HOW TECHNOLOGIES WILL CHANGE THE WORKPLACE OF THE FUTURE

Dissertation zur Erlangung des Grades eines Doktors der Wirtschaftswissenschaft eingereicht an der Fakultät für Wirtschaftswissenschaften von

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Thank you!

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avg.	average
DACH	Germany, Austria, Switzerland (Deutschland, Österreich Schweiz)
ed.	editor
eds.	editors
e.g.	for example (exempli gratia)
et al.	and others (et alii)
etc.	and so forth (et cetera)
f.	and the following page
ff.	and the following pages
HR	human resources
HRM	human resources management
i.e.	that is (id est)
IT	information technology
no.	number
p.	page
rel.	relative(ly)
RBV	the Resource-Based View of the Firm
SHRM	strategic human resources management
SME	small and medium-sized enterprise
tn	trillion
VHB	Verband der Hochschullehrer für Betriebswirtschaft e.V.
VRIN	valuable, rare, inimitable, non-substitutable
vs.	versus
WPD	workplace design

1 INTRODUCTION

Just as a Ferrari performs much better on a well-paved road than on a sandy beach, a high-performance team or organization requires a high-performance workplace.

Becker & Steele, 1995: 3

As stated by Becker and Steele (1995), workplace design plays an essential role in supporting employees and achieving strategic performance goals. While this has been true for some time, the use of technology has caused significant changes in workplace design in recent decades. Today, digital communication technologies like mobile devices and the Internet of Things enable seamless interaction between machines and humans, and allow teams in different countries and time zones to work effectively. The SARS CoV2-pandemic in 2020 is additionally accelerating the already rapidly progressing technological change in the world of work (Marr, 2020). Overnight, companies had to implement new regulations for health protection, such as social distancing. Not only does technology affect *how* work changes in terms of individualized processes and borderless collaboration, but also *where* we work (Waber, Magnolfi, & Lindsay, 2014). For example, offices are changing from closed cellular designs with individual desks to open spaces with desk-sharing opportunities and activity-based approaches. In some cases, they are vanishing altogether, which allows employees to work anywhere (Bloom, Garicano, Sadun, & van Reenen, 2014; Colbert, Yee, & George, 2016; Khazanchi, Sprinkle, Masterson, & Tong, 2018). During the crisis, such flexible working technologies are even proving to be essential for the survival of some companies.

Against the background of these new developments, the effects of implementing modern workplace technologies and workplace design are gaining attention. For example, Cascio and Montealegre (2016) provide an overview containing research on organizational effects of monitoring systems, robots, teleconferencing, and wearables. However, they—and other researchers with them—conclude that further research is needed to understand the role of modern technologies in the workplace (Autor, Mindell, & Reynolds, 2019; Cooren, 2016; Karanika-Murray & Michaelides, 2015). One reviewer of our article 'New Work—New Motivation' stated: "This strikes me as an important topic and a timely one, as many people are currently (and for the foreseeable future) working in a more remote, technology-mediated environment than we are accustomed to." (Reviewer 1, Academy of Management Annals, 2020)

While several research areas shed light on the topic—such as facility management, environmental psychology, or computer sciences—some of the most important mechanisms are yet to be understood. Whereas the focus in psychology lies on work content and its effect on people (Karanika-Murray & Michaelides, 2015; Martin, 2017; Parker, Morgeson, & Johns, 2017a; van den Broeck, Ferris, Chang, & Rosen, 2016), researchers in the field of real estate or facility management are mainly concerned with the question of how interior design influences financial and performance outcomes (Clements-Croome, 2018; Wadu Mesthrige & Chiang, 2019). These rather isolated considerations lead to various gaps in research.

For one, how employees are influenced by technological changes remains understudied—especially beyond mere performance measurement (Cascio & Montealegre, 2016; Kim, 2014; Martin, 2017; Newell & Marabelli, 2015; Parker & Grote, 2020; Vischer, 2008). As such, employee motivation, satisfaction, or other individual outcomes pose interesting research topics (Karanika-Murray & Michaelides, 2015; Oldham & Hackman, 2010; Parker, 2014). Shedding light on this interdependency is particularly important, as a deeper understanding can provide a holistic comprehension of technology, workplace design, as well as of individual and, ultimately, organizational outcomes. Motivated by this gap in the literature, I seek to address these shortcomings by answering the first overarching research question of this dissertation:

Research Question 1: *How do (digital) workplace technologies influence employees?*

Understanding the impact of workplace technologies thus helps not only researchers, but also managers to improve workplace design in companies and ultimately contribute to strategic outcomes (Montealegre & Cascio, 2017). Naturally, the connection between workplace design, employees, and firm strategy has not gone unnoticed. However, as the introductory metaphor stated, the focus is oftentimes limited to employee and team performance outcomes. Facility management and real estate research frequently limit the value of workplace technologies to their financial contribution (Grant, 1991; Kampschroer, Heerwagen, & Powell, 2007; Mitchell-Ketzes, 2003; Wadu Mesthrige & Chiang, 2019) while management scholars tend to neglect the link of workplace design to long-term strategy and competitive advantages (Kämpf-Dern & Konkol, 2017; Levin, 2005). The fast-changing workplace technologies and the new challenges that arise with them contribute to a lack of up to date empirical data. Combining these streams to understand the role of workplace technologies therefore offers the opportunity for new research. Thus, I seek to answer the second research question in this dissertation:

Research Question 2: *What role do workplace technologies play in corporate strategy?*

The fact that workplace technologies can affect corporate strategy in various ways only adds to the complexity of the problem. The issues at hand are embedded in a field of tension consisting of the four elements strategy, workplace, technology and people. Figure 1 illustrates this. The two research questions aim to shed light on the interfaces in this area. In order to answer them from different perspectives, the present dissertation is divided into three papers. In the first and second papers, I seek to answer Research Questions 1 and 2, respectively. The third paper, however, addresses both questions.

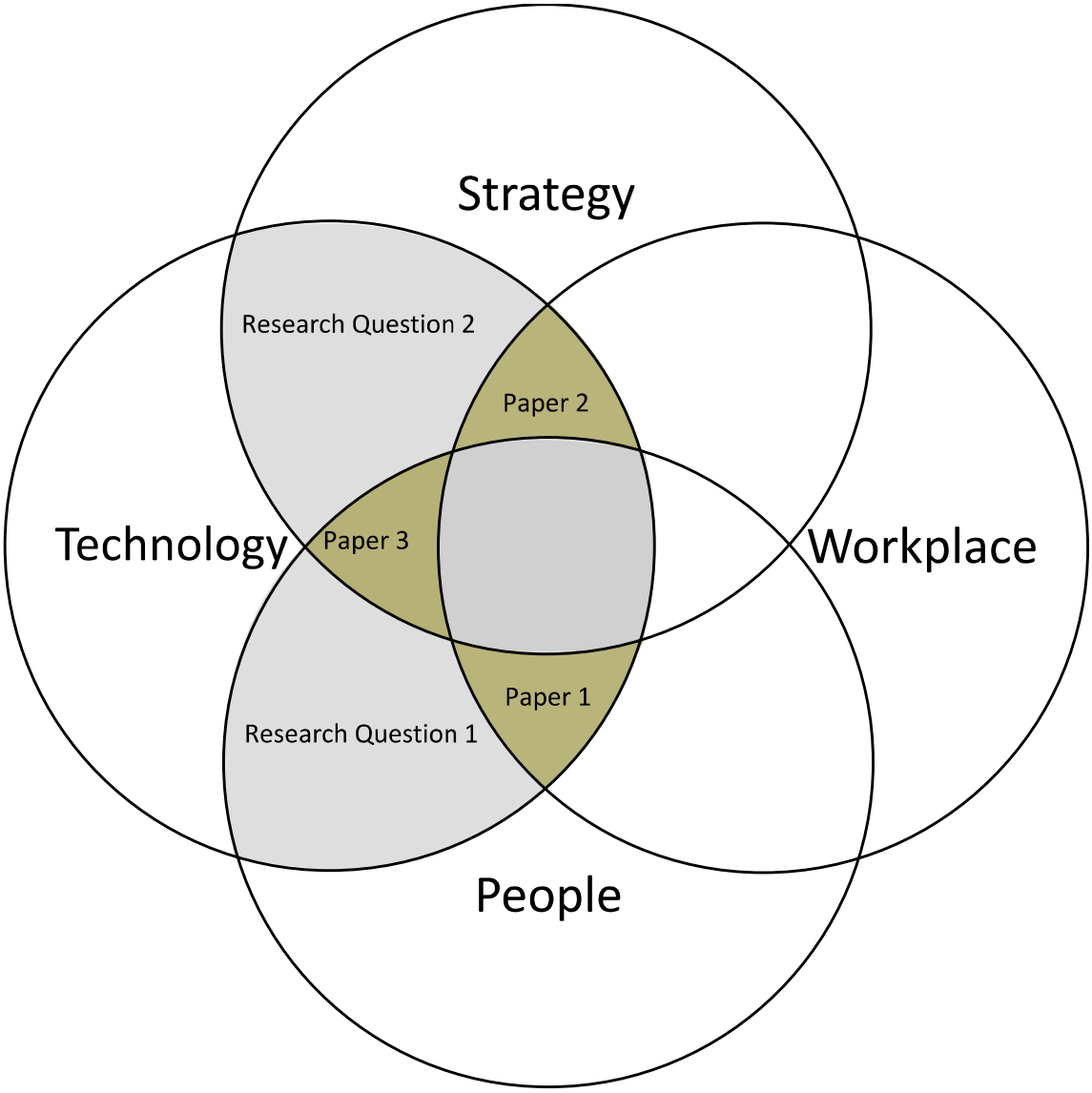

Figure 1: The Three Papers in This Dissertation Address Two Research Questions in the Fields of Strategy, Workplace, Human, and Technology

To answer the research questions in this dissertation, I use a mix of literature research, as well as qualitative and quantitative approaches. In Papers 2 and 3, I collect empirical data from medium-sized and large German companies. Focusing on one region provides more specific results as regulatory issues—specifically those regarding labor law—influence the implementation of workplace technologies. Germany traditionally has extensive co-determination rights and strong employee protection laws and should thus be evaluated distinctly (Niedenhoff, 2005; Pfeifer, 2014). However, to enhance the generalizability of the results, I use data from various industries of the private sector in both papers.

The dissertation comprises five chapters. In the first part of Chapter 1, I present the terms and theoretical backgrounds of workplace technology. In the second part of Chapter 1 (Section 1.2), I introduce concepts and terms related to the digital transformation and how its technologies are affecting workplaces. These concepts form the basis of the three papers, which are the focus of my dissertation. Those papers follow in Chapters 2, 3, and 4. Finally, in Chapter 5, I summarize the main findings, provide answers to the overarching research questions stated above, and highlight the contributions to research. I conclude with the managerial and research implications of the dissertation as well as its limitations.

1.1 Digital Transformation

In this section, I present the technologies and dynamics of digital transformation that were the motivation behind this dissertation.

Digitization is "the material process of converting analog streams of information into digital bits" (Brennen & Kreiss, 2016: 1). Digitizing is not a new concept, as it merely encompasses turning analog information into a binary system. However, starting with the Morse Code being one of the earliest digital technologies, through punch cards, technology has become increasingly complex (Brennen & Kreiss, 2016). During the last few decades, innovations in the area of information and communication technology (ICT), data processing, sensor systems, machine learning, and many other areas have enabled the comprehensive emergence of digital technologies (Cascio & Montealegre, 2016). Modern digital technologies are characterized by their ability to compute increasing amounts of information as well as provide communication and connectivity (Vial, 2019). Today their potential has reached unprecedented levels and their applications are ubiquitous (Wang, Wiesemes, & Gibbons, 2012). Whether we dim our lights through voice-activated systems in our 'smart home' or stream the latest TV show while messaging friends on our way to work—our everyday lives are unimaginable without digital tools (Colbert et al., 2016). This restructuring of "social life […] around digital communication and media infrastructure" (Brennen & Kreiss, 2016: 1) is thus coined **digitalization**. The technological changes also affect

business models, processes, and organizational structures, and are changing them forever (Fenech, Baguant, & Ivanov, 2019: 166).

Increasing digitalization thus leads to fast-paced and volatile market environments for companies. Reacting to these changes and keeping up becomes an essential task for managers in order to not lose their competitive standing (Harwardt, Niermann, Schmutte, & Steuernagel, 2020; Kretschmer & Khashabi, 2020; Vial, 2019). As a result, companies adapt their product portfolio, business models, and internal processes by implementing digital innovations. This "process of rapid and widespread adoption and application of digital technologies in commercial settings is commonly referred to as **digital transformation**" (Kretschmer & Khashabi, 2020: 86). The relevance of the topic becomes clear when looking at the investments being made into digital transformation: In 2019, the digital transformation market had a worldwide revenue of USD 1.18 tn. This figure is expected to nearly double to USD 2,3 tn. by 2023—not even the SARS CoV-2 pandemic is slowing it down (IDC, 2020; IDC/Statista estimates, 2020). However, this unchecked trend cannot be observed in Germany. Although many decision-makers in companies place a high priority on digitalization, Germany is only a midfield player in Europe when it comes to technology utilization. Although usage is predicted to increase, readiness surveys show that a rapid increase is probably not to be expected (BMWi, 2018; Harwardt et al., 2020). Nevertheless, significant changes in processes and equipment are already visible.

