference ($\beta = .27$, $p < .01$) and household size ($\beta = .13$, $p < .01$) are positively related to burnout. These results contrast with isolation as apparently not only the lack of social interaction but also an excess of social interaction affects burnout positively. During the pandemic, it is particularly important to point out the additional need for many parents to care for their children at home.

Work success can be explained by the interaction of employee attitudes and work outcome (Yalabik et al., 2013). While satisfaction and burnout are used to operationalize employee attitudes, productivity is used to measure the work outcome. The results indicate a strong positive effect of real estate resources on satisfaction and a strong positive effect of socio-psychological demands on burnout. While burnout is negatively related to satisfaction ($\beta = -.17$, $p < .01$) and satisfaction is positively related to productivity ($\beta = .54$, $p < .01$), meaning that H13 and H14 can be confirmed, burnout is surprisingly significantly positively related to productivity ($\beta = .09$, $p < .01$) and, thus, H15 must be declined. This fact could be due to the time of data collection. The participants are surveyed in the first months after the emergence of the COVID-19 pandemic and when fear and uncertainty dominated. The horizon of experience as well as the comparability with colleagues, as would be possible in the office, was not given in that point of time. Boundaries between work and life become blurred and employees are more likely to supplement commuting time with working time.

This can have led to the fact that employees who actually suffer from mental exhaustion work even more in order to keep up with other colleagues even though the evaluation of their own productivity was difficult at that time due to a lack of comparability. To summarize, satisfaction influences productivity when working from home and satisfaction depends to a large extent on real estate resources. As such, real estate resources play a crucial role when working from home successfully.

6.5.2 Practical implications

For organizations and practitioners, several implications can be derived from this study. First, working from home offers opportunities but at the same time also risks. Many scholars clarify that working from home will be very much part of a post-COVID future (Bloom, 2020; Brynjolfsson et al., 2020). Therefore, it is necessary to evaluate work from home from different perspectives to maximize opportunities and minimize risks for employees and employers. A necessary first condition for successfully working from home is a suitable job. First investigations suggest that only slightly more than one-third of all jobs in Germany can be performed entirely from home (Dingel and Neimann, 2020). Besides this necessary condition, there are other parameters that influence successful work from home. As this study shows, real estate resources are positively related to satisfaction and influence productivity. Real estate resources here specifically include the quality of the property in terms of room layout and the architectural concept and, in addition, specifically the design of the workplace at home. This also includes the lighting, room temperature, noise level, and air quality. To close the gap between scientific acknowledgements and practical implications, and to follow the principles of inclusive organizational behavior (Mor-Barak and Cherin, 1998; Baldridge, Floyd, and Markóczy, 2004; Aguinis et al., 2010; Schwab et al., 2011; Sabharwal, 2014), real estate resources should be more recognized in future decision-making processes of organizations and employees regarding working from home. Employees should evaluate their housing conditions and IEQ factors whether these are suitable for working from home. For that purpose, organizations could provide their employees with guidelines on whether their housing conditions are basically suitable for working from home and in the frame of workshops explain how IEQ can affect their productivity. Organizations in turn can improve satisfaction and thus productivity by providing the workplace at the homes of their employees with equipment, furniture, and the necessary technical advice. In addition, organizations could include the equipment of their employees' workplaces at home in the company agreement. Hence, organizations should aim to support physical and

functional comfort for their employees' workplaces at home. That means from a cost-benefit view that relatively low costs on the part of the organization (i.e., equipment or furniture) might lead to an increase of productivity of an employee. Joint exchanges between organizations and employees could create productivity potentials.

Moreover, to improve employees' productivity, socio-psychological parameters should be taken into account. Isolation, family-work interference, boredom, and household size are demands that foster burnout and buffer the effects of resources on satisfaction and productivity when working from home. In order to curtail this effect, it is necessary to think about strategies for multilocal work and to reconsider the currently available office space. Alternative work locations to the corporate office and work from home, such as coworking spaces, could substitute for unfavorable working conditions at home and at the corporate office by mitigating isolation, distractions, and interruptions. There, employees find co-workers or a community and can separate work and family more easily. Organizations should consider taking advantage of these professionalized work settings if employees might not want to travel to the corporate office every day and do not have ideal work settings at home. Management should continue to be able to address the socio-psychological demands of working from home. To this end, appropriate measures such as coaching or mentoring should be offered to mitigate the negative effects of socio-psychological demands. As part of a better separation of work and private life, "well-being managers" could be established in companies to support employees in achieving a good balance between private life and work life when working from home. In addition, the networking of employees, which no longer just happens alone in the corporate office, should be proactively addressed by organizations.

6.5.3 Limitations and directions for future research

This study illustrates how real estate resources and in particular housing conditions, workplace environment, and IEQ enhance satisfaction and productivity with regard to working from home. To the best of the authors' knowledge, this is one of the first studies to examine the importance of real estate resources when working from home. Furthermore, the study evidences that for elaborating on burnout, satisfaction, and productivity, a multidimensional approach including physical, socio-psychological, and organizational parameters is necessary. By bringing together different strands of literature, a more comprehensive understanding of work from home is thus achieved.

Additionally, by building on the JD-R model, this study contributes to a more inclusive framework by offering new approaches to extend it. Finally, this study offers implications for organizations and employees on how to handle the transformation of work organization in the future.

While providing a first step toward understanding the impact of real estate resources on work success in a holistic conceptualization for working from home, some limitations are observable and further research steps necessary. Data were collected at an early stage of the COVID-19 pandemic. Besides the fact that due to the pandemic a broad investigation on work from home is possible, this pandemic is a worldwide shock and affects a variety of aspects, especially the behavior of the sample. Particularly at the beginning of the pandemic, uncertainty and fear dominated. It cannot be excluded that these behavioral changes lead to a bias in the responses of the survey participants. Furthermore, causal and endogenous concerns cannot be fully excluded. In addition, there are some reservations about collecting data via MTurk or Clickworker (Kennedy et al., 2020). Attention checks were incorporated into the survey to address these reservations. Nevertheless, other data collection methods should be used in the future to verify the results.

Concerning these limitations, future research should verify the research model using longitudinal data (Ployhart and Vandenberg, 2010; Ployhart and Ward, 2011). In addition, it would be meaningful to add further dependent variables into the research model. Examples for those additional dependent variables could be creativity or turnover intention while working from home. Finally, it would be advisable to measure the influence of real estate factors on work success also in the context of other work locations, such as the office or third places, e.g., coworking spaces, in order to demonstrate the high relevance of real estate.

7 Article 5: The purchase intention of smart homes and the moderating role of affinity for technology

Title:	The purchase intention of smart homes and the moderating role of affinity for technology[6]
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Abstract

The COVID-19 pandemic and its far-reaching impacts prompted a profound societal transformation, ushering in a new era where the widespread adoption of smart technologies has become the prevailing norm. The transition to an increasingly digital society has significantly heightened technology use within the home environment, with remote work emerging as a primary driver for the adoption of smart home solutions. Nevertheless, there are only a few studies that deal with users' perspectives on smart homes on one hand while taking into account the increased affinity for technology in society on the other. The study attempts to close this research gap by using the Theory of Planned Behaviour and data from n = 748 private households about their demand for smart homes. The research questions are analysed using a structural equation model. The results show that the purchase intention of private households is mainly affected by their social environment. Additionally, perceived behavioural control, i.e. resources like money and information, play a decisive role when it comes to purchasing smart homes. The findings suggest that an individual's inclination towards technology serves as a positive moderator in the relationship between their attitudes towards smart home adoption and their intention to make a purchase.

7.1 Introduction

Digitalisation has a transformative impact on both the economy and society (Parviainen et al., 2017). Hence, digitalisation refers to more than just converting analogue data into a digital form; it contains the application of smart technologies in daily life, describing a more

[6] Please note that this article is written in British English and therefore differs from the rest of the dissertation, which generally uses American English.

fundamental character of digitalisation (Stolterman and Fors, 2004; Parviainen et al., 2017). In particular, the application of smart technologies influences how people live, interact and work together (Papagiannidis and Marikyan, 2020).

In housing, digitalisation is often associated with smart homes. In literature, a smart home is frequently defined by three central features: technology, connectivity and service (Marikyan, Papagiannidis and Alamanos, 2019). Accordingly, a smart home is a residence, i.e. a house, an apartment or other form of housing (Balta-Ozkan, Boteler and Amerighi, 2014), equipped with interconnected information and communication technologies through an integrative system (Lutolf, 1992; Aldrich, 2003; Balta-Ozkan, Boteler and Amerighi, 2014; Li et al., 2021). At the same time, using technologies in a smart home is intended to address users' needs and provide them with more comfort, security or entertainment (Chan et al., 2008; Alam, Reaz and Ali, 2012). Following these explanations, in this study, the term 'smart home' means a residence in which information and communication technologies are installed and that can be operated by an integrative control system to offer user-oriented added value.