Although the digital transformation affects all areas of life and has already fundamentally changed a number of industries, major gaps in research remain. Vial (2019), for example, provides an extensive literature review and concludes that we still lack a deeper understanding of the overall impact of digital technologies.

1.2 Workplaces and Workplace Technologies

In order to sharpen the focus and to approach the central research questions, in the following section, I will examine the area of workplaces and how they are affected by the digital transformation.

Technological progress has always been an essential part of work. During the First Industrial Revolution, inventions like mechanical looms enabled growth in both the quantity and quality of products. Mass production and specialized processes led to a centralization of workers in factories and growing cities. The workplace was suddenly outside the home. In the following decades, the working day was characterized by specialization and automating technologies, resulting in two further Industrial Revolutions (Komlosy, 2014). Today, ubiquitous communication

technologies like mobile devices and the Internet of Things enable borderless cooperation between international team members, machines, and humans (Vial, 2019). Once again, the workplace is changing significantly, leading Waber et al. (2014: 77) to state: "[W]e must aggressively change the definition of what workspace is, from *where* work is done to *how* it's done, and then design spaces—physical and digital—around that."

Some authors reflect this shifting paradigm by their distinctive use of the terms 'workplace' and 'workspace'. While the **workspace** mostly refers specifically to the spatial environment of work, the **workplace** additionally encompasses digital, social, and organizational aspects (Bicknell, 2017; Dale & Burrell, 2008; Waber et al., 2014). The German language provides a similar, yet more distinctive terminology: 'Arbeitsplatz' vs. 'Arbeitsort'. Many publications—both English and German—use the terms interchangeably or prefer workplace/Arbeitsplatz to address both physical and social, legislative, or other aspects. However, in this dissertation, I recognize the slightly different meaning. While I emphasize the spatial aspect when using the term 'workspace,' I highlight the complex (i.e., more than physical) effects of technology when using the term 'workplace.' Table 1 provides some definitions and usages that distinguish the 'workplace' and 'workspace' from each other.

Workplace	Workspace
"workplaces are *the supporting infrastructure* that nurtures work" (Bicknell, 2017)	"physical workspace and its characteristics such as *layout, appearance, comfort and functionality*" (Allen, Bell, Graham, Hardy, & Swaffer, 2004)
"the workplaces of today's organisations consist of entangled digital-physical spaces, in which *physical spaces, digital technologies and collaborative work practices* are reciprocally defined and constitutively intertwined." (Sheikh, Baptista, & Albuquerque, 2018: 1)	"'Workspace' as *a distinctive bounded place* […] workspaces […] are diverse and not bounded at all by the traditional separation of spheres of production, consumption and reproduction. From shops to museums, gyms and banks, hairdressers to heritage parks, workspaces are overlaid on other sorts of spaces." (Dale & Burrell, 2008: 2)
	"Workspace is defined by *how space is used*, and its quality as a function of the experience of the user." (Vischer & Malkoski, 2015: 4)
	"workspaces are *where work occurs*" (Bicknell, 2017)
	"the *working environment* and culture of the employee—characterized here as the 'workspace.'" (Forbes Insights, 2017)

Table 1: Examples of the Use of the Terms 'Workplace' and 'Workspace' (emphases by the author)

As outlined in the section on digital transformation, the workplace is affected by various technological innovations. By automating and augmenting human work, modern technologies have a massive impact on work and the labor market (Frey & Osborne, 2017; Parker & Grote, 2020). Examples include, but are not limited to: Mobile and stationary ICT (Bloom et al., 2014; Sheikh et al., 2018; Thomas, 2014), artificial intelligence (Autor, 2015; Kretschmer & Khashabi, 2020), robotics (Argote & Goodman, 1986), and space layouts (Khazanchi et al., 2018). These technologies can be summarized under the term **workplace technologies**, which "are used in conjunction with one's job to communicate and/or to perform work either at a traditional work setting

or away from such a setting." (Thomas, 2014: 282) Technologies in the workplace are diverse and differ depending on the location and area of application. For this reason, the paper "New Work—New Motivation" (Chapter 2) deals with this issue in detail. We use our own definition, which goes beyond that of Thomas (2014): "[W]e define workplace technologies as the technologies that surround the employee and are needed to get the job done." (Schmid & Dowling, 2020: see Chapter 2)

Adopting workplace technologies requires high investments and educated managerial decisions to integrate them into company processes (Chan, Beckman, & Lawrence, 2007; Kampschroer & Heerwagen, 2005; Vischer, 2007). Referring to the distinction between workplace and workspace can help illustrate the complexity of this implementation: Adding a new device to the physical equipment of a room is a relatively easy task (=workspace); however, adopting a new technology into a workplace can also affect the processes, individual perceptions, organizational structure, and other non-physical aspects. I will refer to this task as '**workplace design' (WPD)** in this dissertation. To acknowledge the multi-dimensionality of workplace design, different perspectives need to be considered to embed the new technology in the company in a strategic manner. Chan et al. (2007: 7) thus state that workplace design "is a highly iterative, messy, and never-ending process that involves the four dimensions […] financial management, organizational design, information technology, and facilities management."

Experts do not agree on what "the" workplace of the future will look like. The most predominant trends enabled by modern technology are more flexibility regarding work contracts, place, and time; the dissolution of borders, both physically and socially; and close interaction between technology and humans. There are also several other complex social, economic, political, and environmental issues to be considered for a holistic picture. Examples of such frequently published future scenarios include, among others, CBRE and Genesis (2014), Dirks (2016), Beyond Tomorrow (2017), Harris, Kimson, and Schwedel (2018), or Autor et al. (2019). Some scholars even predict a time in the near future when work (as we understand it today) will no longer be a part of our lives and people will instead fill their time with creative, fulfilling, and altruistic tasks (Bergmann & Friedland, 2007). While this point of view is not shared by many, significant changes can be expected (Mokyr, Vickers, & Ziebarth, 2015).

1.3 Overview of the Dissertation

Building on the terminology and theoretical concepts outlined above, I seek to answer the overarching research questions in the three papers of my dissertation. I will outline the respective structure as well as the theoretical foundations and methodology in the following section. Table 2 provides an overview of the three papers with the categories title, authors, research question,

discussed theories, applied methodologies, the research context, empirical data, and publication status.

As described in the Introduction and depicted in Figure 1, the dissertation with its three papers is embedded in the fields of strategy, workplace, people, and technology. While Papers 1 and 2 focus on the impact of workplace technologies and workplace design on individuals and company strategy, Paper 3 concentrates on HRM as a function facilitating technological change and being affected by it at the same time. I outlined the theoretical groundwork in Chapters 1.1 and 1.2. Based on this, I use different models and concepts in the three papers to explore the topics in detail and to ultimately answer the overarching research questions.

	Paper 1	Paper 2	Paper 3
Chapter	Chapter 2	Chapter 3	Chapter 4
Title	New Work—New Motivation? A Comprehensive Literature Review on the Impact of Workplace Technologies	Workplace Design as a Strategic Resource—A Qualitative Study	The Strategic Relevance of HRM and its Activities in Times of Digital Transformation: A Mixed-Methods Study in Germany
Authors	• Yvonne Schmid • Prof. Dr. Michael Dowling	• Yvonne Schmid	• Frederik Pscherer • Yvonne Schmid
Research Question	How does technology in the workplace affect employee motivation?	How can firms incorporate workplace design into their resource portfolio to achieve a sustained competitive advantage?	How does digital transformation affect HR practices and thus the strategic relevance of HR?
Theory	Motivation Theories (Deci & Ryan, 1985; Hackman & Oldham, 1976; Herzberg, Mausner, & Snyderman, 2017/1959)	Resource-Based View (Amit & Schoemaker, 1993; Barney, 1991; Penrose, 1959)	Strategic HR Management (Combs, Liu, Hall, & Ketchen, 2006; Ichniowski, Shaw, & Prennushi, 1997)
Methodology	Conceptual: Comprehensive Literature Review (Onwuegbuzie & Frels, 2016)	Qualitative: multiple case study analysis (Yin, 2018)	Mixed Method: text mining, qualitative content analysis, interviews
Research Context	Literature on workplace technologies affecting employee motivation	Seven workplace design projects in four German non-SMEs	HR practices in 27 DAX companies 2009-2018
Data	Secondary data via literature review (67 publications)	Cross-sectional data, primary and secondary sources (four cases based on 24 interviews & 131 pages field diary)	Longitudinal data, primary and secondary sources (270 annual reports & four interviews)
Status	Accepted: Management Review Quarterly VHB: C[1]	Published: International Journal of Strategic Management 2020, 20(1), 21-40 VHB: C[1]	Under Review: European Management Review VHB: B[1]

Table 2: Summary of the Three Papers of the Dissertation

[1] „Verband der Hochschullehrer für Betriebswirtschaft e.V." (VHB) evaluates scientific journals relevant to business research. Mentioned classification refers to VHB-Jourqual 3 from 2015, which lists 3.4% of journals as A+, 11.1% A, 33.3% B, 41.9% C and 9.1% D. Source: http://vhbonline.org/en/service/jourqual/vhb-jourqual-3, accessed on 8th September, 2020.

In **Paper 1** (co-authored with Prof. Dr. Michael Dowling), we investigate how workplace technologies affect the individual. Employees are complex beings that cannot be grasped in their entirety. However, employee motivation is a theoretical construct that is able to explain a great variety of behaviors and performance outcomes in the workplace.

Theoretical framework: "Motivation is often described as an unobservable force that directs, energizes, and sustains behavior over time and across changing circumstances." (Diefendorff & Chandler, 2011: 66) Better performance, lower fluctuation, lower accident rates (Hackman & Oldham, 1976; Kanfer & Ackerman, 2004; Maxwell, 2008; Seeck & Diehl, 2016), and job satisfaction (Taylor & Westover, 2011) are but some exemplary outcomes of a high employee motivation. The relevant motivation research mainly focuses on cognitive and emotional processes (Ariely, Gneezy, Loewenstein, & Mazar, 2009; Karasek, 1979; Ryan & Deci, 2000), social environment (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Khazanchi et al., 2018), or job content (Ferris & Gilmore, 1984; Hackman & Oldham, 1976) to explore motivation and explain behavior. In many of these publications, technological change is mentioned as a potentially relevant influence, but is not the focus of attention. Instead, it takes on a subordinate role, which we understand as 'background music'. This means that although technology is acknowledged as an environmental aspect, it is mainly ignored. As a result, in our paper we concentrate on the research focusing on workplace technology and its impact on employee motivation.

Methodology: To assess these publications in a thorough and transparent manner, we opted for a Comprehensive Literature Review (Onwuegbuzie & Frels, 2016). In doing so, we respond to calls for methodological rigor in management literature reviews (Bouncken, Gast, Kraus, & Bogers, 2015; Fisch & Block, 2018; Tranfield, Denyer, & Smart, 2003). Applying a rigorous selection process, we followed clear rules and provide a transparent four-step-approach. In Step 1, we search the major scientific databases with general search terms, such as 'motivation,' 'technology,' and 'workplace,' which provides more than 200,000 results. We subsequently filtered these results by assessing a representative number of abstracts (Krejcie & Morgan, 1970, as cited in Onwuegbuzie & Frels, 2016: 102)—resulting in 1,454 abstracts. In Step 3, we selected publications that focus on employee motivation as defined above, which resulted in 205 useful publications. Finally, we identified 67 publications on motivation research placing workplace technologies at the center of attention.

Results: After assessing the 67 publications based on their theoretical foundation and their understanding of workplace technology, we can divide the research into three directions in addition to understanding technology as background music: technology as hygiene factor, motivator, and influencer of mediators. These schools of thought differ in the relationship they perceive

between technology and motivation. While research viewing technology as a hygiene factor (following Herzberg et al. (2017/1959)) focuses on the negative impact of technology, such as stress or dissatisfaction, technology as a motivator assumes a direct motivational connection. However, the viewpoint that is adopted in the publications with the most thorough research methods and published in the highest-ranking journals on average is that presuming an indirect connection. According to those researchers, the influence workplace technology has on employee motivation depends on mediators, such as the addressed needs, provided autonomy, or skill variety applied on the job. In addition to this detailed map of the field, we provide promising directions for research, including potential research questions. Thus, we offer a broad field of research opportunities, such as the development of a taxonomy to achieve a better understanding of workplace technologies or the need for detailed quantitative multi-level models exploring variables moderating and mediating the relationship between workplace technologies and employee motivation.

This study departs from prior motivation research that treats workplace technology as a background condition, providing thereby a comprehensive overview of the role of technology in the center of motivation research. Overall, our findings help to structure existing motivation research and pave the way to future human-centric technology research.

In contrast to considering the individual within a company in the previous paper, in **Paper 2** I focus on the question of what role workplace design plays in corporate strategy. As mentioned in the Introduction, the main research focus until now was on reducing workplace design to a cost factor (Grant, 1991; Kampschroer et al., 2007; Mitchell-Ketzes, 2003; Wadu Mesthrige & Chiang, 2019). But—like other assets—workplace design can lead to a sustained competitive advantage according to the Resource-Based View (RBV).

Theoretical framework: The RBV, which emerged in the 1980s, is a perspective in management research developed to complement the until-then predominant market-based view (Penrose, 1959; Porter, 1980; Wernerfelt, 1984). In the 1990s, it was increasingly the subject of attention and constitutes one of the main research frameworks in management today (Barney, 1991; Foss, 1997; Grant, 1991; Wang & Ahmed, 2007; Wibbens, 2019). The basic assumptions of the RBV are the heterogeneity and immobility of resources among firms. Differences in the set of resources allow firms competing in the same market to pursue different strategies (Barney, 1991). These differences may lead to competitive advantages for one firm over its competitors. Workplace technology can thus be understood as a resource bundle. Penrose (1959), Barney (1991), and Amit and Schoemaker (1993) provide several characteristics in addition to immobility and heterogeneity: value/appropriability, rareness/scarcity, overlap with strategic industry factors,

inimitability, non-substitutability, complementarity, durability, and versatility. Recognizing and adjusting these characteristics may contribute to a sustained competitive advantage. Applying this notion to WPD, I develop six theory-based propositions, allowing a comparison to empirical data.

Methodology: Addressing the question of how workplace design can contribute to firm strategy and researching contemporary events requires a qualitative approach (Keplinger, Feldbauer-Durstmueller, & Mitter, 2012; Yin, 2018). Barney and Mackey (2005) suggest collecting data and observing resources directly in a sample of firms. To assess the complexity of WPD, scholars call for interpretive approaches such as case studies (Bluhm, Harman, Lee, & Mitchell, 2011; Kim, 2014; Mitchell-Ketzes, 2003). Following these recommendations, a multiple-case design seemed the most promising approach. Thus, I collected data employing the triangulation method based on observation, interviews, documents, and other available sources. The resulting case analyses are based on 24 semi-structured interviews (avg. 1 hour) and field observations (documented on 131 pages of field diary). Theoretical sampling resulted in four cases of non-SMEs[2] from different private sector industries currently or recently undertaking a work design project (Eisenhardt, 1989; Goffin, Åhlström, Bianchi, & Richtnér, 2019). These firms have been successful in their respective markets for several decades, from which a sustaining competitive advantage can be assumed. I first evaluate these case studies individually and then as part of a cross-case analysis. The analysis is based on the six propositions derived from the state of the research.

Results: The individual and cross-case analyses provide valuable insights into the relevant characteristics for workplace design to provide sustained competitive advantage (Amit & Schoemaker, 1993; Barney, 1991; Penrose, 1959). I find that the data is at least partly consistent with five out of the six propositions and I develop a seventh. In detail, the analysis shows that while rareness and inimitability play a subordinate role, expression emerges as a relevant aspect highlighting the symbolic character workplace technologies have. Appropriability and overlap with firm strategy relate to the aspect of productivity and thus the power to directly contribute to financial outcomes. Versatility of workplace design enables a firm to quickly adapt to changing environments, which is crucial in times of digital transformation. Finally, the complementarity of workplace design elements with each other as well as with other elements of the firm is necessary to do justice to the complexity and variety of workplace technologies.

[2] According to the European Commission (2015), small and medium-sized enterprises (SMEs) are defined as firms with less than 250 employees.

This study departs from prior RBV research that focuses on single industries and conceptualizes quantitative relationships. Thus, I include several industries and capture complex work design situations by applying a qualitative approach. The integration of workplace design into the RBV research stream is also a novelty.

After focusing on the individual and strategy perspectives in Papers 1 and 2, respectively, in **Paper 3**, Frederik Pscherer and I investigate the impact of digital transformation on the department-level. It is particularly interesting to look at the HR department, as digital change has a twofold effect: On the one hand, its processes undergo change themselves through the use of digital workplace technologies. On the other hand, it accompanies digital change and the associated workforce challenges within the company, which in turn has an impact on its strategic relevance. In a survey conducted by Personalwirtschaft und Promerit, 80% of 124 managers from the DACH area state that Human Resource Management (HRM) is or should be responsible for driving digital transformation. This makes HRM the most important driver after IT and management (Anderson & Rohrscheidt, 2016)

Theoretical framework: HRM is rooted in the same movement as motivation research outlined above, i.e., research on the motivation and productivity of workers (Herzberg et al., 2017/1959; Mayo, 1949; Obedgiu, 2017). In the decades that followed these early stages, the focus of the role within companies was on managing the workforce and maintaining relations with unions, which is why the term "personnel administration" became widely used. In the 21st century, the focus has shifted, and staff is viewed as an asset, thus adding further activities to the now so-called “human resource management” (Obedgiu, 2017). In the course of this process, the strategic relevance of HRM also came to the fore. Questions on how HRM and its practices can contribute to company success instead of merely administrating employees arose. The research area of strategic human resource management (SHRM) deals with these topics. Empirical data suggests HR activities can support company performance significantly—especially when in alignment (Combs et al., 2006; Ichniowski et al., 1997). The extent of a shift transforming HR into a strategic business partner is controversially discussed in the literature (Charan, 2014; Fenech et al., 2019; Jesuthasan, 2017; Ulrich, 2014). To assess the impact the digital transformation is having on SHRM in detail, we deducted eight core activities from literature: organizational design, staffing, human resources development, performance management, remuneration, employee relations, health management, and policies (Adamovic, 2018; Becker & Gerhart, 1996; Jackson, Schuler, & Jiang, 2014; Noe, Hollenbeck, Gerhart, Wright, & Eligh, 2016).

Methodology: As prior research mainly used empirical data by interviewing and surveying employees and managers, we opted for a different data source: annual reports (Adamovic, 2018;

Becker & Gerhart, 1996; Boxall & Macky, 2009). German corporations are obliged to provide annual documents (including annual reports, non-financial reports, and sustainability reports) by law. Analyzing these documents reduces the response bias in comparison to survey data and thus paints a more unpolluted picture of firms' activities. As the basis for our analysis, we use the HR-relevant sections from annual business, sustainability, and non-financial reports published in English by the largest German companies during the period from 2009 to 2018. Investigating large-sized companies helps to achieve future-oriented insights on the topic, as they show a more mature use of digital technologies in HRM (Parry, 2011), while the overall application of the systems can be compared to SMEs (Hussain, Wallace, & Cornelius, 2007). The DAX30 consists of the thirty largest corporations in the German economy and thus serves as a benchmark. For our analysis, we considered 27 of the 30 companies, as the other three were not part of the DAX for the majority of the observation period. Since the most important industries are represented, the generalizability of the results improves. Having extracted all employee-related chapters of HR in the reports, the research basis thus comprises text sections from a total of 444 documents. We analyzed these documents using the tidy text mining method and applied the technical tools Tesseract OCR and RStudio, including the text mining packages (Google, 2019; R Core Team, 2019; Silge & Robinson, 2017). We assigned the resulting grams and bigrams to the core activities derived from literature, basing our approach on a qualitative content analysis (Mayring, 2010). The final dataset consists of 10,530 bigrams in eight categories and 39 subcategories. Additionally, we identified 3,889 grams referring to strategy or digitalization. Table 3 provides an overview over the final dataset. The complexity of the data allows analyses regarding the HR activities (categories) on company- or industry-level, or over time. The grams also enable a comparison to the intensity of digitalization and strategic relevance.

Category	Sub-Category	Number of bigrams
Organizational Design	Work design	942
	Change Management	743
	HR Structure	14
	Culture	1,928
	Organizational Development	1,120
	Process Management	1,078
Staffing	Retirement	460
	Executives	2,098
	Succession Management	483
	Recruitment & Selection	3,030
	Talent Management	5,602
HR Development	e-Learning	660
	Informal learning	758
	Career Management	1,492
	Competence management	359
	On the job	61
	Skill Management	1,523
	Training (Formal)	11,898
Performance Management	Assessment Content	2,392
	Feedback Process	877
Remuneration	Benefits	1,899
	Bonus	979
	Fixed Payment	2,659
	Employee Stock Option Plans	713
Employee Relations	Complaint Management	20
	Union Relations	1,169
	Knowledge Management	925
	Communication	1,238
	Participation	2,831
Health Management	Occupational Health and Safety	5,714
	Ergonomics	277
	Evaluation	1,398
	Healthcare	7,616
	Work-Life-Balance	2,707
Policies	Employment Models	2,026
	Corporate Social Responsibility	13
	Diversity	3,233
	Equal rights	3,573
	Guidelines	1,510

Category	Number of Grams
Strateg*	2,609
Digit*	1,280

Table 3: Overview of the Final Text Mining Dataset after Tidying and Categorizing

We thus identified trends and correlations over time and between industries using different statistical tools, such as t-tests or linear regression. Lastly, we discussed the results with four HR managers from Allianz, Bayer, Continental, and Deutsche Telekom. We took this final step to

verify both our previous results and to enrich the insights by gaining more detailed information on organizational structures and technology usage.

Results: We can summarize the results into three main findings. First, as expected, the maturity of technology deployment differs among the corporations. We found four categories: Pioneers, Enthusiasts, Followers, and Laggards. We can link a lack of HR's strategic relevance to Laggards. Second, a general link between strategic relevance and HR cannot be established on company level. This leads us to the conclusion that companies focus on certain activities during their respective transformation process. Third, outliers and trends often seem to be connected to personnel changes in the management boards or market developments rather than to technological or strategic factors. Further research is necessary to understand the relationships and impacts of external factors on HRM's strategic relevance. Our study departs from prior research by applying a novel mixed-methods approach using text mining, qualitative content analysis, and interviews to assess the impact of digital transformation on the strategic relevance of HRM activities.

In this chapter, I introduced the theoretical background on the digital transformation as well as its impact on workplaces and briefly outlined the content and structure of the three papers. The following Chapters 2, 3, and 4 contain these papers. Since I have submitted the manuscripts to (Papers 1 and 3) or published (Paper 2) them in different journals (see Table 2), their structure varies slightly depending on the requirements of the respective journals. I merely adjusted the formatting to provide a consistent layout in this dissertation.

2 Paper 1: New Work—New Motivation?[3]

A Comprehensive Literature Review on the Impact of Workplace Technologies

2.1 Introduction

New technologies are emerging at an ever-accelerating pace. Not only are voice-recognition systems, household robots, or new digital services, e.g., Amazon's Alexa, having an impact on our private lives, but work environments are also changing significantly (Brynjolfsson & McAfee, 2016; Cascio & Montealegre, 2016; Leopold, Ratcheva, & Zahidi, 2016; Oldham & Hackman, 2010). Technologies in the workplace, such as mobile devices, the Internet of Things, or AI-based applications, shape modern work processes and spaces.

Adopting new technologies and designing workplaces requires high investments and educated managerial decisions to integrate them into the companies' strategies (Chan et al., 2007; Kampschroer & Heerwagen, 2005; Schmid, 2020; Vischer, 2007). Meanwhile, labor shortages and other challenges in recruiting and retention management are affecting human resources (HR) and strategic management processes (Cascio & Montealegre, 2016). The much sought-after high skilled workers demand modern and appropriate resources to work with. According to the Future Workforce Study 2016, "[n]early half of American Millennials (42%) say they'd likely quit a job if workplace tech didn't meet their standards" (Dell Technologies & Intel, 2016: 6). As a result, it is necessary to understand the individual needs and perceptions to implement workplace technologies in an effective and strategic manner (Parker & Ohly, 2008). These challenges raise the question of how technology in the workplace affects employees on an individual level.

Prior research focuses mainly on how workplace technology influences well-being, productivity, comfort, satisfaction, and territoriality and identity/belonging (Kim, 2014; Vischer, 2008). Most of these concepts are linked to employee motivation (Miller, Erickson, & Yust, 2001). The scientific discussion is dominated by works that focus on the changes in work content caused by technological change that lead to motivating aspects in the workplace. Regarding technology itself, technology demotivating employees is oftentimes a popular notion. However, according to an Eventboard survey among 1,000 professionals, 38% claim they are motivated by innovative tech tools (Eventboard.io, 2016).

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Motivation is a widely accepted construct that leads to, among other things, better performance, lower fluctuation, lower accident rates (Hackman & Oldham, 1976; Kanfer & Ackerman, 2004; Maxwell, 2008; Seeck & Diehl, 2016), and job satisfaction (Taylor & Westover, 2011). Brown (2012: 4) even declares that "[m]otivation is one of the most critical elements within any kind of workplace." Thus, employee motivation becomes a crucial strategic asset from a managerial point of view. With this aspect in mind, it might be useful to rephrase our initial question as:

How does workplace technology affect employee motivation?

There are many publications with practical recommendations on how to successfully design workplaces and integrate upcoming technology to keep employees motivated and productive (Barrett, 2015; Caramela, 2018; Hartog, Weijs-Perrée, & Appel-Meulenbroek, 2017; Prince, 2017). As most of these publications are merely based on anecdotal insights and the scientific field is fragmented, rigorous academic research is needed (Karanika-Murray & Michaelides, 2015; Oldham & Hackman, 2010; Parker, 2014). In this paper, we investigate existing research and assess whether current models and theories are suitable for explaining how workplace technologies influence employee motivation. This paper departs from prior studies by focusing on motivational theories and studies from the point of view of changing workspaces in the digital era in a structured and comprehensive manner.