Smart homes have the potential to shape future living (Li et al., 2021) and to improve the life quality of their inhabitants (Basarir-Ozel, Turker and Nasir, 2022; Rhee et al., 2022). Additionally, smart homes offer a wide range of applications, especially in the areas of healthcare (Gaul and Ziefle, 2009; Rhee et al., 2022), energy efficiency (Noppers et al., 2016; Radtke, 2022) and home security (Korneeva, Olinder and Strielkowski, 2021). Nevertheless, the adoption of smart homes in recent years has been lower than expected (Shin, Park and Lee, 2018; Nikou, 2019; Chang and Nam, 2021). For example, of 40.9 million private households in Germany only 9.1 million were designated as smart home households in 2020 (Destatis, 2023). Among the main reasons for the slow diffusion of smart homes are the lack of trust in the technologies, the limited perception of smart homes, the anticipated costs, concerns about data security and the anxiety of technologies (Balta-Ozkan, Boteler and Amerighi, 2014; Li et al., 2021; Korneeva, Olinder and Strielkowski, 2021; Ghafurian, Ellard and Dautenhahn, 2023). Furthermore, the adoption of smart homes depends mainly on demographics and psychographic profiles (Sanguinetti, Karlin and Ford, 2018). For example, studies show that the adoption of smart homes is lower among older people (Maswadi, Ghani and Hamid, 2022).

The COVID-19 pandemic represents a turning point in the perception and usage of smart technologies (Amankwah-Amoah et al., 2021). There have been evident changes in people's habits and their attitudes towards smart home technologies (Maalsen and Dowling, 2020).

Working from home as a result of the restrictions during the COVID-19 pandemic has played a crucial role in this. Work from home has forced many people to quickly use smart technologies to maintain work productivity at home (Al-Habaibeh et al., 2021). There are hints that working in a smart home can result in greater productivity (Guan et al., 2022; Martin, Hauret and Fuhrer, 2022; Marikyan et al., 2023). Bloom, Han and Liang (2022) show clear evidence that work from home has led to increased use of technology. Alhussein, Kocaballi and Prasad (2022) further explain that work from home reinforces the process of incorporating smart technologies at home. Ghafurian, Ellard and Dautenhahn (2023) indicate that work from home is one of the most important reasons why people have developed smart home purchase intentions after the pandemic. Thus, the COVID-19 pandemic and work from home are considered as catalysts for technology and innovation (Umair et al., 2021), and have led to the widespread use of smart technologies in various application areas (Radtke, 2022). As a result, the population's affinity for technology has increased significantly due to the COVID-19 pandemic.

Even though research contributions in the field of smart homes have increased steadily in recent years, these studies primarily focus on the technical perspective (Li et al., 2021) while the user-oriented and more sociological perspectives have received little attention (Marikyan, Papagiannidis and Alamanos, 2021). Although the technical perspective on smart homes serves providers and, thus, the product development process, the user perspective is essential for the acceptance and diffusion of smart homes. Enhanced attention and consideration should be given to users in the smart home purchasing process. This can only be successful if the providers know why smart homes are relevant for the users. Especially in the post-COVID period, there is a lack of empirical studies that integrate increased affinity for technology into the purchasing process of smart homes. This paper offers an initial empirical basis on how the purchase intention of smart homes can be explained and what role the increased affinity for technology plays. In particular, the paper examines two research questions: (RQ1) What are the antecedents for the purchase intention of smart homes and (RQ2) is there a moderating effect of increasing affinity for technology on the purchase intention of smart homes. To address these research inquiries, the study employs the Theory of Planned Behaviour (TPB) introduced by Ajzen (1991). Quantitative survey data obtained from private households in Germany are analysed with partial least squares structural equation modelling (PLS-SEM).

7.2 Research framework

7.2.1 Theoretical Background

This study uses the TPB to investigate the relationships between subjective attitudes, affinity for technology and the intention to purchase smart homes. The TPB is based on the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980). The need for further development of the TRA stemmed from its initial inability to comprehensively depict individuals' behaviour and intentions (Ajzen, 1991). The TPB is applied in this study as it provides a robust framework to understand how an individual's beliefs influence their intention to perform a certain behaviour. An individual's intention is explained by the combination of attitudes towards the behaviour, subjective norms and perceived behavioural control. For Ajzen (1991), attitudes towards a behaviour represent a particular behaviour's positive or negative evaluation. Attitudes are assumed to be influenced by behavioural beliefs that capture expected consequences at the individual level (Ajzen, 1991). Subjective norms are determined by normative beliefs, which capture the likelihood that people in the surrounding environment will approve or disapprove of a particular behaviour. Accordingly, subjective norms refer to a behaviour's subjectively perceived social consequences (Ajzen, 1991). Perceived behavioural control is determined by evaluating control beliefs regarding an indivudal's ability and capacity to control (Ajzen, 1991). Perceived behavioural control is higher, with fewer obstacles and more available resources and opportunities (Ajzen, 1991).

Numerous studies from different scientific fields have successfully tested and applied the TPB (Ajzen, 1991; Armitage and Conner, 2001; Ajzen, 2020). Regarding housing, for example, Judge, Warren-Myers and Paladino (2019) and Tan (2013) have used the TPB to examine intentions to purchase sustainable housing. Purchasing a property is not only an economic transaction but is also a complex social process for the users. Concerning smart homes, the complexity of this social process is even higher as there are more uncertainties about the technologies (Balta-Ozkan, Boteler and Amerighi, 2014). The TPB offers a possibility to investigate on this social process and to set a focus on the user. Figure 26 illustrates these relationships under the TPB.

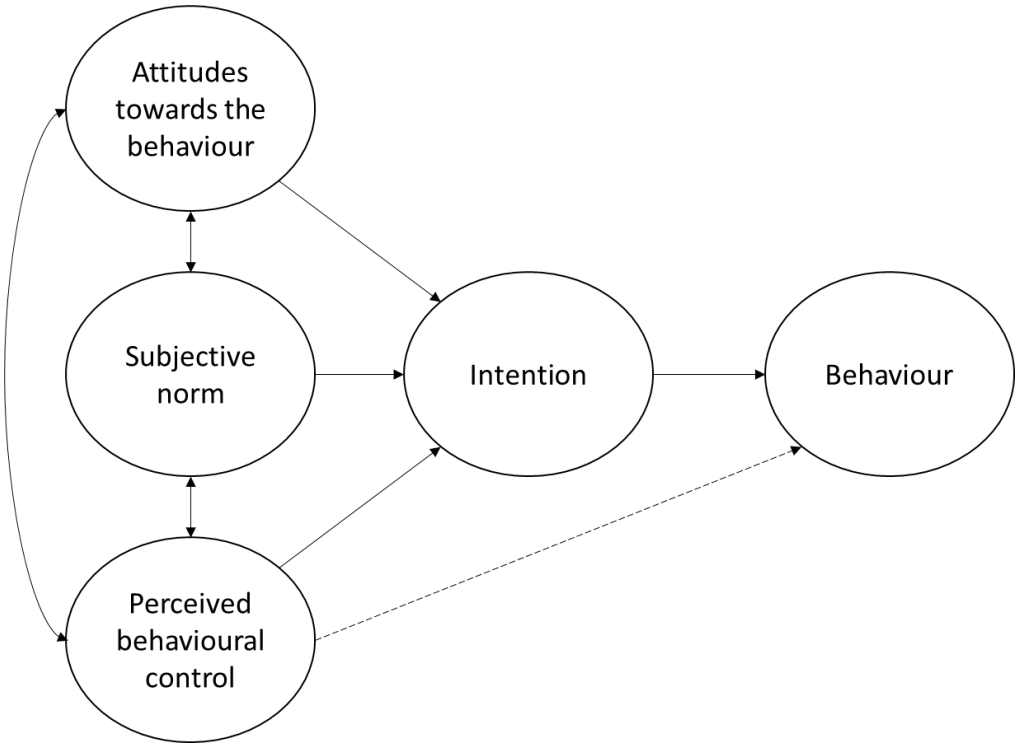

Figure 26: Theory of Planned Behaviour (Ajzen, 1991)

7.2.2 Derivation of hypotheses and research model

The COVID-19 pandemic forced society to change their habits rapidly. Radtke (2022) speaks about a change towards an online society with a more positive attitude towards smart technologies. Nascimento et al. (2023) show that attitudes are most decisive for accepting smart home technologies. Users of smart technologies appreciate the added value they bring (Balakrishnan, Vasudavan and Murugesan, 2018). The literature often discusses comfort and energy savings as additional benefits (Wilson, Hargreaves and Hauxwell-Baldwin, 2017; de Souza Dutra, Anjos and Le Digabel, 2019; Iten, Wagner and Zeier Röschmann, 2021). At the same time, attitudes towards smart homes change with the population's increasing environmental awareness. Schill et al. (2019) show that environmental concern positively impacts the intention to purchase smart homes. Thus, it is postulated:

H1: Attitude towards the behaviour is positively related to the purchase intention of smart homes

The purchase decision for high-involvement products such as smart homes entails a high demand for information (Koklic and Vida, 2011; Amarasinghe Arachchige et al., 2022). Such information is also partly provided by the social environment of a user. Purchase decisions are often made through the influence of family and friends (Levy and Lee, 2004; Kotani and

Nakano, 2023). Consequently, the environment also exerts a certain social pressure. Thus, it is postulated:

H2: Subjective norm is positively related to the purchase intention of smart homes.

Perceived control over a behaviour is primarily determined by available resources and opportunities (Ajzen, 1991). On one hand, the execution of the behaviour necessitates the availability of financial resources while on the other hand an adequate supply of smart homes is required. Perceived control is further bolstered by access to specialist information (Aitken, Watkins and Williams, 2017; Babcock, 2009; Aitken et al., 2020). However, especially in housing, there are hardly any user-friendly rating systems that make statements about the quality of smart homes. Thus, it is postulated:

H3: Perceived behavioural control is positively related to the purchase intention of smart homes.