In the following sections, we will describe the theoretical background of the topics at hand before introducing our approach based on the Comprehensive Literature Review as proposed by Onwuegbuzie and Frels (2016). After analyzing these results in depth, we will cluster them into the four schools of thought which are characterized by the nature of the technological influence on motivation: Technology as 1. background music, 2. hygiene factor, 3. motivator, and 4. influencer of mediators. We will then present implications for research and management and our conclusion.

2.2 Theoretical Background

2.2.1 Workplace Technology

There is no uniform understanding in the literature of what terms denote the technologies used in the workplace. For this reason, we coin the term workplace technologies to provide a common understanding for the following literature review. "Technology is a system-level variable or cluster of variables, which can be conceptualized as the techniques used by an organization or its subunits to transform inputs into outputs." (Billings, Klimoski, & Breaugh, 1977: 319) Following this definition, technology in the context of organizations focuses on the value creation process

in general. While this is also the case for workplace technologies, these can be divided into two categories. On the one hand, the "technical tools [are] needed to get work done, such as workstations, computers, or mobile devices." (Schmid, 2020: in press) On the other hand, technologies incorporated into workplace design are a necessary situational aspect to support value creation, such as office design, room layout, or furniture. Accordingly, *we define workplace technologies as the technologies that surround the employee and are needed to get the job done*. Thus, we call the act of implementing such technologies and therefore shaping the physical work environment 'workplace design'. While these definitions provide a good starting point to assess the topic, we will evaluate the terms used in the literature more closely in our analysis in Chapter 4.2.

2.2.2 Employee Motivation

Diefendorff and Chandler (2011: 66) provide a comprehensive yet concise understanding of motivation, which we also base this work on: *"Motivation* is often described as an unobservable force that directs, energizes, and sustains behavior over time and across changing circumstances." While other authors provide different definitions, they all have in common that motivation is a construct or invisible driver, which induces behavior. Research in motivation and thus the origin of behavior in the workplace already began a century ago with the conception of humans contradicting the technocentric worldview that had been predominant at the beginning of the 20th century (Komlosy, 2014). One of the most cited research projects on workers from that time is the Hawthorne Studies (Landsberger, 1968; Mayo, 1949). These experiments observed how changes in the working conditions influence worker productivity. Researchers interpreted the results as mechanisms inherent in the individual and group structures affecting employee motivation.

These insights led others to shift the focus of their research from the physical aspects to the emergence of a more person-centered view on motivation in the following decades (Kim, 2014; Veitch, 2018). Groundbreaking theories like Maslow's hierarchy of needs or Herzberg's Two Factor Theory as well as various process theories focusing on the cognitive mechanisms leading to behavior emerged (Herzberg et al., 2017/1959; Maslow & Stephens, 2000).

Herzberg's Dual-Factor Theory is one of the most frequently cited theories in management research. Using the critical incidents method, he identified context factors as a hygiene factor, which leads to dissatisfaction when absent or unfavorably designed. However, sufficient workplace technology or other context factors may not lead to motivation (Herzberg et al., 2017/1959). While still one of the major theories taking external factors and employee motivation into account, it is often criticized for not being replicable with other approaches. Scholars

suspect a methodological artefact (Hackman & Oldham, 1976). However, the notion of adequate context factors merely preventing demotivation led to another direction for research.

In the following years, many researchers examined the impact of work conditions on health and how the work environment can influence humans negatively. For example, the **Job-Demand-Control-Model** and its successor, the **Job-Demands-Resources-Model**. explain the development of exhaustion based on an unfavorable working environment (=job demand) (Demerouti & Bakker, 2011; Veitch, 2018). Depending on the level of demands or resources available, a job can be perceived as straining/stressful or motivating (Karasek, 1979; Parker et al., 2017a). Physical and technological resources are part of this approach, yet the allocation explains negative results like stress rather than motivational aspects (Demerouti & Bakker, 2011).

To consider individual differences in motivation and work design perceptions, Hackman and Oldham developed the **Job Characteristics Model (JCM)** based on a study with the Job Diagnostics Survey. Technology is not a central part of the model (Hackman & Oldham, 1976).

The **Self-Determination Theory (SDT)**, which was developed a decade after the identification of the Job Characteristics, focuses on the person and conceptualizes intrinsic motivation achieved by addressing the needs autonomy, relatedness, and competence (Deci & Ryan, 1985; van den Broeck et al., 2016). Prior content theories have already focused on needs or need categories. The underlying assumption in all cases is that a person is motivated to show a certain behavior in pursuit of satisfying these needs (Maslow & Stephens, 2000).

Yet another perspective on the topic highlights the emotional component of feeling motivated. Mihaly Csikszentmihalyi coined the term "**flow**" in 1990 to describe a mental state in which a person is fully focused on a task. Flow occurs depending on individual readiness, tasks, and external circumstances (Csikszentmihalyi, 2010).

Another wave of research that occurred in the 1990s and 2000s attempted to integrate existing research and create a broader perspective as each of the motivation theories and models focuses on a different aspect to study the concept of motivation (Diefendorff & Chandler, 2011; Humphrey, Nahrgang, & Morgeson, 2007; Parker et al., 2017a). In this period, empirical data provided new insights—particularly on the properties of extrinsic incentives. The results indicate ambiguous effects of material rewards on intrinsic motivation in so-called interesting or creative tasks (Amabile, Hennessey, & Grossman, 1986; Becker & Steele, 1995; Deci, Koestner, & Ryan, 1999; Heckhausen & Heckhausen, 2010). For innovative behavior in particular, this connection plays a critical role in improving work results (Seeck & Diehl, 2016).

2.3 Literature Review

Due to the constant growth in publications in this research domain during the past decades, the existing literature is plentiful. To cope with the amount of research and achieve a comprehensive overview, we chose a structured approach. In response to calls for methodological rigor in management literature reviews (Bouncken et al., 2015; Fisch & Block, 2018; Tranfield et al., 2003), we provide a structured review of motivation research publications and how they consider workplace technologies. Onwuegbuzie and Frels (2016) suggest that the Comprehensive Literature Review offers the opportunity to assess large volumes of publications in a transparent manner. To identify the key publications on the topic, we followed the four steps as outlined below. Figure 2 presents an overview of the details of each step.

1. Search*:* To capture a broad range of results, we placed no prior restrictions on the definition of motivation or workplace-related influences. We chose general search terms accordingly. Search strings in different scientific databases with combinations of search terms related to the topic provided more than 200,000 results.

2. Filter*:* We filtered these results by assessing a representative number of abstracts (Krejcie & Morgan, 1970, as cited in Onwuegbuzie & Frels, 2016: 102)—resulting in 1,454 abstracts. Here, we relied on the databases' results sorted by relevance.

3. Selection*:* Depending on the search engine, we found hundreds of results unrelated to the initial question. Many of these publications used the term "motivation" to describe the relevance of the topic. Others were closer to the topic at hand, yet unfit for shedding light on the current question. A recurring notion, for example, is the use of "workspace" to describe the radius of a robot arm. Other publications, some of which were works on the Technology Acceptance Model and its variations, referred to the mechanisms of how people can be motivated to use certain technologies at work. As the guiding criterion in this step was to select publications that cover aspects of employee motivation as defined above, we excluded those search results, which resulted in 205 useful publications.

4. Evaluation*:* We evaluated the remaining publications in depth to find out whether they addressed motivational theory in general and, specifically, the influence of workplace technology as defined above. During this assessment, we find that that a large part of motivation research has only marginally considered workplace technologies in their research. The authors mention 'workplace attributes' (Karanika-Murray & Michaelides, 2015; Taylor & Westover, 2011), 'workplaces' (Wong, Gardiner, Lang, & Coulon, 2008) or other situational aspects including techno-

logical elements. However, workplace technology is not at the center of attention but can instead be perceived as "background music" within these approaches. Thus, we excluded those publications. We also assessed reference lists to add further relevant publications (backward snowballing). Finally, we identified 67 publications dealing with job motivation and workplace technologies.

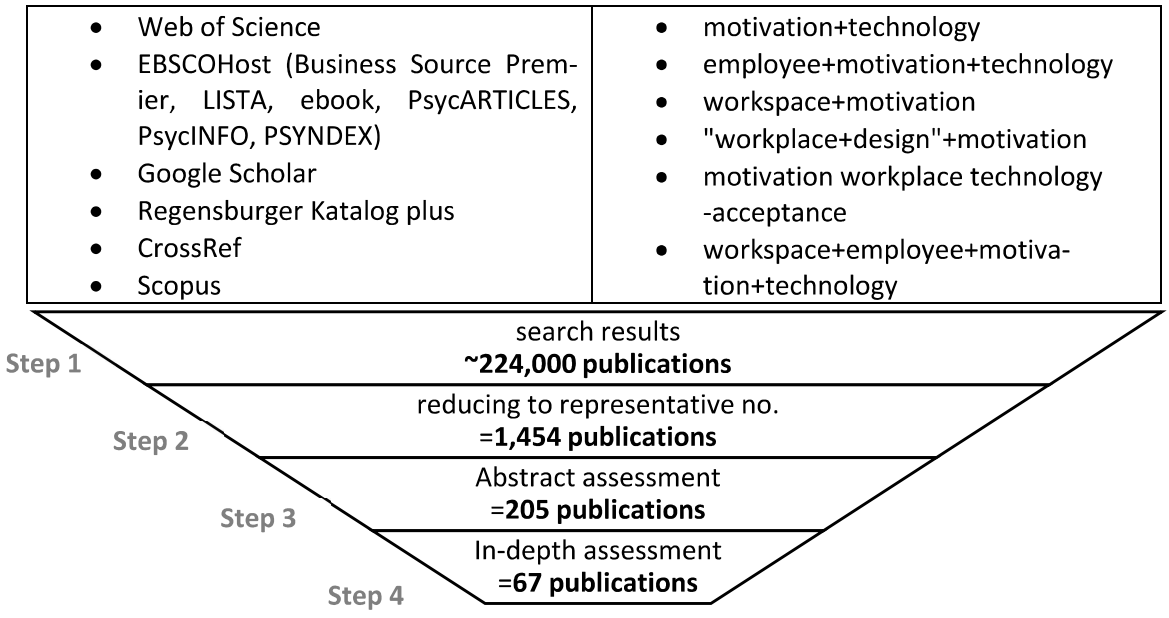

Figure 2: Search Strings and Filtering Methods Produced 67 Results for a Comprehensive Literature Review

2.4 Analysis of the Literature Sample

In this section, we will analyze the 67 publications resulting from the above-mentioned procedure. To do so, we use an integrative approach including a systematic descriptive analysis to identify trends and gaps in this research area. Following a descriptive analysis on origin, publication date, and quality of the results, we will assess the contents in detail by mapping the perspectives on motivation and the theories applied as well as the different external factors. Subsequently, different perceptions of the relationship between workplace technologies and motivation are reviewed.

2.4.1 Descriptive Analysis of the Sample

From the 67 publications, the earliest works are from Denise M. Rousseau and Oldham and Brass applying the 'Job Characteristics Model' by Hackman/Oldham from the 1970s.[4] While office au-

[4] Older works such as Herzberg et al.'s "Motivation to Work" also showed up, but as later editions.

tomation was a popular topic in the 1980s, works by Teresa M. Amabile on creativity and intrinsic motivation had an undeniable effect on motivation research in the 1990s. Most of the results though are from the 2000s and later, where the diversity of disciplines and origin increased.

Over time, the authors' country of origin shifted away from the United States. Overall, the focus still lies on Northern America, with more than half of the authors working there, but widens to include other regions such as Europe, Southeast Asia, and Australia—particularly after 2010 (see Figure 3). These results reflect the growing interest in motivating workplace design in developed countries.

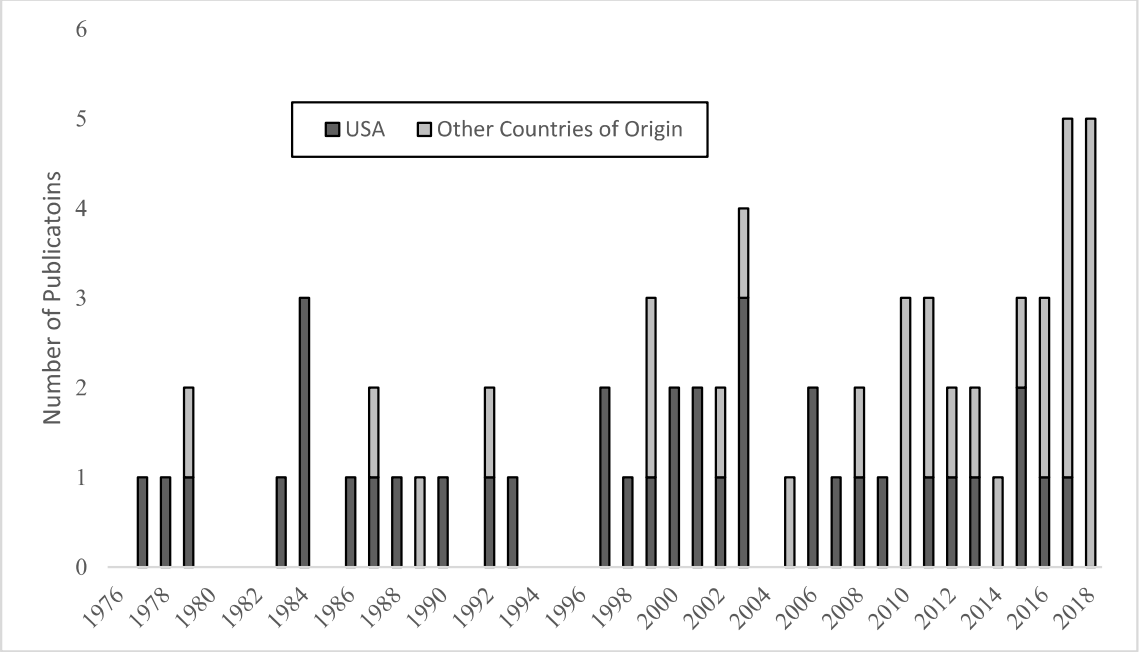

Figure 3: First Authors' Origin Over Time Shows Rising Numbers of Non-US-Based Publications (n=67)

Most publications come from rather traditional fields like psychology and (HR) management as well as from more recent disciplines like technology and facility management. Depending on the field, the perspective on the topic differs. While psychological and pedagogic publications have a stronger focus on the cognitive and affective processes, authors with a technological background tend to initially build on motivation theories but then focus on technological characteristics and details (Liu, Huang, & Zhang, 2018; Perryer, Celestine, Scott-Ladd, & Leighton, 2016).

Since we considered different databases, about one quarter of the results are not scientific journal articles, but books (reference books, textbooks, anthologies) or grey literature such as reports or comments. To determine the quality of the scientific articles, we consulted the most recent editions of the VHB Jourqual published by the German Association of Business Professors, the AJG from the British Chartered Association of Business Schools, and the JCR Impact Factor provided by Web of Science. The type and quality of the relevant results are listed in Table 4.

Books	**16**	
Grey Literature	**2**	
Scientific Journal Articles	**49**	
VHB Jourqual	**AJG (Academic Journal Quality Guide)**	**JCR Impact Factor (Clarivate)**
A+: 5 publications	4*: 6 publications	≥3: 19 publications
A: 5 publications		≥2: 2 publications
B: 7 publications	3*: 4 publications	≥1.5: 3 publications
C: 2 publications	2*: 2 publications	≥0.7: 8 publications
D: -	1*: 7 publications	≥0: 1 publication

Table 4: Types and Quality Level of the 67 Final Publications Examined

Another third of the results contains quantitative analyses—with questionnaires as the primary method of choice. Depending on the underlying theory, the Job Diagnostics Survey (JDS), Work Preference Inventory (WPI), Work Design Questionnaire (WDQ), or a combination of items from these and other questionnaires were used. Other data collection methods include experiments or diary surveys; the critical incidents-method is a specific approach that is mostly used when reproducing data based on Herzberg's Two Factor Model (Knight & Westbrook, 2015). Few authors opted for a qualitative or mixed approach including thematic analyses of interviews and diary entries. Table 5 provides an overview.

Number of Publications	Method
	Conceptual
20	Literature Review
11	Theory Building
	Quantitative Methods
5	Descriptive Methods
4	Variance Analyses
9	Regression Analyses
4	Factor Analyses
3	Qualitative Methods
3	Mixed Methods
8	Others

Table 5: Applied Methodologies in Research on Motivating Workspace Design (n = 67)

Having described the quantity and structure of our 67 search results, we turn to the content of the publications in the following sections. To ensure a systematic process, we first outline the different types of technologies influencing job motivation mentioned in the literature. We will then show how the researchers conceptualized the relationship between those influences and job motivation.

2.4.2 Types of Workplace Technologies

Different authors provide different understandings of the influencing technologies—the terms used vary greatly. Table 6 provides an overview of these terms.

Area	Terms and Concepts	Examples
General terms	Situation, Job/work context physical, Working conditions, Work/office environment, Workplace design, Technology, Technological factors/environment	Amdan, Rahman, Shahid, Bakar, Khir, and Demong (2016), Demerouti and Bakker (2011), Hancock (2009), Heckhausen and Heckhausen (2010), Herzberg et al. (2017/1959), Knight and Westbrook (2015), Morgeson and Campion (2003), Parker, van den Broeck, and Holman (2017b)
Room appearance	Open office layout, Room size, Number of workstations per room, Furniture, Control of space Mobile working	DeVoe and Prencipe (2001), Houghton, Foth, and Hearn (2018), Kleibrink (2011), Knight and Haslam (2010), Oldham and Brass (1979), Samani, Eskandari, Zadeh, and Samani (2018)
Taxonomy	Thompson's Technology Classification, Chronological taxonomy, Tool vs. toy	Malone and Lepper (1987), Millman and Hartwick (1987), Rousseau (1977, 1978)
Specific technologies	Production technologies, ICT (computers, mobile devices, training applications), ERP systems, Gamification applications	Argote and Goodman (1986), Eden, Ganzach, Flumin-Granat, and Zigman (2010), Housand and Housand (2012), Liu et al. (2018), Martin (2017), Perryer et al. (2016)

Table 6: Overview of the terms used to describe external, technology- or workplace-related influences

Many authors work with rather **general terms** to include physical environmental aspects. Expressions like situation (Heckhausen & Heckhausen, 2010), job/work context (Herzberg et al., 2017/1959; Humphrey et al., 2007), physical environment (Demerouti & Bakker, 2011; Mitchell, 1997; Mitchell & Daniels, 2003), physical working conditions (Knight & Westbrook, 2015; Osteraker, 1999; Rožman, Treven, & Čančer, 2017), work/office environment (Amdan et al., 2016; Barford & Hester, 2011; Brenner, 1999), or workplace design (Hancock, 2009) are used. These terms represent a rather general understanding including—but not focusing on—workplace technologies.

Other authors narrow down their understanding: Technology (Amabile, 1993; Methot & Phillips-Grant, 1998; Morgeson & Campion, 2003; Parker & Ohly, 2008), technological factors (Das, 1999; Parker et al., 2017b), or technological environment (Jong, 1989) are the terms used. Again, these publications do not explain their meaning any further or provide specific classification. This lack of definition can be vexing; however, as most of these publications are reviews or theory-building papers, there is no imminent need for operationalization.

Room appearance and layout*:* A popular approach for taking workplace technologies into account is observing reactions to office layout and equipment. While these technologies do not

directly generate added value, they are an integral part of the workplace. One of the earlier examples is the research by Oldham and Brass (1979). They observed employees' reactions after moving into an open office layout. Greenberg (1988), DeVoe and Prencipe (2001), and Lawrence and Nohria (2002) also focused on workplace technologies incorporated into workplace design, such as room size or furniture. Miller et al. (2001) chose a very specific approach and examined how the 'sense of place' influences motivation. As the perception of the physical environment differs, this concept may well hold explanatory power for how workplace technology affects workers in different ways. In a survey, they collected data on physical comfort, the perception of objects, furniture, and other environmental aspects (= sense of place). Their findings suggest a significant positive correlation between sense of place and motivation.

Samani et al. (2018) conducted a survey on the effects of transforming an open space layout by adding partitions. Their results show increased satisfaction and motivation. The new individual workstations offered the opportunity for workers to adjust their surroundings to their individual needs to a certain degree, e.g. the level of lighting. A similar approach was chosen by Knight and Haslam (2010). In their survey, they focused on managerial control of office space. Other researchers evaluate office layout or changing environments due to flexible work models. Research includes details on single office, multi office, or open space layouts (Kleibrink, 2011) as well as interactive concepts like coworking spaces (Houghton et al., 2018). Olson and Tasley (1983) and Janneck, Jent, Weber, and Nissen (2018) also included other working concepts, like home office or mobile working (= hoteling). These approaches are particularly popular in the research areas of facility and real estate management. They reflect the office trends shifting away from the individual office to open solutions with tele- and virtual working. While this approach is specific and comprehensive at the same time, details on technological tools and characteristics are lacking.

One possibility for ensuring both a comprehensive understanding of and a focus on technological aspects of the workplace is to classify them in a **taxonomy**. Rousseau (1977, 1978), for example, applies James D Thompson's technological classification scheme from 1967 that distinguishes between long-linked, mediated, and intensive technologies. Long-linked technologies describe a structured system with clear cause-and-effect-relationships. They are characterized by highly standardized sequential processes like an assembly line. Mediated technologies still contain prescribed processes; however, the tool to be applied must be chosen individually by the employee. With current technological advances, intensive technologies are on the rise. Here, the result of processes is not clear, and the appropriate technology has to be chosen individually

(Thompson, 1967). These systems are mainly found in jobs with creative tasks and human interaction, which are gaining in importance during the digital transformation (Frey & Osborne, 2017). In their survey on employees' responses to environmental structures, Pierce, Dunham, and Cummings (1984) took a similar stance. To operationalize technology, they adopted a multidimensional approach, taking operations technology, material technology, and knowledge technology into account.

Another approach for classifying technology is to do so chronologically. Millman and Hartwick (1987) summarized different early ICT-applications, such as mainframe and personal computers, or teleconferencing, under the term 'office automation.' Cascio and Montealegre (2016) analyze ubiquitous computing (e.g., electronic monitoring systems, robots, teleconferencing, and wearable computing devices) as a further development of enterprise, end-user, and strategic computing. Malone and Lepper (1987) categorize technologies and activities based specifically on how they influence motivation; they can be tools or toys. While tools are primarily used to achieve an external goal, toys are used for their own sake. The authors use an example to show that this classification is not necessarily distinctive. While most people use their computer to get work done, others take pleasure in mastering this tool (=toy).

Several authors opted for a focused approach and investigated **specific technologies**. One area worth noting is production technologies. Argote and Goodman (1986), for example, review how individuals react to the introduction of robotics, and Osterloh and Gerhard (1992) discuss the potentials of an anthropocentric production design.

Other research projects focus on applications in the area of information and communication technologies, such as hardware and software tools (Martin, 2017; Pacauskas & Rajala, 2017; Sidler, 1984; Siemens, 2005). Lazar, Jones, and Shneiderman (2006), and Eden et al. (2010) examined (stationary) computers in the workplace while the growing mobile access to data plays a major role in a survey undertaken by Sinha and Arora (2015).

Although Benson and Dundis (2003) use the rather general term "technology" in their analysis, they discuss the specific implementation of ICT in nursing trainings. Housand and Housand (2012) also focus on training applications—placing emphasis on educational purposes. Other software applications include communication platforms (Brown, 2012), enterprise management systems (Bala & Venkatesh, 2013), email applications, or access to internet (Martin, 2017). The easy and fast access to information due to these tools is mostly the crucial aspect influencing motivation and behavior.

A very young topic in the area of technology and motivation is gamification. It can be defined "as the use of game design elements in non-game contexts" (Deterding, Dixon, Khaled, & Nacke, 2011: 9). This innovation deserves special mention as software applications and systems are designed using gamification elements specifically to motivate. The combination of rewards, collaboration, and competitive setting is crucial (Domínguez, Saenz de Navarrete, Marcos, Fernández-Sanz, Pagés, & Martínez-Herráiz, 2013; Janneck et al., 2018; Liu et al., 2018; Perryer et al., 2016).

2.4.3 Types of Relationships Between Technology and Motivation

Ten publications adhere to Herzberg's view on work conditions as a **hygiene factor** (Herzberg et al., 2017/1959). This paradigm highlights the constraining characteristics of workplace technologies. As these design elements and technological applications change over time, the original empirical results are called into question (Siemens, 2005). Therefore, Knight and Westbrook (2015) reproduced Herzberg's critical incidents method with data from telecommuters. Their results mainly correspond to those of Herzberg; however, communication and flexibility enabled by ICT became motivators highlighting the role of technology.

Other researchers follow the perspective of this model by viewing external aspects as restricting motivation and performance (Demerouti & Bakker, 2011; Karasek, 1979). By taking a diary approach, Lazar et al. (2006) examined frustrating effects when using computers. While the authors acknowledge that mild frustration can be motivating, they view most experiences as a problem in the workplace.

Ryan and Deci (2000) evaluate research on the Self-Determination Theory and view motivation as the individual need for growth that inner resources foster. Environmental aspects act as an infrastructure in which demands can cause negative results if too prevalent (Demerouti & Bakker, 2011; Karasek, 1979; Taylor, 2015).

Another 17 publications claim a **direct relationship** between environmental influences and motivation. Ford (1992) explains the connection as follows: "Because humans are open systems whose existence, functioning, and development depend on material-energy and information exchanges with relevant contexts, the environment is always an integral part of their functioning" (Ford, 1992: 51). While the author does not elaborate on the relationship further, other researchers included this aspect in a similar manner. Several authors illustrate the situational (job context) influence on cognitive and motivational processes in their frameworks as an influence equal to the personal disposition/individual inputs (Barford & Hester, 2011; Heckhausen & Heckhausen, 2010; Houghton et al., 2018; Jong, 1989).