The surge in societal tech-savviness, spurred by the COVID-19 pandemic and its ripple effects such as the adoption of work from home, is expected to serve as a positive moderating factor in the connections between attitudes towards smart home adoption, subjective norms, perceived behavioural control and the intention to purchase smart homes. Individuals with a strong affinity for technology who use smart home systems require more than just functional technical systems; they also demand reliability and performance. It is essential to these individuals that they have detailed knowledge that goes beyond the basic functions (Kesharwani, 2020). Users with a high affinity for technology are also more aware of digital living. Thus, it is postulated:

H4: Affinity for technology enhances the positive effect of attitude towards the behaviour, subjective norm and perceived behavioural control on the purchase intention of smart homes.

Figure 27 illustrates the hypotheses for the direct and moderation effects of affinity for technology.

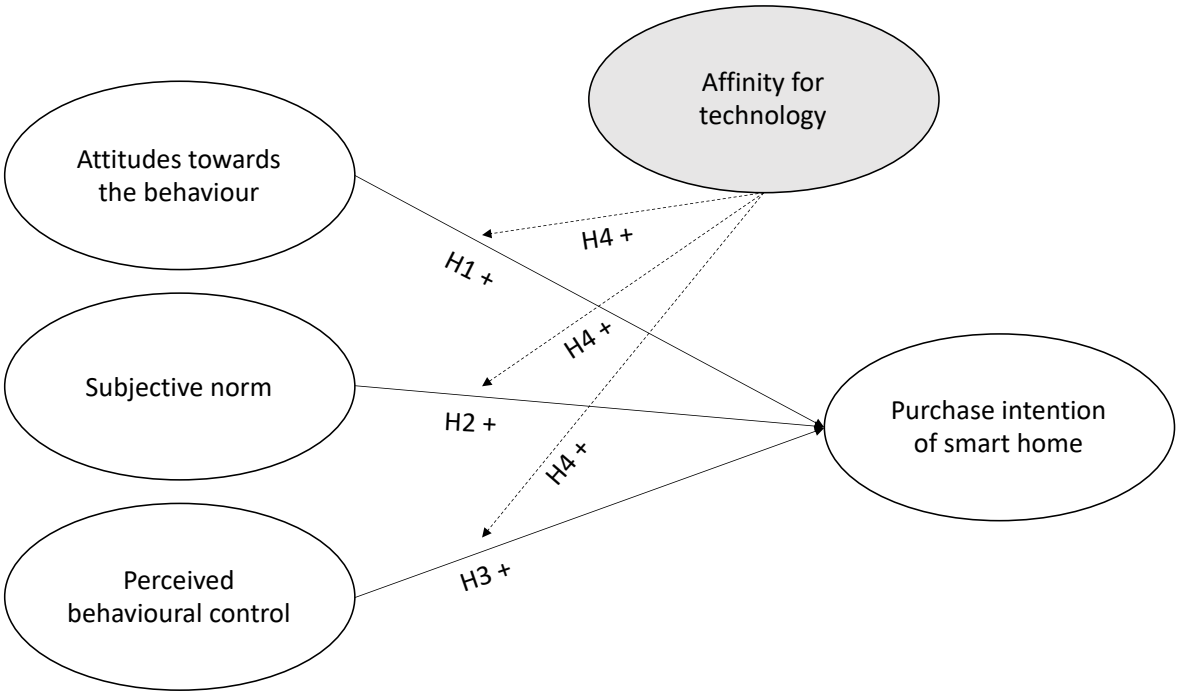

Figure 27: Research model on the purchase intention of smart homes

7.3 Methodology and procedure

7.3.1 Operationalisation and data sample

The analysis of this research is based on primary data gathered through an online survey conducted in September and October 2022. The online survey was generated in SoSci Survey and distributed via Clickworker in Germany. Clickworker is a sampling platform with increasing popularity in research to generate fast and reliable responses. The quality of the responses on such platforms (Clickworker, MTurk, etc.) is comparable to those obtained using more traditional sampling methods (Lutz, 2015; Brawley and Pury, 2016; Follmer, Sperling and Suen, 2017). The sample refers to private households in Germany. The respective participants were incentivised and equipped with an associated ID. Data cleaning took place in two steps using IBM SPSS Statistics (Sarstedt and Mooi, 2014). First, all surveys completed in less than seven minutes are excluded. Second, missing values and single outliers are eliminated. In total, $n = 748$ respondents participated in the survey. An overview of the sample is shown in Table 24.

Table 24: Sociodemographic values of the sample

Demographic Characteristics	*Frequency (n = 748)*	*Percentage (%)*
Gender		
Male	**436**	**58.3**
Female	308	41.2
Diverse Gender	4	0.5
Age		
18-20	22	2.9
21-39	**400**	**53.5**
40-55	230	30.7
56-76	96	12.8
Net household income		
<1,000 €	25	3.3
1,001-2,000 €	93	12.4
2,001-3,000 €	**188**	**25.1**
3,001-4,000 €	154	20.6
4,001-5,000 €	128	17.1
>5,000 €	88	11.8
N/A	72	9.6
Relationship Status		
Divorced	28	3.7
Married	**302**	**40.4**
Relationship	181	24.2
Single	231	30.9
Widowed	3	0.4
N/A	3	0.4
Professional Status		
Employee (full time)	**401**	**53.6**
Employee (part time)	84	11.2
Official	27	3.6
Self-employed	127	17.1
Unemployed	12	1.6
Trainee	6	0.8
Pensioner	31	4.1
Student	37	4.9
Other	23	3.1

Note: Dominant characteristic values of the items are printed in **bold**

7.3.2 Measures

7.3.2.1 Attitudes towards the behaviour, subjective norm, perceived behavioural control and intention to purchase smart homes

Primarily existing and empirically tested measurement scales are employed when available. With reference to Ajzen (1991), measures are adapted to the context of purchasing smart homes.

The items used to measure the constructs from the TPB are adapted from the work of Judge, Warren-Myers and Paladino (2019) and Tan (2013). These items are measured on a scale ranging from 1 (totally disagree) to 7 (totally agree). Attitudes towards the behaviour are measured with four items, subjective norm with three items, perceived behavioural control with three items and the intention to purchase smart homes with three items.

7.3.2.2 Affinity for technology

The ATI scale is used to measure affinity for technology (Wessel, Attig and Franke, 2019). This scale assesses affinity for technology in user studies. Hence, affinity for technology is analysed by four items measured on a scale from 1 (totally disagree) to 7 (totally agree). A complete list of items is provided in Table 25.

7.3.3 Analysis approach

PLS-SEM is used for the calculations. This method is particularly suitable for applied science as it makes it possible to test hypothesised relationships while a prediction focus is on the model estimation (Cepeda et al., 2016; Sarstedt, Ringle and Hair, 2021). To estimate the model parameters, SmartPLS 3 is applied using a path weighting scheme (Hair et al., 2021). To calculate the standard errors, individual preprocessing and nonparametric bootstrapping with 1,000 replications are used (Chin, 1998b). The continuous moderator variable is measured with multiple items to reduce problems with predictive validity (Diamantopoulos et al., 2012). To reduce collinearity problems and facilitate the interpretation of the moderating effect, the indicators of the moderator are standardised (Hair et al., 2021).

A two-step approach is applied to empirically evaluate the derived hypotheses. This approach underscores the importance of the moderating effect as it exclusively involves reflectively measured constructs and moderators, thereby yielding a higher level of statistical power (Henseler and Chin, 2010). In the first step, a base model is run, including attitudes towards the behaviour, subjective norm, perceived behavioural control and purchase intention of smart home, to test the direct effects. The reason for initially executing the analysis without the moderator is that the direct effects become simple effects in the moderator model, which differs in its estimated value, meaning and interpretation. In the second step, the interaction/moderator analysis for affinity for technology is conducted to evaluate the influence in enhancing the positive effects of attitudes towards the behaviour, subjective norm and perceived behavioural control.

7.4 Results

7.4.1 Measurement model

In the first step, the PLS-SEM algorithm evaluates the measurement model results. Primary, it investigates the relationship between the constructs and their indicator variables (Hair et al., 2021). A desirable value for reflective specified constructs indicator loadings (their outer loadings) is 0.708. The outer loadings are presented in Table 25 and indicate that the constructs explain more than 50% of the indicator loading variance (Sarstedt, Ringle and Hair, 2021). Consequently, satisfactory reliability can be concluded (Chin, 2009).

Table 25: Indicator loadings, mean values and standard deviations

	Outer Loading	Mean Value	Standard Deviation
Attitudes towards the behaviour			
AB_1	0.90	4.68	1.60
AB_2	0.88	4.88	1.50
AB_3	0.90	5.07	1.44
AB_4	0.90	4.94	1.49
Subjective Norm			
SN_1	0.92	3.13	2.00
SN_2	0.91	3.36	1.87
SN_3	0.94	3.14	1.90
Perceived behavioural control			
PC_1	0.86	3.84	1.84
PC_2	0.85	3.03	1.58
PC_3	0.91	3.52	1.76
Affinity for technology			
AT_1	0.94	4.81	1.63
AT_2	0.89	5.06	1.59
AT_3	0.55	3.72	1.65
AT_4	0.60	3.89	1.58
Purchase intention of smart homes			
PI_1	0.95	2.91	1.83
PI_2	0.97	3.09	1.92
PI_3	0.96	3.16	1.94
Note: All items are measured on a seven-point Likert scale ranging from 1 = totally disagree to 7 = totally agree.			