While the nature of the relationship (particularly regarding the technological factors) is not described in detail, expectations may play a crucial role (Heckhausen & Heckhausen, 2010; Jong, 1989; Mitchell, 1997; Mitchell & Daniels, 2003). Other authors do not provide additional insights on the mechanisms of these processes either, but offer instead more details on the influences investigated. Das (1999), for example, developed a holistic framework describing several factors—technological, among others—that make up work design. Pierce et al. (1984) evaluated environmental structures on different levels (job, technology, work unit, leadership) and how these influence employee behavior (performance, absenteeism, intrinsic motivation, etc.). Results show that job and technology are the most important aspects explaining responses.

An approach to exploit this direct connection is utilizing workplace technologies as rewards. Perryer et al. (2016), for example, argue that one aspect of gamification applications is extrinsic prizes or badges—depending on the game design—that can be won. Other workplace technologies can also be perceived as a reward. In his survey on equity, Greenberg (1988) distributed status symbols, like remuneration and offices, among sales managers. Here, it is not the functionality of the furniture, but its symbolism that influences perceived fairness and extrinsic motivation (Vilnai-Yavetz, Rafaeli, & Yaacov, 2005). Elsewhere, using technology as rewards is mostly based on managerial recommendations, the scientific value of which is low (DeVoe & Prencipe, 2001; O'Donovan, 2002; Sidler, 1984).

Miller et al.'s (2001) empirical findings suggest a significant positive correlation between sense of place and motivation. Interestingly, it seems that it is not the examined environmental aspects themselves that are the contributor to motivation, but the opportunity to control them. Personalization of furnishings and positioning of objects seem to be particularly important here. This hints towards a rather **indirect relationship**—researchers in 39 publications describe such mechanisms. In this perspective, some factors act as mediators between the external influence and the motivational processes. Depending on the conceptual framework, these mediators range from emotional aspects and needs to job characteristics.

Table 7 provides an overview of the mediators with underlying frameworks and examples. To ensure a structured presentation of the mediators and allow for readability, we numbered each item in both the table and in the text. The numbers do not represent a ranking.

Mediator	Associated with theoretical concepts	Examples
1 Needs	Self-Determination Theory Maslow's Need Hierarchy	Benson & Dundis, 2003; Lawrence & Nohria, 2002; Maslow & Stephens, 2000; Nohria, Groysberg, & Lee, 2008; Osteraker, 1999; Paul, 1997; Perryer et al., 2016; Sinha & Arora, 2015; van der Voordt, 2003
2 Task Identity	Job Characteristics Model	Humphrey et al., 2007; Oldham & Brass, 1979; Rousseau, 1977, 1978
3 Skill Variety	Job Characteristics Model	Humphrey et al., 2007; Morgeson & Campion, 2003; Oldham & Brass, 1979; Rousseau, 1977, 1978
4 Task Significance	Job Characteristics Model	Humphrey et al., 2007; Oldham & Brass, 1979; Rousseau, 1977, 1978
5 Feedback	Job Characteristics Model	Humphrey et al., 2007; Millman & Hartwick, 1987; Oldham & Brass, 1979; Rousseau, 1977, 1978
6 Autonomy	Job Characteristics Model, Self-Determination Theory	Amabile, 1993; Cascio & Montealegre, 2016; Housand & Housand, 2012; Humphrey et al., 2007; Liu et al., 2018; Millman & Hartwick, 1987; Oldham & Brass, 1979; Olson & Tasley, 1983; Parker et al., 2017b; Parker & Ohly, 2008; Rousseau, 1977, 1978
7 Competence	Self-Determination Theory	Cascio & Montealegre, 2016
8 Relatedness	Self-Determination Theory	Cascio & Montealegre, 2016; Housand & Housand, 2012
9 Challenge	Intrinsic Motivation	Amabile, 1993; Housand & Housand, 2012; Malone & Lepper, 1987; Methot & Phillips-Grant, 1998
10 Recognition	Intrinsic Motivation	Housand & Housand, 2012; Malone & Lepper, 1987; van der Voordt, 2003
11 Control	Job-Demand-Control-Model	Argote & Goodman, 1986; Bala & Venkatesh, 2013; Housand & Housand, 2012; Knight & Haslam, 2010; Malone & Lepper, 1987; Osterloh & Gerhard, 1992; Samani et al., 2018
12 Efficacy		Eden et al., 2010; Martin, 2017
13 Flow	Flow Concept	Domínguez et al., 2013; Hancock, 2009; Pacauskas & Rajala, 2017
14 Emotions/ Moods		Hancock, 2009; Veitch, 2018

Table 7: Overview of the publications explaining technology affecting mediators

Perhaps the most obvious understanding of the indirect influence of technologies is that they can satisfy needs (1). Osteraker (1999), for example, claims that physical working conditions address physical needs. Other examples of needs include safety, esteem, self-actualization (Maslow & Stephens, 2000), social interaction (Brown, 2012; Lawrence & Nohria, 2002), or the need to succeed (Nohria et al., 2008; Perryer et al., 2016; Sinha & Arora, 2015). Brenner (1999) and Benson and Dundis (2003) provide a very clear and holistic perspective on how technology contributes to need satisfaction. They discuss the effects of workplace design elements, ICT, and training on employees in offices and the healthcare sector on every level of Maslow's Need Hierarchy. They argue for example, that technology applied in training situations can provide the feeling of (job) security and the application of ICT enhance belonging to groups regardless of the person's current location

A wide array of publications—in fact the whole ergonomics research stream—deal with workplace technologies and how they affect the human body. As the focus here is anatomy, cognitive and affective outcomes—like work motivation—are mainly neglected. Paul (1997) provides an exception. He connects workplace design (including office equipment) with the notion that it can have pampering effects on need satisfaction—both on the human body and motivation. He assumes an inverted U-shaped correlation with productivity and employee motivation. The implication would be that a physically uncomfortable workplace design leads to dissatisfaction (which would be in line with the Herzberg's findings), while a too 'plushy' workplace leads to employees feeling too comfortable and even lazy.

Another approach is to focus on the characteristics of the workplace rather than individual needs. Soon after Hackman and Oldham published the Job Characteristics Model, Denise M Rousseau analyzed the Job Characteristics (2 Task Identity, 3 Skill Variety, 4 Task Significance, 5 Feedback, 6 Autonomy) and how they interact with the (technological) environment (Rousseau, 1977, 1978). She found that the design of processes and technology use is correlated with Job Characteristics as well as with behavioral and attitudinal outcomes. At the same time, Oldham and Brass (1979) evaluated the internal motivation of office employees after moving from cellular to open offices. A sharp decline in motivation can be explained by a drop in the Job Characteristics.

Other authors argue that the Job Characteristics can be shaped by technologies: It is easy to agree with the claim that "autonomy originates in the workplace rather than the job" (Karanika-Murray & Michaelides, 2015: 227) when imagining that (mobile) access to data provides employees with the power to decide where and when to work (Millman & Hartwick, 1987; Olson &

Tasley, 1983). In their experiment with CNC machine operators, Liu et al. (2018) designed a gamified approach to influence Skill Variety, Feedback, and Autonomy for workers. An app provides points and badges for achievements in different challenges. The data on 80 participants in total reveal a significant increase in motivation and job satisfaction.

To motivate employees, Cascio and Montealegre (2016) recommend implementing technologies addressing the needs for autonomy (6), competence (7), and relatedness (8) based on the Self Determination Theory. While physical design decisions can influence perceived relatedness, virtual technologies can also contribute to satisfying social needs. Housand and Housand (2012) suggest mentoring networks and online group tasks to promote cooperation.

In their Expanded Work Design Model based on the JCM, Humphrey et al. (2007) conducted a meta-analysis with 259 studies and 219,625 participants. While there were not enough studies available to make valid claims on the effects of work context characteristics on motivation, a positive effect of both work conditions and ergonomics on attitudinal outcomes and a negative effect of physical demand on behavioral outcomes can be assumed (Humphrey et al., 2007)—this finding is in line with the publications we subsumed under the "technology as a hygiene factor" section. While physical demand in the form of insufficient and complicated workplace design demotivates employees, work needs to be challenging to a certain extent to motivate (Amabile, 1993; Housand & Housand, 2012; Malone & Lepper, 1987). As too great a challenge or too difficult tasks can cause frustration and unchallenging work can be monotonous, Housand and Housand (2012) point out the opportunities online programs offer for students: gifted students can attend additional classes and solve harder tasks to achieve their optimal level of challenge (9). One of the mechanisms influencing this aspect is whether the technology at hand is associated with increased skill requirements (Methot & Phillips-Grant, 1998).

Another mechanism is based on the information technological elements convey (see also technology as a reward). Recognition (10) as a facilitator for motivation is closely connected to feedback (5) and rewards as they can be perceived as symbols of recognition for the performance. Technology can be leveraged to provide recognition, for example, by implementing gamification elements containing achievements, badges, and rewards for individuals (Housand & Housand, 2012). The act of implementing technologies and placing emphasis on workplace design can also provide recognition (van der Voordt, 2003).

The feeling of control (11) over one's individual environment can in fact enhance motivation (Samani et al., 2018) while a lack of control may lead to discomfort and demotivation (Argote & Goodman, 1986; Bala & Venkatesh, 2013; Knight & Haslam, 2010; Osterloh & Gerhard, 1992). A

close connection to autonomy (6) can be assumed, as Cascio and Montealegre (2016) find: "Autonomy is the need to control one's actions" (p. 356), and Housand and Housand (2012) even analyze the two concepts as one. Organizations can provide this feeling of control by implementing new technology and accompanying processes. For example, when introducing mobile devices, management can increase the autonomy by offering the free choice of where to work.

Technologies in the workplace can also motivate employees by enabling them to do their job. ICT in particular can provide smooth processes and motivate through means efficacy (12) (Eden et al., 2010). Martin's (2017) findings point in a similar direction. She shows that technologies facilitating internal information flow increase employees' introjected regulation and intrinsic motivation. On the other hand, technologies decreasing communication costs (e.g., groupware or intranet) cause negative effects as they provide information access to higher management and make employees feel less empowered.

Yet another approach to understanding motivation is to consider affective aspects. Emotions and other factors play a major role in the flow concept (13) (Csikszentmihalyi, 2010). The concept describes a cognitive state of focus and enjoyment, like intrinsic motivation. This state can be facilitated by activities and individual preferences as well as by situational aspects. Veitch (2018), for example, claims that a positive working environment (with regards to lighting and ventilation) can lead to a good mood/pleasure (14) and engages employees with an "intrinsic interest in their work" (Veitch, 2018: 84–85). Easy-to-use technology can also contribute to achieving this state (Domínguez et al., 2013; Hancock, 2009; Pacauskas & Rajala, 2017). The ease of use is determined by—among other factors—an intuitive interface.

2.5 Discussion

We examined publications from the fields of psychology, management, educational sciences, and facility management. The results from our comprehensive review of the literature show that researchers hold different perspectives on the question of how workplace technologies influence employee motivation.

2.5.1 Map of the Field

After reviewing the past research on work motivation and how it takes workplace technology into account, we propose clustering research into four paradigms. While the distinction is not mutually exclusive in all cases, most of the publications can be assigned to at least one of them.

1. Technology as background music*:* As described in the process of our literature selection, we find that traditional motivation theories tend to focus on motivation being a result of cognitive processes and individual preferences. Most of the content and process theories can be taken as

examples here. Although they promote a person-centered view, situational aspects in general and workplace technologies in particular are mentioned. These researchers acknowledge the influence of these external aspects with varying specification, and some also examine them more closely (Sundstrom, 2001; Taylor & Westover, 2011; Wong et al., 2008). Yet, in their observations and frameworks, environmental aspects can be compared to background music, i.e., it is there, but in their approaches , technology does not make a difference. While these works were not at the center of our research as they do not focus on technology, it is essential to acknowledge this paradigm as it constitutes a major amount of research.

2. Technology as a hygiene factor: This is a popular paradigm researching the influence of workplace technology by focusing on the negative and health related effects. Mainly considerations based on Herzberg's findings, the Job-Demands-Control-Model, and publications on ergonomics can be found in this paradigm. These publications all share the view that appropriate physical surroundings are necessary to prevent dissatisfaction and illness, but not to motivate (Herzberg et al., 2017/1959). This research was mostly published in scientific journals with an average JCR impact factor of 3.0. While this perspective certainly holds true to a certain extent, both the suspected research artifact of the critical incidents method (Hackman & Oldham, 1976) and the emergence of new technologies (Knight & Westbrook, 2015) suggest a more complex connection.

3. Technology as a motivator: A number of publications propose a direct (and positive) impact on employee motivation. Offering the latest gadget as an incentive for high performing employees poses a feasible solution for managers; however, these recommendations mostly do not explain which aspects of this approach are crucial, nor do they take the differences between intrinsic and extrinsic motivation into account. Here, mainly managerial recommendations view technology as a potential reward to improve (extrinsic) motivation and employee retention (DeVoe & Prencipe, 2001; Houghton et al., 2018; Miller et al., 2001; O'Donovan, 2002). Most of these publications are not peer reviewed research and those that are have an average JCR rating of 2.2.

4. Technology as an influencer of mediators: The majority of publications claim an indirect relationship between workplace technology and motivational outcomes. These frameworks mostly build on the Job Characteristics Model, the Self Determination Theory, and needs models (see Table 7). The two Job Characteristics 'Autonomy' and 'Skill Variety,' as well as individual needs are the most frequently mentioned mediators (Schmid & Auburger, 2020). Researchers representing this perspective mostly based their assumptions on rigorous data and prior research results, which is also reflected by the average JCR rating of 5.0 for these articles. The

consideration of a mediating factor can explain some of the complex structures of motivation; however, research does not (yet) follow a predominant paradigm regarding the connection between workplace technologies and motivation.

2.5.2 Practical Implications

Regardless of the individual perspective on the topic, when implementing a new workplace technology or rethinking workplace design, management should consider the effects on employee motivation. These can even be addressed strategically (Kim, 2014; Mitchell, 1997; Schmid, 2020). The literature shows that by choosing suitable technology, Job Characteristics, ergonomics, and needs satisfaction can be facilitated to motivate employees and thereby increase productivity, output quality, or achieve other strategically relevant outcomes. As research results are still fragmented and often include overly specific technologies or overly general constructs, it is difficult to make an overall recommendation. Yet, the results show two aspects applicable to most decision situations managers face when it comes to motivating workplace design:

1. Conscious technology implementation*:* Modern technologies offer great potential for new processes and interactions. Implementing a new tool has various consequences for other organizational features. While the decision for the "right" technology is important, the way it is implemented and perceived is crucial. How these innovations are perceived depends on aspects such as company culture, leadership style, individual skills, etc. We illustrate this consideration using the (previously mentioned) example of mobile devices: Having a smartphone at hand can empower an employee to access work-related information whenever and wherever he or she wants. This increases autonomy and therefore motivation. At the same time, the very same technology also enables managers to monitor their subordinates more closely and can increase the expectancy to be available at any time. This results in a lack of control for the employee and can cause demotivation (Schmid & Auburger, 2020). In this case, leadership style mediates the connection between technology and motivation. In addition, the perception of technologies determines whether employees sense opportunities or threats in these innovations (Bala & Venkatesh, 2013; Cascio & Montealegre, 2016; Parker & Grote, 2020). Eden et al. (2010) conceptualized this relationship as 'means efficacy' and showed that believing in the usefulness of a tool can increase efficacy and productivity. For management, this means that these and other aspects need to be considered consciously when implementing new technology or redesigning workplace.

2. Allow employee participation: Depending on the area of work and the individual preferences, every 'ideal' workplace looks different. Including employees in the design process can have various effects. First, they have access to a platform to express their individual needs and help select the workplace technology in a manner that achieves needs satisfaction. Second, by giving them control over design decisions, the design process will become motivating in itself.

Providing endless options to create individual workplace settings will be neither financially nor organizationally feasible. We suggest a predefined range of design features complying with company standards—a cafeteria-style workplace (Becker & Steele, 1995).

Miller et al. (2001) show that providing choices—even on small and cost-effective features—can be applied successfully in many cases: choosing and arranging furniture or personalizing one's desk can have a positive effect on motivation.

2.5.3 Agenda for Further Research

While this paper provides only a partial examination of the available literature, our structured approach offers a comprehensive picture of existing research. The 67 results show that a person-centered view is still the predominant paradigm. "This is unfortunate, as research in other areas has documented the importance of both the social environment and work context for a wide range of outcomes" (Humphrey et al., 2007: 1332). The number of calls for research on a holistic perspective is already on the rise. Drawing on these calls and the results presented, we propose the following research questions for future topics:

How can different types of workplace technologies be classified?

When collecting research on the effects of workplace technology, different disciplines address the topic from their individual point of view. The result is a variety of terms and concepts attempting to describe the external influences on motivation (see also Table 3). While many authors prefer a general understanding, such as context, situation, or environment, others narrow it down to work-specific terminology, such as workplace, workspace, job/work design, or technology. Almost all these concepts lack a clear and universal understanding.

In this paper, we have already provided a definition of workplace technology. It provides a broad understanding of technology, that is quite suitable for the purpose of this study. However, a taxonomy would offer the opportunity to change the focus of the investigation without changing the terminology. Only a few researchers worked with a clear system that included different technologies based on their functionality or effect. While the approach pursued by Millman and Hartwick (1987) or Cascio and Montealegre (2016)—to classify technology according to its evo-

lution—is intuitively understandable, it focuses on a certain kind of technology and ignores others. In the aforementioned publications, the focus lies on ICT, while production technologies or ergonomic aspects are neglected. On the other hand, James D Thompson's technological classification applied by Rousseau (1977, 1978) and Pierce et al. (1984) focuses on the way technology influences processes and tasks. This kind of taxonomy offers the inclusion of various workplace technologies. As the focal point lies on value adding processes, namely ergonomics and real estate, aspects such as office design are not considered.

Providing a comprehensive categorization is challenging, especially at a time when boundaries are blurred, and workplace technologies are becoming more diverse than ever before. Yet, achieving this might just be the cornerstone on which to build linking conceptualization.

How do new technologies influence the workplace and therefore affect employee motivation?

Conceptualizing technology influencing mediators seems the most promising perspective of the four schools of thought outlined above. Scholars representing this perspective mostly base their arguments on rigorous research and complex models. However, a holistic framework including both the specifics of workplace technologies and motivational outcomes could help to explain the complex interrelationships. As these concepts are still rare, we recommend combining existing theories and frameworks. Some authors have already made promising advances here. Parker and Ohly (2008), Diefendorff and Chandler (2011), Taylor (2015), and Humphrey et al. (2007) propose multi-level frameworks including some workplace design characteristics and individual outcomes. These frameworks offer insights on interdependencies between individual, organizational, and external factors. However, the role of workplace technology remains vague.

The paths between workplace technologies and individual outcomes lack understanding (Parker & Ohly, 2008). Therefore, we propose empirical research based on the insights described in this paper. As prior research has been predominantly quantitative and focused on correlations, qualitative approaches like case studies can help to gain a better understanding of causal relationships.

How do moderators affect the relationship between workplace technology and employee motivation?

Having shown that holistic frameworks are necessary to understand the complex relationship between workplace technology and employee motivation, we would like to emphasize the role of moderators. In our example about the mobile devices, leadership can affect perceptions of the impact workplace technologies have on motivation. This and other organizational aspects have already been examined, such as coworkers or leadership (Amabile & Kramer, 2010;

Csikszentmihalyi, 2010; Karanika-Murray & Michaelides, 2015; Maxwell, 2008), processes or reward systems (Seeck & Diehl, 2016: 11ff; Wright & Cordery, 1999), or organizational climate (Ferris & Gilmore, 1984), as well as extrinsic workplace attributes, e.g., pay, job security (Amabile et al., 1986; Deci & Ryan, 1985; Taylor & Westover, 2011), or tasks (Hackman & Oldham, 1976; Luczak, Kabel, & Licht, 2012; Medsker & Campion, 2001). These authors provide insights on the role these organizational factors play regarding employee motivation, whereas most of the research excludes workplace technologies.

Other potential moderators might be socioeconomic or cultural aspects. Some authors assume that the relationship between workplace technology and motivation is determined by age. Based on empirical data on more than 3,000 managers and professionals, Wong et al. (2008) identified age-related differences in motivational drivers. Members of the generations X and Y were found to be more motivated by progression and an affiliative workplace than Baby Boomers. Barford and Hester (2011) support these findings. Moreover, work environment demonstrates a higher overall relevance (after compensation) for the younger employees (Rožman et al., 2017). One of the reasons for this might be that the ease in handling technology and the accompanying high speed of communication make the younger generations seem more demanding. Kanfer and Ackerman (2004: 455) argue in a similar manner: “The differences in work motivation as adults age pertain mainly to the impact of age-related changes in competencies and motives on motivational-processing components.” Being confronted with new technology can therefore cause a dissonance between competences and demands, which might lead to behavior aimed at protecting self-concept rather than progression in later stages of life (Kanfer & Ackerman, 2004). As these insights are mainly assumptions at this stage, further research on this topic seems both interesting and necessary.

Which aspects of new technology influence the individual work organization and how?

As outlined above, existing research discusses either vague concepts of workplace design elements or the effects of specific technologies. These mostly include office design and ICT applications. The motivational impact of other upcoming technologies lacks scientific understanding and offers a wide field of research opportunities: production technologies like automation systems or robotics as well as promising applications of artificial intelligence, like voice recognition systems, personal virtual assistants, or virtual/augmented reality applications. We believe that these technological trends have unprecedented qualities. In the era of ‘Industrie 4.0’ and ‘Made in China 2025,’ everything is connected and technology is ubiquitous (Brynjolfsson & McAfee, 2016; Cascio & Montealegre, 2016; Parker & Grote, 2020). While this leads to a significant increase in collaborative types of work, these new technologies allow greater opportunities for

individualization and autonomous work organization as well (Brown et al., 2017). The amount and velocity of new skills needed is greater than ever before (Frey & Osborne, 2017; Koetsier, 2018; Leopold et al., 2016). To understand these technologies and how their characteristics affect work motivation, we suggest further research. Empirical data on different use cases is necessary.

2.6 Conclusions

In this paper, we developed a research agenda to include workplace technology in motivation research. No matter how workplace technologies are defined, many researchers emphasize the need for individualization. What one employee perceives as the optimal workplace design might be perceived as dissatisfying to another. The person-environment fit plays a major role (Samani et al., 2018). The toys vs. tools approach from Malone and Lepper (1987) and research on the 'sense of place' (Miller et al., 2001) shows how technologies can be perceived individually and help to explain different effects on employees. Current and future technologies provide individualized solutions and applications, and therefore the opportunity to address individual needs and motivation in the workplace. The advances in robotics, ICT, and artificial intelligence can pave the way towards motivational workplace design, instead of acting only as a restriction to change processes and job characteristics (Daugherty & Wilson, 2018).

The highly volatile job market and fast changing environment pose increasing uncertainty for individuals and a need for lifelong education. With creative tasks and knowledge-based jobs on the rise, creativity emerges as an essential requirement—employees need to be highly intrinsically motivated to meet these requirements (Amabile et al., 1986). Creating a motivating workplace can be a sustainable investment for a company's decision maker. Whereas further research is needed, it is not necessarily the physical environment in itself that might be the motivating factor, but the way it is perceived and the power to influence it (Brill, Margulis, & Konar, 1984; Knight & Haslam, 2010) as well as the way it shapes job characteristics and addresses needs (van der Voordt, 2003). Both researchers and managers need to take these aspects into account to generate fruitful research and sustainable workplace strategies. Workplace technology needs to be more than just background music in the future.

3 Paper 2: Workplace Design as a Strategic Resource —A Qualitative Study[5]

3.1 Introduction

New technologies are leading to an ever-connected world, increasing complexity, and more dynamic and competitive markets. Blurring industry boundaries, market entrants with new business models, the war for talents, and disruptive technologies require the building of new resources and capabilities to succeed (Barney, 1991; Prince, 2019; Wang & Ahmed, 2007).

One of these resources is workplace design (WPD). As work practices are becoming more and more digital, the physical WPD and related technologies are of increasing importance. Since WPD constitutes a major part of corporate assets, it deserves closer examination by management researchers (Kampschroer et al., 2007; Parker & Grote, 2020; Sheikh et al., 2018).

Until recently, firms have considered workplaces merely as a capital asset. During re-designing processes, cost saving potential and increased efficiency have been the main goals (Grant, 1991; Kampschroer et al., 2007; Mitchell-Ketzes, 2003; Wadu Mesthrige & Chiang, 2019), while management often neglects the link of WPD to long-term strategy and competitive advantages (Kämpf-Dern & Konkol, 2017; Levin, 2005). Due to the above-mentioned changes in technology and market dynamics, I argue that WPD holds greater potential—which is in line with the current research (Haynes, 2008; Heeroma, Melissen, & Stierand, 2012; Kim, 2014; Sheikh et al., 2018). To support my arguments, I make use of one of the most prominent theories in strategic management research: The Resource-Based View of the firm (RBV). Several authors have already applied the concept to other non-market resources, such as identity, human resource management, or quality management (Acedo, Barroso, & Galan, 2006; Frynas, Child, & Tarba, 2017; Lado & Wilson, 1994; Prince, 2019; Rockwell, 2019). In this paper, I evaluate the current literature on the resource-based view and WPD to build a framework of crucial characteristics of WPD as a strategic resource that leads to sustainable competitive advantage. I show that integrating an explicit WPD strategy into a corporate strategy will turn company offices into resources that enable a sustained competitive advantage. My main research question is:

How can firms incorporate workplace design in their resource portfolio to achieve a sustained competitive advantage?