In the second step, internal consistency reliability is tested using Cronbach's α, composite reliability and ρA. The values vary between zero and one, and higher values indicate higher reliability (Hair et al., 2021). The results presented in Table 26 vary between 0.797 and 0.991, which is a recommended value range for satisfactory to good results. This implies that the indicator variables are valid measures of the constructs. In addition, convergent validity, measured with the average variance extracted (AVE), is checked here. For all constructs of the measurement model, the AVE value is above 0.50, indicating that the construct explains at least 50% of the variance of its items (Chin, 1998b; Hair et al., 2021).

Table 26: Internal consistency reliability and convergent validity

	Internal Consistency			**Convergent Validity**
	Cronbach's α	ρ_A	Composite Reliability	AVE
Attitudes towards the behaviour	0.919	0.943	0.942	0.803
Subjective Norm	0.911	0.919	0.944	0.849
Perceived behavioural control	0.845	0.866	0.906	0.762
Affinity for technology	0.797	0.991	0.842	0.584
Purchase intention of smart homes	0.958	0.958	0.973	0.922

The assessment of discriminant validity finalises the evaluation of the measurement model. The analysis states how strongly constructs differ from each other and the correlations' heterotrait–monotrait (HTMT) ratios with a threshold value of 0.90 are evaluated (Henseler, Ringle and Sarstedt, 2015). The results are shown in Table 27 and there is no indication of violation of the assumptions.

Table 27: HTMT ratios

HTMT	Attitudes towards the behaviour	Subjective norm	Perceived behavioural control	Affinity for technology	Purchase intention of smart home
Attitudes towards the behaviour					
Subjective norm	0.478				

Perceived behavioural control	0.405	0.714			
Affinity for technology	0.299	0.252	0.278		
Purchase intention of smart home	0.433	0.764	0.666	0.250	

Due to the assessment of the outer loadings, internal consistency and convergent and discriminant validity, it can be concluded that the data fit the model well, allowing the structural relationships to be tested.

7.4.2 Structural model

The evaluation of the structural model focuses on the path coefficients and their significance between the independent and dependent variables. The variance inflation factors (VIF) are assessed to avoid undetected collinearity. The VIF values should be below the conservative threshold of 3.33 (Diamantopoulus and Siguaw, 2006). The VIF are shown in Table 28, indicating no undetected collinearity leading to biased results. The adjusted R^2 value for the base model without the moderation is 0.56.

Table 28: Variance Inflation Factors (VIF)

	Purchase intention of smart homes
Attitudes towards the behaviour	1.326
Subjective norm	1.827
Perceived behavioural control	1.708
Affinity for technology	1.168

Figure 28 shows the results of the structural model. Attitudes towards the behaviour have a weak positive impact on the purchase intention of smart homes ($\beta = 0.090$; $p < .01$). Subjective norm has the most substantial impact on the purchase intention of smart homes ($\beta = 0.519$; $p < .01$). Furthermore, perceived behavioural control influences the purchase intention of smart homes positively ($\beta = 0.238$; $p < .01$).

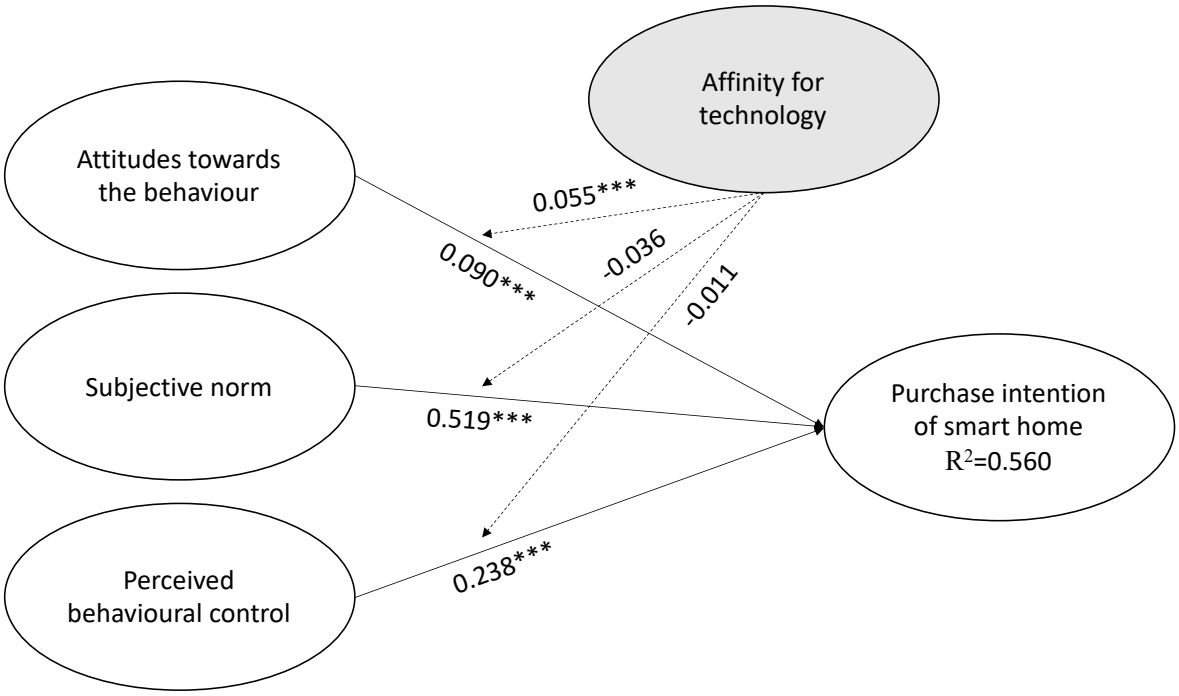

Figure 28: Results of the structural model

To investigate the moderating effect of affinity for technology on the relationships between the three independent variables and the purchase intention of smart homes, the moderator analysis follows as a complementary analysis. A PLS model is run using the two-step approach while including affinity for technology as an interaction term.

Partly consistent with H4 regarding the interaction effects, affinity for technology moderates the effect of attitudes towards the behaviour on purchase intention of smart homes by increasing the positive effect ($\beta = .055$, $p < .01$; $R^2 = .56$). No significant moderation can be detected regarding the effect of affinity for technology on subjective norm and perceived behavioural control. The moderating effect is shown using a slope plot that indicates that people with high degrees of affinity for technology are strongly affected by their attitudes when purchasing smart homes.

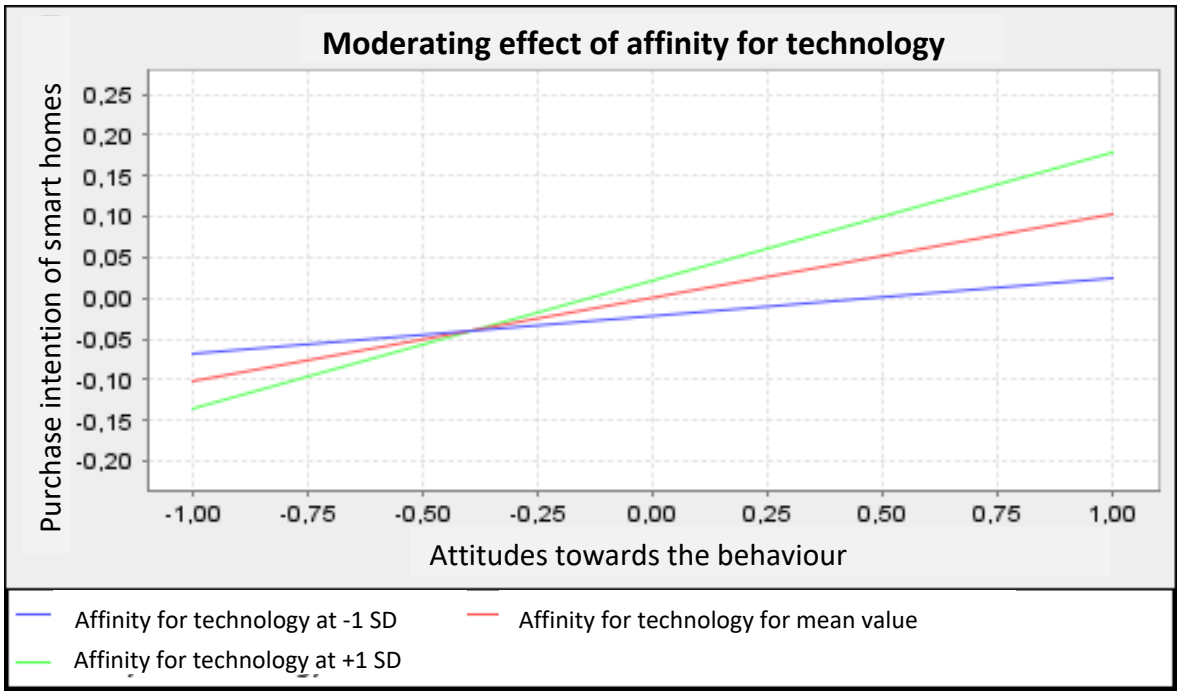

Figure 29: Slope plot of the moderating effect of affinity for technology

7.5 Discussion

7.5.1 Theoretical implications

The two research questions of this study are as follows: RQ1 examines the antecedents for the purchase intention of smart homes and RQ2 investigates whether affinity for technology as a moderator impacts the relationships. The study uses the TPB in order to investigate the research questions. Overall, the results underpin the research model and the proposed relationships. The study's results will help to better understand user behaviour concerning smart homes.

First, the results confirm a positive effect of attitudes towards the behaviour on intention to purchase smart homes ($\beta = .090$, $p < .01$). Thus, H1 can be confirmed. This finding aligns with research focusing on the intention to purchase sustainable housing, which consistently found a positive relationship between attitudes towards the behaviour and the purchase intention of sustainable houses (Tan, 2013; Judge, Warren-Myers and Paladino, 2019). While real estate professionals may regard the housing market as "intrinsically rational, readily comprehendible and ultimately self-regulating" (Smith, Munro and Christie, 2006:85), buying a property involves more than an economic transaction and includes complex social processes. Attitudes towards the behaviour play a minor role when purchasing smart homes compared to sustainable housing. This might be due to an increased

awareness of sustainability in the light of global climate change (Almulhim and Abubakar, 2021). In addition, information about sustainability standards is often accessible and understandable to occupants through certification systems (Lamy et al., 2021; Jiménez-Pulido, Jiménez-Rivero and García-Navarro, 2022). Nevertheless, this study's findings are in line with the argumentation of Nascimento et al. (2023), who describe attitudes towards purchasing smart homes as essential. Second, subjective norm has a strong positive effect on the intention to purchase smart homes ($\beta = .519$, $p < .01$). Thus, H2 can be confirmed. The literature provides mixed results regarding the effect of subjective norms on other housing domains, for example, sustainable housing. While Tan (2013) finds no significant relationship between subjective norms and intention to buy sustainable homes, Judge, Warren-Myers and Paladino (2019) show a significant and strong positive relationship. The lack of information concerning smart homes leads individuals to seek advice from their immediate social environment. The opinions of family and friends, in particular, are often considered here (Levy, Murphy and Lee, 2008; Levy and Lee, 2004). Third, perceived behavioural control positively affects the intention to purchase smart homes ($\beta = .238$, $p < .01$). Thus, H3 can be confirmed. This finding aligns with research on the intention to purchase sustainable housing, which has consistently found a positive relationship between perceived behavioural control and purchase intention (Tan, 2013; Judge, Warren-Myers and Paladino, 2019). Regarding smart homes, users may overestimate the costs of smart technologies. Concerns about financial issues are a primary barrier to adopt smart technologies at home (Balta-Ozkan, Boteler and Amerighi, 2014; Li et al., 2021). The perceived control over one's own resources is therefore distorted here. In addition, the supply of smart homes still needs to be improved so that investment opportunities are less available than sustainable real estate. The stronger the perceived control over the intended behaviour, the stronger the intention to buy smart homes.

Lastly, this study shows that an individual's affinity for technology enhances the positive impact of attitudes towards the behaviour on the intention to purchase smart homes. Therefore, H4 can solely be partly confirmed. This relationship is shown in Figure 29. Because of the positive moderating effect ($\beta = .055$, $p < .01$), the high moderator line's slope (affinity for technology +1) is steeper. That means the relationship between attitudes towards the behaviour and the purchase intention of smart homes becomes stronger with high levels of affinity for an individual's technology. In other words, with low levels of affinity for technology, the relationship between attitudes towards the behaviour and intention to purchase smart homes becomes weaker. Hence, people who consider themselves technically affine are more influenced by their attitudes towards purchasing smart homes.

7.5.2 Implications for management practice

Understanding why and how users develop the intention to purchase smart homes is important not only in theory but also for the economy and society. For Germany, an increase to 18.45 million private households is forecast to use smart home technologies by 2025 (Destatis, 2023). This corresponds to a doubling compared to 2020. Several factors are responsible for this increase. On the one hand, using smart home technologies depends strongly on an individual's environmental awareness (Schill et al., 2019; Ferreira, Oliveira and Neves, 2023). Zhang and Liu (2022) show that eco-friendly smart home services can positively influence environmental protection. Furthermore, smart home technologies can also be helpful for the health sector against the background of an ageing population (Gaul and Ziefle, 2009; Rhee et al., 2022). Finally, smart home technologies are also increasingly being used at work. Now that work from home has become firmly established in the world of work (Gauger, Bachtal and Pfnür, 2022; Höcker, Bachtal and Pfnür, 2022) and work from home is the main reason for some people to purchase smart home technologies in the post-COVID era (Ghafurian, Ellard and Dautenhahn, 2023), the area of work is also a factor that can lead to an increase in the purchase intention for smart homes. Research indicates that smart home workers are more productive than those who do not live and work in them (Guan et al., 2022; Martin, Hauret and Fuhrer, 2022; Marikyan et al., 2023). The breadth of the discussion shows that smart homes create added value at many levels of the economy and society, but this only comes into play when users intend to purchase them. Based on the results of this study, four primary implications can be derived to enhance the development of purchasing smart homes.

First, it is important to use targeted marketing measures to focus on the benefits of smart technologies at home and highlight their added value for the economy and society. One possibility is to promote and focus education on using smart technologies to enhance the affinity for technology within the society, which breaks down barriers and helps users develop self-confidence using such technologies. In particular, smart technologies create added value when combined with other technologies, thereby generating synergy effects.

Second, meeting the high demand for information associated with purchasing smart homes is crucial. It is advisable to disseminate the provision of information using diverse media channels. Targeted employee training on the side of smart home providers is required to adequately address the information needs of users.

Third, certification systems for smart homes can provide a remedy and increase understanding within society regarding smart home technologies. Certification systems for

sustainable buildings have already established themselves nationally and internationally (Jiménez-Pulido, Jiménez-Rivero and García-Navarro, 2022; Lamy et al., 2021). This has demonstrably strengthened real estate users' understanding of sustainability (Judge, Warren-Myers and Paladino, 2019). Policymakers' targeted subsidies are also an effective means. For project developers of residential real estate, showrooms and the creation of model apartments are imaginable.

Finally, digitalisation in housing through smart homes can catalyse the digitalisation of other areas. Potentials of increasing digitalisation of housing, living and working environments include, for example, the reduction of CO_2 emissions, the flexibilisation of space requirements in housing and the increase of digital services.

7.5.3 Limitations and directions for future research

The following limitations of this study can be noted. First, this study has collected data that examine the attitudes and intentions of the respondents and not their actual behaviour. Therefore, for future research, there is an opportunity to extend these data longitudinally to the actual behaviour of respondents who intend to purchase smart homes. A longitudinal approach would also reduce common method bias. Second, the survey only includes respondents from Germany. Comparing with other countries with varying degrees of technological affinity could enrich the comprehension of the subject and enhance the insights into the purchase intention for smart homes. Moreover, an exploration into whether the utilisation of smart home technologies while working from home yields productivity benefits at the individual employee level is imperative. Such findings may subsequently translate into organisational-level productivity gains.

8 Thesis conclusions and contributions

8.1 General conclusion

This thesis aimed to examine the effects of WFH holistically. To this end, investigations at the level of the employee (person), the immediate working environment (environment), and work success (fit) were carried out. The COVID-19 pandemic led to almost all office workers gaining experience with WFH. Even though these experiences were positive on average for many employees, various studies show that a considerable proportion of office workers could not work successfully at home. These studies suggest that the interaction between the person, the physical environment, and the associated psychological aspects is particularly pronounced when working from home. To date, hardly any studies do justice to this complex interaction. This dissertation attempts to close this research gap and uses three research questions: (1) Which people work successfully from home? (2) What role do real estate factors play in being able to work successfully from home and what is their relative importance compared to personal and socio-psychographic factors? (3) Does the increased affinity for technology, partly due to WFH, lead to the purchase intention of smart homes? A total of five articles answered these research questions.

Before answering the research questions, WFH was first categorized in a hybrid working environment. In an international comparison between the U.S. and Germany, it became clear that WFH is highly significant in a hybrid work environment. The desired proportion of working time at home is 43 % in the U.S. and 57 % in Germany. While the desired proportion of working time in the office is roughly the same for both countries at one-third, respondents in the U.S. want to spend significantly more time at third places. There are two reasons for this: first, respondents in the U.S. have significantly more experience working at third places; second, cultural aspects, such as avoiding uncertainty and long-term orientation, play a decisive role.

The first research question is mainly answered by Articles 1-3. In Article 1, a broad literature analysis identified three dimensions that lead to successful work at home: work-related, spatial, and personal characteristics. The intersection of these three dimensions represents an efficiency scope for WFH and only around 25 % of employees who can work at home meet the conditions of this efficiency scope. This purely qualitative approach is expanded in Article 2 with bivariate, correlational analyses. The analyses show correlations on all three dimensions mentioned with work success. There are positive correlations at the level of personal characteristics, especially with professional experience and income, but also with the respondents' resistance to digital stress.

On the other hand, stress, loneliness, and boredom are negatively correlated with work success at home. Regarding work-related characteristics, task variety and autonomy are positively correlated with work success. At the level of spatial characteristics, the characteristics of the workplace at home and the general satisfaction with the housing situation are crucial. High-quality residential properties with sufficient space can lead to more work success when working from home. To verify and consolidate these results, hierarchical cluster analyses were performed for the U.S. and Germany using the three identified dimensions in the third article. Above all, the results make it clear that older employees can work better at home compared to younger employees in Germany. In the U.S., it is evident that younger employees often use third places (especially coworking spaces) as an alternative to WFH. The results show that work success at home varies widely and the proportion of employees who can work successfully at home is relatively small. Only around one in four employees who can work at home are successful. These are primarily senior employees who have a high degree of autonomy at work and whose residential properties have high-quality furnishings.

The second research question is mainly answered by Article 4. Using the JD-R model, the dimensions identified in the previous articles are examined together in a causal analytical model and their influence on work success is investigated. The results demonstrate the immense importance of the physical work environment for satisfaction when working from home. Residential properties with high-quality furnishings, good planning concepts, and quiet locations strongly influence satisfaction with WFH, which leads to high employee productivity. In addition to this global environment, the local environment in the form of the immediate workplace environment and the IEQs also play an essential role. Equipment and furniture, room acoustics, lighting, and climatic conditions influence employee satisfaction and, thus, productivity. From the perspective of the physical aspects of WFH, two factors are crucial: the global environment of the residential property and the local facilities of the workplace in the residential property. The fourth article also shows the importance of physical resources compared to organizational and socio-psychological resources and demands. While organizational resources hardly play any role in describing work success at home, socio-psychological demands may enhance symptoms of burnout and, hence, influence productivity.

The third and final research question is answered by Article 5. With the increasing proportion of WFH due to the COVID-19 pandemic, many employees have been forced to use smart technologies as quickly as possible to maintain productivity at work even at home. Many

employees used smart technologies at home that were not intended for work. The COVID-19 pandemic and especially WFH made smart technologies part of everyday life and increased the population's affinity for technology. The article examines which factors influence the intention to buy smart homes and what role increased affinity for technology plays. The results show that above all, the social environment and the available resources influence the intention to buy smart homes. At the same time, affinity for technology moderates and reinforces the effect between attitudes and intention. It becomes clear that WFH is relevant not only for employees and employers but also for the economy and society. Spillover effects from a higher degree of digitalization in housing to other areas of life and work are conceivable.

Overall, this thesis provides a holistic overview of the effects of WFH by conducting various studies at the individual level (person), at the workplace level at home (environment), and at the work success level (fit). In addition, it provides information about how a hybrid working world could look like and what economic and social potential WFH offers.

8.2 Theoretical contributions

The effects of WFH and the results of this thesis are profound and complex, and provide valuable contributions to various strands of literature. The five studies discussed in this thesis and presented primarily contribute to the workplace, CREM, HRM, and housing literature.

Appel-Meulenbroek and Danivska (2021) have already provided a good overview of theories and models relating to workplace issues. The inclusion of hybrid working in this framework will be unavoidable in the future. Hybrid working, i.e., working in the office, from home, and at third locations (Halford, 2005), is increasingly demanded by employees (Pfnür et al., 2023c). This is mainly because combining the different work locations can compensate for the disadvantages of a single work location. Appel-Meulenbroek et al. (2022), for example, show that not everyone wants to work at home. At the same time, many employees value the improved work-life balance through WFH (Yang, Kim, and Hong, 2023). Some employees rated the office as unsatisfactory (Pfnür et al., 2023c); however, it allows other employees to have a quieter working environment than at home. Other alternative work locations or forms of work, such as "workation", are now being discussed (Voll, Gauger, and Pfnür, 2023). The depth and breadth that arise from hybrid working were suggested as part of the thesis. However, the integration into theoretical models is only at the beginning and requires further research efforts.

The thesis also has theoretical implications for CREM. As a result of hybrid working and especially WFH, the proportion of working time employees spend in the office has decreased (Gupta, Mittal, and van Nieuwerburgh, 2022; Pfnür et al., 2023c). However, the value contribution or resource productivity of real estate, which primarily serves the service creation process, is significantly influenced by low occupancy rates on the part of employees. Pfnür, Seger, and Appel-Meulenbroek (2021) provide a profound theoretical overview of the value contribution of real estate that serves the service creation process. Offices contribute to corporate success on various levels through operating performance. On the organizational level, they serve for corporate identity; on the strategic level, they serve as a management tool and employer branding. At the project level, they should contribute to efficient collaboration among employees. At the employee level, they make a valuable contribution to work productivity. WFH massively impacts all of these different levels of office operating performance. The results of this thesis can be used to exploit valuable insights into work from home and integrate them into the future direction of the office.

This thesis also has valuable implications for HRM. Using the JD-R model (Demerouti et al., 2001), the role of physical characteristics when working at home was examined in particular. In addition, the relative importance of physical characteristics compared to organizational and socio-psychological characteristics was considered. Above all, this holistic methodological approach showed that WFH is not equally beneficial for every employee. In particular, the residential property where the employee works plays a crucial role. Those employees who are particularly successful in WFH are those whose residential property has good technical equipment and, above all, who have enough space and a well-equipped workplace at home. At the same time, WFH is a challenge, especially for younger employees. Loneliness, stress, boredom, and the lack of interaction with colleagues are often reasons for lower productivity at home. Only those with suitable spatial, organizational, and socio-psychological requirements successfully work from home. Nevertheless, WFH does offer the potential for optimizing work success, but this must be negotiated with employees individually or on a team level.

Finally, the results of this thesis also provide theoretical contributions to housing. WFH can have a far-reaching impact on housing as a whole, but especially on the level of digitalization of residential real estate. Ghafurian, Ellard, and Dautenhahn (2023) explain that WFH is one of the main reasons for purchasing a smart home. At the same time, Marikyan et al. (2023) show that employees who work in a smart home are more productive than those who live and work in a residential property with a low level of digitalization. If the trend toward

working from home continues, then this could increase the demand for smart homes. Greater diffusion of smart homes also leads to new opportunities in other areas of life, such as health and energy management.

The five studies in this thesis cover a wide range of perspectives. Each perspective provides a valuable theoretical contribution. The results on employees (person) primarily expand the HRM literature strand while the results on the work surroundings (environment) expand the CREM and housing literature. Work success (fit) findings are primarily based on workplace and HRM literature.

8.3 Practical contributions

In addition to theoretical implications, this thesis presents valuable implications and contributions for practice. The implications derived from this thesis are primarily aimed at organizations, corporate real estate managers, real estate professionals, actors in the housing industry, urban planners, and the public sector.

Due to the experiences that employees have gained in WFH in recent years, a direct comparison between the workplace at home and the workplace in the office is now possible. The physical organization of work has never been more important for employees than it is today. This also means that employees' demands on offices have changed and will continue to do so. Organizations must recognize these developments at an early stage and anticipate emerging trends in order to ensure high office quality. At the same time, the results show that organizations should pay particular attention to which people they allow to work from home. Without coordination between the employee and the employer, WFH can lead to decreased productivity. These statements emphasize that HRM and CREM should be more closely linked. Increasing work productivity is only possible through an individual or team-level combination of a high-quality office and a suitable workplace at home. In other words, hybrid working offers immense potential for organizations, employees, and society.

Hybrid work as an implication for organizations also leads to a rethinking in CREM. Pfnür, Seger, and Appel-Meulenbroek (2021) have conceptually outlined the value contribution of corporate real estate that serves the service creation process. The value contribution of this corporate real estate arises at the organizational (corporate identity), the strategic (management tool and employer branding), the project-related (collaboration), and the employee level (productivity). Each level depends to a greater or lesser extent on employees' working time in the office. By establishing hybrid working, measures must be taken to

maintain the operating performance of corporate real estate. One such measure is investing in the quality of the existing office space. Employees will not return to offices with insufficient quality (Pfnür et al., 2021), so upgrading the space is essential. In addition to office quality, measures must also be taken to maintain the corporate identity despite reduced working hours in the office. The office has taken on a different but still significant meaning due to hybrid working.

Due to the increased requests for the quality of offices, office development will also have to change. Wagner (2021) already accentuated the importance of users in the transformation of the real estate industry. Project developers and investors must recognize that office properties that do not meet the requirements of corporates will be in significantly less demand in the future (stranded assets). Even before the COVID-19 pandemic, Pfnür (2019) showed that 60 % of company space needed to be adapted due to new user requirements. This proportion has probably increased dramatically in the wake of WFH. Project developers should try to integrate the advantages of WFH into office planning. In particular, it should be questioned how it is possible to improve the work-life balance in the office, provide sufficient space for concentrated and collaborative activities, and strengthen the corporate identity.

The results of this thesis also have direct implications for housing and urban planning. The conditions of the housing environment directly influence work success at home. The location of the residence, in particular, plays an important role. The demand for residential properties in peripheral locations has increased due to WFH. On the one hand, commuting to the office has been drastically reduced due to WFH, so living close to the office is no longer necessary. On the other hand, residential properties in peripheral locations are attractive due to their affordability (Pfnür et al., 2023a). At the same time, residential properties in peripheral locations often offer enough living space and a separate working room and, therefore, good conditions for successful working from home. The migration of many employees to peripheral areas, which WFH triggered, also directly impacts inner cities. Barrero, Bloom, and Davis (2021) state that WFH has reduced spending in inner cities by around 5-10 % compared to the pre-pandemic period. Urban planning is essential here in order to be able to absorb this reduction caused by WFH. In particular, greater focus should be placed on reuse concepts for no longer needed office spaces. Moreover, WFH also leads to an enlargement of digitalization. The basic requirement for working successfully from home is a fast and reliable internet connection and, thus, the digital infrastructure at the location of the residence. The integration of smart technologies into residential property was also

strengthened by WFH (Alhussein, Kocaballi, and Parsad, 2022). There are opportunities here for providers of smart home solutions to integrate working from home even more closely into existing systems. Increasing digitalization in the housing sector also creates synergy effects in other areas of life.

Finally, there are also some implications for the public sector. Properly used, WFH makes it possible to increase some employees' quality of life and productivity, which can lead to economic growth. The basic requirement for this is the creation of an accurate infrastructure suitable for WFH. In particular, digital infrastructure in the form of fiber optic expansion can optimize WFH. At the same time, the results of this thesis clearly show that WFH can certainly lead to social imbalance. While in principle, only around 25-30 % of employees in the private sector in Germany can work from home (Kagerl and Starzetz, 2023), the results of this study show that senior employees with a great deal of autonomy regarding their work processes and suitable housing conditions can work successfully at home. Therefore, the proportion of those who can work successfully from home will be well below 25 % of the employees. WFH could become a status symbol in the world of work, which could create a potential for social conflict.

All in all, it should be noted that WFH has far-reaching consequences for different actors. In the future, it is crucial to be aware of these consequences and to take advantage of the opportunities through increased WFH while at the same time taking into account and minimizing the risks.

8.4 Limitations and future research

The results of this thesis provide valuable contributions to theory and practice. Nevertheless, the thesis also has some limitations. Although the limitations specific to the individual articles have already been mentioned, some limitations will be discussed here and explained in more detail. These limitations are also the starting point for future research prospects.

In all articles, it was aimed to use scales that were as valid and already tested as possible. However, some of the scales used have yet to be psychometrically tested. This can certainly have an impact on the quality of the data. To do justice to these limitations, an attempt was made to subject such scales to a pretest.

All five articles are based on quantitative data collected using a questionnaire. This survey took place mainly on crowdsourcing platforms such as Clickworker and MTurk. The collection of data on such platforms is highly debated. Some studies show that the quality of

data collected on crowdsourcing platforms is comparable to that collected using traditional survey forms (Lutz, 2015; Brawley and Pury, 2016; Follmer, Sperling, and Suen, 2017). However, other studies show that using only crowdsourced data could be problematic in the case of correlated self-assessments of the dependent and independent variables (Chan, 2009; Paulhus and Vazire, 2009; Kennedy et al., 2020). Nevertheless, collecting self-assessment data is common sense in social sciences but this limitation should be mentioned.

At the same time, problems with the sample's representativeness often arise on such crowdsourcing platforms. For all five articles, the general population includes office workers who are generally able to work from home. All samples used in the five articles are, on average, younger than the office workers in the general population and male respondents are often overrepresented. In addition, the respondents in the sample are often more digitally affine than the general population. Overall, this could result in a bias in the response behavior, which must be considered when interpreting the results. In addition to this bias, collecting data through a questionnaire carries the risk of common method and response bias.

To do justice to the common method and response bias, an attempt was made to collect longitudinal data, especially in the fourth study. By measuring the dependent and independent variables at different points in time, it is possible to mitigate the problems of the common method and response bias (Podsakoff et al., 2003; Ployhart and Vandenburg, 2010). However, some of the studies presented here are based on cross-sectional data, where the risk of bias is particularly high.

These mainly methodological limitations can be taken into account in further research. In terms of content, this thesis results in three new research prospects.

First, in further studies, job satisfaction and productivity assessments in WFH should be expanded by integrating the perspectives of employees and companies. On the employee side, the assessment can be collected using subjective or objective measurements. If the measurements are based on subjective assessments, then choosing a longitudinal approach is recommended to reduce the dangers of common method and response bias. The challenge will be to ensure that the time lag between surveys is not too short or too long (Mitchell and James, 2001). Randomized experiments can be an appropriate method for collecting relevant data if the measurements are objectively made. On the company side, measurements are also required to record companies' productivity assessments. In principle, a distinction should be made between the individual productivity of an employee and the productivity within team processes for both employees and companies. Overall, a holistic

approach through integrating employees and companies can provide a better picture of how successful WFH is in a narrower sense and hybrid working in a broader sense.

Second, research on the future role of the office will be essential. WFH and integrating hybrid work are putting offices to the test, changing the strategic approaches of corporates, investors, and service managers when dealing with offices. Corporates are challenged to reassess the value contribution and thus the resource productivity of commercially used real estate in times of hybrid working. Offices should contribute not only to higher productivity among employees but also to good collaboration on a team level. They also have strategic benefits for corporate identity and employer branding. Measuring the value contribution at the individual level in times of hybrid work is particularly important. At the same time, corporates are planning to reduce their office space due to the high WFH share. This directly affects investors' return expectations. In the future, the question arises as to how these spaces that are no longer needed can be used. Service providers face the challenge of involving users more closely in their business model. Other user requirements must be integrated into their service portfolio. Therefore, the office's future must be viewed from various perspectives and requires a systematic research approach.

Third, future research should also focus on the effects of WFH on housing and urban planning. Housing will change and WFH will impact many people, which should be considered. The results show that WFH is only successful in some residential situations. This could result in price premiums for WFH-capable residential properties. Furthermore, the extent to which working in smart homes increases WFH productivity should be investigated. In addition, the effect of WFH on inner cities should be viewed in a more differentiated manner. Cities with a high proportion of knowledge workers, in particular, could face challenges in the future.

To conclude, this thesis provides a broad and in-depth overview of WFH and its far-reaching impacts. In particular, the thesis focuses on the employee (person), the working environment (environment), and work success (fit). It shows that there is no best model but only a best fit regarding work from home. Satisfied and productive work at home is only possible if the spatial conditions at home and the organizational and socio-psychological conditions are in place. WFH will continue to have a high priority in the physical organization of work and, thus, hybrid working in the future. The potential of WFH to increase productivity is significant, but it must be leveraged differently for each company. This thesis provides a basis on which future research can build to gain new insights into WFH and hybrid working.

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Appendix

List of Appendices

Appendix A – Appendix of the article Work from home: bane or blessing? Implications for corporate real estate strategies

A1: Factors and associated items determined in the EFA

	Factor	Items
Personal	Perceived stress with regard to the profession exercised	1. I feel emotionally drained from my work. 2. I feel burnt out by my work. 3. I feel drained at the end of the working day.
	Perceived loneliness at home workplace	1. I feel lonely in my workplace at home. 2. I feel isolated in my workplace at home. 3. At my workplace at home, I lack opportunities to socialise at and after work.
	Perceived boredom in private life and job	1. I feel bored in my private life. 2. I am frustrated in my private life. 3. I am not able to concentrate in my private life. 4. I am not fascinated by my private life. 5. I feel bored in my job. 6. I am frustrated in my job. 7. I am not able to concentrate. 8. I am not fascinated by my tasks.
Work-related	Variety of demands and tasks in the job	1. My work requires a wide range of skills. 2. My work requires the use of many different skills. 3. My work requires the use of sophisticated skills. 4. In my work I can use many of my talents. 5. In my work I do a lot of different things. 6. In my work I am always doing something new. 7. In my work I have to work on a variety of tasks. 8. My work is very varied.
	Planning and decision-making autonomy at work	1. I am free in the timing of my work. 2. I can decide for myself the order in which I do my work. 3. I can plan my work the way I want to. 4. My work allows me to take initiative and act at my own discretion. 5. I can make many decisions independently in my work. 6. My work gives me a lot of freedom to make decisions.
Real estate-related	Technical equipment of the home workplace	1. I have full information and communication technology equipment (computer, printer, etc.) in my home. 2. I have a reliable internet connection at my workplace in my home. 3. In my home, I have a sufficiently fast internet connection at my workplace.
	Real estate quality and suitability of the home workplace	1. All in all, I am very satisfied with the spatial situation of my work at home. 2. All in all, I am very satisfied with my housing situation. 3. All in all, I am very satisfied with my apartment/property. 4. All in all, I am very satisfied with the location of my apartment/property.

		5. All in all, I am very satisfied with the planning concept of my flat. 6. All in all, I am very satisfied with the construction quality of my flat. 7. All in all, I am very satisfied with the economy of my housing situation. 8. The available rooms (equipment, furniture) support work optimally. 9. Creativity is encouraged by the working environment. 10. The room acoustics are conducive to work. 11. Productivity at work is promoted by the spatial environment. 12. I can make undisturbed phone calls/ I have sufficient privacy for (spontaneous) phone calls.
	Demands on environmental factors in the corporate office	1. I attach great importance to an unobstructed view from the window. 2. I attach great importance to fresh, pleasant air. 3. I attach great importance to pleasant lighting conditions. 4. I attach great importance to a pleasant indoor climate. 5. I attach great importance to a low noise level. 6. I attach great importance to sufficient space.
	Demands on equipment in the corporate office	1. I attach great importance to a height-adjustable desk. 2. A couch or armchair is important to me. 3. I attach great importance to music at the workplace. 4. I attach great importance to good catering facilities (e.g. a high-quality coffee machine) at the workplace.
Work success factors	Job satisfaction working from home	1. I am very happy with my home workplace. 2. I like working in my home workplace. 3. I enjoy working in my home workplace.
	Availability at home	1. I take shorter breaks. 2. I am available more often. 3. I also work, although I would not have felt comfortable enough to work in the office.
	Motivation and focus working from home	1. I feel less motivated without my team. 2. I am more easily distracted by TV, mobile phone, etc. 3. I am more easily distracted by family, child or other people. 4. I am more easily distracted by household tasks (e.g. washing, ironing, cooking, etc.). 5. Work and private life get mixed up.
	Job satisfaction in the corporate office	1. I am very satisfied with my office workplace. 2. I like working at my office workplace. 3. I enjoy working in my (company) office.

A2: Personal, work-related and real estate characteristics of the different clusters

	Cluster	n	Age	Work experience	Household income	Perceived stress with regard to the profession exercised	Perceived loneliness at home workplace	Perceived boredom in private life and job	Variety of demands and tasks in the job	Planning and decision-making autonomy at work	Technical equipment of the home workplace	Real estate quality and suitability of the home workplace	Commuting time	Demands on environmental factors in the corporate office	Demands on equipment in the corporate office
German clusters	Senior employees	30	50.3	24.4	3.1	2.6	1.7	2.1	5.2	5.1	6.3	5.5	19.9	5.6	3.0
	Skilled workers	22	32.3	7.5	3.0	2.6	1.9	2.4	4.5	4.1	5.7	5.3	46.4	5.1	3.4
	Senior managers	14	46.8	22.6	5.1	2.8	2.9	2.7	5.7	5.4	6.4	5.9	43.6	5.7	4.1
	Academics	47	32.3	8.8	4.3	2.0	1.8	1.6	5.8	5.5	6.1	5.7	19.6	5.7	4.5
	Young professionals	61	31.2	6.1	3.4	3.1	2.5	3.7	4.9	5.0	5.3	4.8	18.6	4.8	3.7
	Decision-makers of tomorrow	32	31.4	6.1	3.3	2.8	3.6	3.1	5.0	5.3	6.4	5.3	29.9	6.0	3.6
	Under-challenged	37	40.9	13.2	3.0	2.8	3.4	3.6	4.3	4.1	4.5	4.3	27.8	5.6	3.3
US clusters	Senior managers	30	47.9	26.7	5.6	1.7	1.7	1.6	6.5	6.3	6.8	6.0	36.4	5.5	3.6
	Senior specialists	35	47.3	25.2	5.4	2.9	2.3	2.1	5.7	5.2	6.3	6.0	19.4	5.8	3.4
	American dreamers	26	39.9	16.5	2.9	1.9	1.9	2.0	6.0	5.7	6.5	6.0	22.9	5.9	4.7
	Nine-to-five clerks	38	37.4	15.2	4.4	2.8	3.1	3.0	4.9	4.9	6.2	5.3	26.2	5.4	2.8
	Coworking affine	30	33.2	9.8	3.2	3.2	2.6	3.9	4.9	4.7	5.0	4.3	22.6	5.0	4.3
	Office affine	39	31.3	8.6	5.5	1.7	1.6	1.6	5.8	6.0	6.3	5.8	16.3	5.5	4.4
	Coworking youngsters	47	33.1	7.4	4.9	3.5	3.5	4.7	5.8	5.4	5.9	5.6	28.3	6.0	5.6

Appendix B – Appendix of the article The power of place: The impact of real estate on work success when working from home

B1: Operationalization

Item	Constructs	Sources
Physical Resources		
reflective	Indoor Environmental Quality	
IEQ_1	My workplace is bright.	(Brill and Weidemann, 2001; Maarleveld, Volker and van der Voordt, 2009; Krupper, 2013)
IEQ_2	The lighting at my workplace is pleasant.	(Brill and Weidemann, 2001; Maarleveld, Volker and van der Voordt, 2009; Krupper, 2013)
IEQ_3	My workplace is attractively designed.	(Brill and Weidemann, 2001; Maarleveld, Volker and van der Voordt, 2009; Krupper, 2013)
IEQ_4	The indoor climate at my workplace is pleasant (e.g., temperature, humidity).	(Brill and Weidemann, 2001; Maarleveld, Volker and van der Voordt, 2009; Krupper, 2013)
reflective	Housing Conditions	
HC_1	All in all, I am very satisfied with the spatial situation of my work at home.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
HC_2	All in all, I am very happy with my living situation	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
HC_3	All in all, I am very satisfied with my property.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007;

		Maarleveld, Volker and van der Voordt, 2009)
HC_4	All in all, I am very satisfied with the location of my property.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
HC_5	All in all, I am very satisfied with the planning concept of my property.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
HC_6	All in all, I am very satisfied with the quality of the construction of my dwelling/construction.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
HC_7	All in all, I am very satisfied with the economy of my housing situation.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
reflective	Workplace Environment	
WE_1	The available rooms (equipment, furniture) support the work optimally.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
WE_2	Creativity is fostered by the working environment.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
WE_3	The room acoustics are conducive to work.	(Own research following Amérigo and Aragonés, 1990, 1997; Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
WE_4	Productivity at work is promoted by the spatial environment.	(Own research following Amérigo and Aragonés, 1990, 1997;

		Haynes, 2007; Maarleveld, Volker and van der Voordt, 2009)
Organizational Resources		
reflective	Decision-making Autonomy	
DM_1	The job gives me a chance to use my personal initiative or judgement in carrying out the work.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
DM_2	The job allows me to make a lot of decisions on my own.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
DM_3	The job provides me with significant autonomy in making decisions.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
reflective	Work Scheduling Autonomy	
WS_1	The job allows me to make my own decisions about how to schedule my work.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
WS_2	The job allows me to decide on the order in which things are done on the job.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
WS_3	The job allows me to plan how I do my work.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
reflective	Task Variety	
TV_1	The job involves a great deal of task variety.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
TV_2	The job involves doing a number of different things.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
TV_3	The job requires the performance of a wide range of tasks.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
TV_4	The job involves performing a variety of tasks.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
reflective	Skill Variety	
SV_1	The job requires a variety of skills.	(Hackman and Oldham, 1975; Stegmann et al., 2010)

SV_2	The job requires me to utilize a variety of different skills in order to complete the work.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
SV_3	The job requires me to use a number of complex or high-level sills.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
SV_4	The job requires the use of a number of skills.	(Hackman and Oldham, 1975; Stegmann et al., 2010)
Social-psychological Demands		
reflective	Isolation	
Iso_1	I feel lonely at my workplace at home.	(Bloom et al., 2015)
Iso_2	I feel isolated at my workplace at home.	(Bloom et al., 2015)
Iso_3	At my workplace at home, I lack opportunities to socialize at and after work.	(Bloom et al., 2015)
reflective	Family–Work Interference (inverted)	
FWI_1	In most ways, my work–life balance is close to my ideal.	(Diener et al., 1985)
FWI_2	So far, I have gotten the important things regarding my work–life balance.	(Diener et al., 1985; Grawitch et al., 2013)
FWI_3	If I could live my life over, I would change almost nothing about my work–life balance.	(Diener et al., 1985; Grawitch et al., 2013)
reflective	Boredom	
Bor_1	I feel bored in my job.	(Reijseger et al., 2013; van Wyk et al., 2016)
Bor_2	I am frustrated in my job.	(Reijseger et al., 2013; van Wyk et al., 2016)
Bor_3	I am not able to concentrate.	(Reijseger et al., 2013; van Wyk et al., 2016)
Bor_4	I am not fascinated by my tasks.	(Reijseger et al., 2013; van Wyk et al., 2016)
reflective	Age	
reflective	Household Size	
Full Mediators		
reflective	Satisfaction	
Satis_1	All in all, I am satisfied with my job.	(Cammann et al., 1979; Cammann et al., 1983; Bowling and

		Hammond, 2008; Allen, 2001)
Satis_2	I am satisfied with my home office.	(Amérigo and Aragonés, 1990; Gauger, Voll, and Pfnür, 2020)
Satis_3	Your satisfaction with your life overall.	(Diener et al., 1985; Bowling and Hammond, 2008)
Satis_4	Your satisfaction with your financial situation.	(Van Praag, Frijters and Ferrer-i-Carbonell, 2003; Newman, Delaney and Nolan, 2008; Gray, 2014)
reflective	Burnout	
Burn_1	I feel emotionally drained from my work.	(Maslach and Jackson, 1986; Moen et al., 2016)
Burn_2	I feel burned out by my work.	(Maslach and Jackson, 1986; Moen et al., 2016)
Burn_3	I feel drained at the end of the workday.	(Maslach and Jackson, 1986; Moen et al., 2016)
Target Variable		
reflective	Productivity	
Prod_1	Working in my home office makes it easier for me to do my work.	(Own research following Krupper, 2013)
Prod_2	Working in my home office increases my effectiveness at work.	(Own research following Krupper, 2013)
Prod_3	Working in my home office improves my productivity.	(Own research following Krupper, 2013)
Prod_4	I have the feeling that working at home is more productive than working at my professional office workstation.	(Own research following Krupper, 2013)

Eidesstaatliche Versicherung

Ich versichere hiermit, dass ich die vorstehende Arbeit

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selbstständig und ohne fremde Hilfe angefertigt, und dass ich alle von anderen Autoren wörtlich übernommene Stellen wie auch die sich an die Gedankengänge anderer Autoren eng anlehnenden Ausführungen meiner Arbeit besonders gekennzeichnet und die Quellen zitiert habe.

Die Arbeit ist in gleicher oder ähnlicher Form noch nicht veröffentlicht und noch keiner Prüfungsbehörde vorgelegt worden.

Darmstadt, den *11.01.2024* *Unterschrift*

(Yassien Nico Bachtal)