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3.2 Theoretical Background

3.2.1 The Resource-Based View

The RBV, which emerged in the 1980s, is a perspective in management research developed to complement the until-then predominant market-based view (Penrose, 1959; Wernerfelt, 1984). In the 1990s, it was increasingly the subject of attention and constitutes one of the main research frameworks in management today (Barney, 1991; Foss, 1997; Grant, 1991; Wang & Ahmed, 2007; Wibbens, 2019).

Scholars using the resource-based view claim that a firm's success is based on the allocation and characteristics of the resources it owns. Thus, "[…] firm resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991: 101).

One of the basic assumptions of the resource-based view is the heterogeneity and immobility of resources among firms. Differences in the set of resources allow firms competing in the same market to pursue different strategies (Barney, 1991). These differences may lead to competitive advantages for one firm over its competitors. Holding a patent, for example, may allow one firm to offer superior technology, which leads to a disadvantage for its competitors. To protect its superiority, this firm will strive to sustain the advantage. "Sustainable competitive advantage occurs when a company consistently achieves superior performance […] compared to other companies competing in the same marketplace" (Rockwell, 2019: 81).

To ensure such a sustained competitive advantage based on a resource, the above-mentioned heterogeneous and immobile resources need to exhibit a set of characteristics. Various scholars have examined these characteristics of a resource that lead to success. Subsequently, different views on success have been studied: economic profit, competitive advantage, or sustained competitive advantage (Barney, 2018).

In their meta-analysis, Nason and Wiklund (2018) have shown that firm growth is closely connected to resource versatility based on the approach of Penrose (1959), while performance in general (which does not necessarily equal growth) is based on Barney's VRIN-framework. I will describe these and the other most frequently mentioned characteristics in the following sections.

THE PENROSEAN THEORY OF THE GROWTH OF A FIRM is an approach to explain the mechanisms leading to economic growth for a firm and is often claimed to be the earliest work with a resource-based perspective (Foss, 1997). In Penrose's view, a firm consists of a set of resources

being managed. She claims that no two firms facilitate the same resources in the same manner due to the individual managerial setting and services. These considerations lead to the notion that resources are versatile to some extent. This versatility is the crucial characteristic enabling a firm to grow as it can quickly respond to new opportunities with existing resources (Penrose, 1959). Especially in a dynamic environment, resource allocation and versatility play a crucial role (Nason & Wiklund, 2018; Teece, Pisano, & Shuen, 1997).

BARNEY'S RESOURCE-BASED THEORY OF THE FIRM promotes four properties resources need to have in addition to being heterogeneous and immobile: Value, Rarity, Inimitability, and Non-Substitutability (VRIN). Resources exhibiting these so-called 'VRIN'-characteristics are positively related to non-growth related performance—e.g., strategies aiming at profitability or efficiency. (Nason & Wiklund, 2018).

Only when resources meet these requirements can they lead to a sustained competitive advantage. Otherwise competitors are able to gain the same advantage, which thus leads to a loss of the unique market position (Barney, 1991). In their meta-analysis of 125 studies, Crook, Ketchen, Combs, and Todd (2008) show that the possession of strategic resources is strongly related to performance-outcomes, but resources meeting the above-mentioned criteria provide an even stronger correlation to performance.

AMIT AND SCHOEMAKER picked up on these insights and collected eight characteristics (Amit & Schoemaker, 1993). It is worth noting that the authors use a slightly different terminology. They define resources in a narrower sense that excludes capabilities from this notion and summarize "[…] Resources and Capabilities that bestow the firm's competitive advantage" into the term 'Strategic Assets' (Amit & Schoemaker, 1993: 36). As this concept is very close to Barney's understanding of 'Firm Resources', I use these two terms synonymously in this paper.

Table 8 gives an overview over the different characteristics resources need to exhibit to provide sustained competitive advantage, as suggested by Penrose (1959), Barney (1991), and Amit and Schoemaker (1993).

Penrose (1959)	Barney (1991)	Amit/Schoemaker (1993)
	Value	Value Appropriability Overlap with strategic industry factors
	Rareness Inimitability Non-Substitutability	Scarcity Inimitability Limited Substitutability
Complementarity of Capabilities		Complementarity
		Durability
Versatility		

Table 8: Overview of Resource Characteristics Suggested by Penrose (1959), Barney (1991), and Amit/Schoemaker (1993)

3.2.2 Workplace Design as a Strategic Resource

When studying the characteristics of a Firm Resource or Strategic Asset, authors suggest classifying resources for an aggregated perspective. Barney (1995), for example, proposes categorizing financial, physical, human, and organizational resources, while Amit and Schoemaker (1993) mainly name resources (in the narrow sense) and capabilities. Similarly, Teece et al. (1997) choose to distinguish between static and dynamic resources (i.e., capabilities).

In the following considerations, I will focus on the physical aspect of workplaces representing "the static configuration of positional relationships between elements of the physical and digital environment in organisations" (Sheikh et al., 2018: 5). Thus, workplaces include buildings and rooms with furniture and facilities as well as the technical tools needed to get work done, such as workstations, computers, or mobile devices (Kim, 2014). Following this definition, WPD can be understood as a static, tangible resource bundle.

In the following sections, I discuss how the above-mentioned characteristics of resources required by Penrose (1959), Barney (1991), and Amit and Schoemaker (1993) apply to WPD in order to contribute to sustainable competitive advantage (see Figure 4).

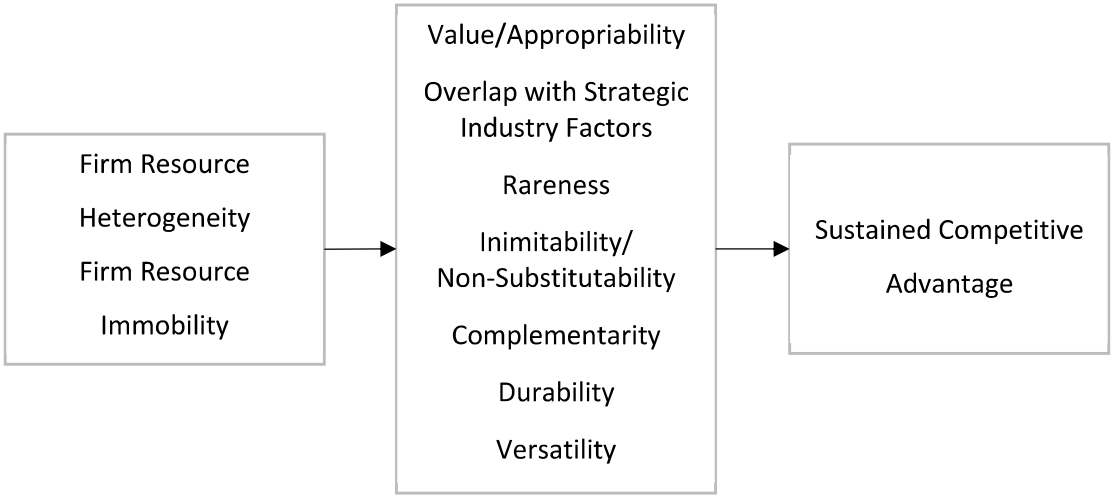

Figure 4: Relationship Between Resources and Sustained Competitive Advantage, extended/based on Barney (1991: 112)

VALUE/APPROPRIABILITY Value in the sense of strategic resources does not necessarily refer to the financial value of the resource itself, but rather the value the resource creates for the firm. If a firm is unable to appropriate the profits or benefits from a resource, it is not valuable (Amit & Schoemaker, 1993; Barney & Mackey, 2005). Hence, a resource may contribute to a firm's sustainable success only if this success (for example, in the form of revenue streams or growth) can be collected by the firm (Collis & Montgomery, 1995). A valuable resource thus allows a firm to improve the value provided to the customer in terms of efficiency or effectiveness, i.e., provide higher quality or decrease costs (Barney, 1991; Lockett, Thompson, & Morgenstern, 2009).

WPD usually does not directly have an impact on a firm's product and consequently the added value for the customer. "The workplace will, however, directly affect the behaviours of the people using it." (Mitchell-Ketzes, 2003: 260) According to Wibbens (2019: 182), such so-called 'higher-order resources' have an indirect impact: "Unlike "ordinary" or "operating" resources, higher-order resources do not yield more profit directly, but instead allow a firm to systematically obtain superior resources that, over time, allow it to grow profit." He shows that the presence of higher-order resources enables firms to hold a superior competitive position even longer than those relying on operating resources.

Several authors have examined the effects of WPD on performance (Allard & Barber, 2003; Becker, 2004; Chan et al., 2007; Housman & Minor, 2016; Kämpf-Dern & Konkol, 2017). Though research is still fragmented, nowadays we have insights on the correlation between certain office layouts, technology use, privacy as well as other aspects of performance oriented WPD and business performance. Thus, I posit:

Proposition 1: To achieve value, firms consider performance and cost aspects in their workplace design.

RARENESS/SCARCITY If a resource is widely available, firms will have difficulties gaining sustained advantage as it is accessible to competitors as well. WPD elements are not rare. Due to their tangible nature, the different elements—such as furniture or devices—are usually widely available (Barney, 1991).

OVERLAP WITH STRATEGIC INDUSTRY FACTORS Even if a resource is common, it may contribute to competitive parity in the industry or—as an essential part of a rare resource bundle—to competitive advantage (Barney, 1991; Collis & Montgomery, 1995). The value of a resource increases when it is tailored to the firm and its competitive environment. Thereby, it addresses specific needs while competitors in a different context attribute a lower value to the same resource (Amit & Schoemaker, 1993). Usually, a firm can compete in different markets—depending on the strategy. In some markets, the (set of) resources will prove to be more suitable than in others (Lockett et al., 2009). Following this argument, the choice of resources—and thus WPD—and competitive strategy need to fit (Chan et al., 2007; Kämpf-Dern & Konkol, 2017; Mitchell-Ketzes, 2003). Miles and Snow (1984) find that firms with a tight fit, i.e., a close alignment between an organization and its environment, leads to superior market performance.

Depending on the industry the firm operates in, a specific approach to WPD might play a superior role. Generally, the higher the demand for a product or service based on the resource in question, the higher the value of said resource for the company (Collis & Montgomery, 1995). Thus, I posit:

Proposition 2: To achieve a tight fit, firms align workplace design with their market strategy.

INIMITABILITY AND NON-SUBSTITUTABILITY Valuable and rare resources may provide competitive advantage, but if other firms can imitate or substitute them, it will not be sustainable (Barney, 1991; Collis & Montgomery, 1995; Lippmann & Rumelt, 1982). Over the course of time, a firm can develop an individual set of resources supporting its competitive advantage and thereby gain a historical uniqueness (Barney, 1991; Penrose, 1959). Another reason for uncertain imitability is what Lippmann and Rumelt (1982) refer to as causal ambiguity. Competitors do not understand the exact cause of a firm's competitive advantage, which makes it impossible to imitate. To achieve causal ambiguity and historical uniqueness, Amit and Schoemaker (1993) describe management practices integrating the resource in the firm's processes. Here, the individual configuration and social complexity provide uniqueness and inimitability. This mechanism can possibly prevent imitation of physical resources such as WPD. These resources are per definition replicable. However, exploiting the economic value of these resources— for example, production technology, information systems, or ideation spaces—require further resources and capabilities such as the skills to apply the technology, or the culture to promote the application. This social complexity thus leads to inimitability (Barney, 1991).

In case of WPD, firms must deeply embed their design elements into their organizations to achieve inimitability. For example, in the WorkPlace 20·20 research program, researchers describe case studies where different departments introduced similar workplaces, but with different outcomes. While different cultures, business models, and processes explain some of the initial differences, the intended behavioral and business-related changes gradually emerged over time. In one case, the positive outcomes could be observed earlier than in others, which can be attributed to the responsible manager's proactive behavior (Kampschroer et al., 2007). Thus, I posit:

Proposition 3: Firms embed workplace design in their processes and culture to achieve inimitability and non-substitutability.

COMPLEMENTARITY A set of firm resources may exhibit the described characteristics but still leave some potential. One reason for this may be that it does not complement other resources (Amit & Schoemaker, 1993). Hence, it makes sense to analyze a set of resources instead of individual ones (Penrose, 1959).

In the case of WPD, this statement easily explains itself. A single chair, an open office layout without employees acknowledging and leveraging its advantages, or a sophisticatedly ergonomic machine interface without the knowledge of how to use it will bring no advantage to the firm. Each design element complements the others and needs to be in line with the other firm resources, such as knowledge, technology, branding, culture, in order to pursue an integrated

workplace strategy (Becker & Steele, 1995). Levin (2005) specifies the need for workplace design to be aligned in five categories: Strategy, structure, process, reward systems, and people. Similarly, Kämpf-Dern and Konkol (2017) describe a configuration of people, leadership, work processes, workspace services, workspace technologies, and physical workspace in their Performance Oriented Office Ecology Model (see Figure 5).

Current technological developments in big data and artificial intelligence are leading to an even greater interdependency between the different categories than ever before (Parker & Grote, 2020). Automatization and sophisticated digital applications allow a human-centric WPD, where the 'soft' aspects, such as people, individual needs, leadership, culture, and others must be considered. Thus, I posit:

Proposition 4: To achieve complementarity, firms carefully plan and implement their workplace design with a holistic set of measures.

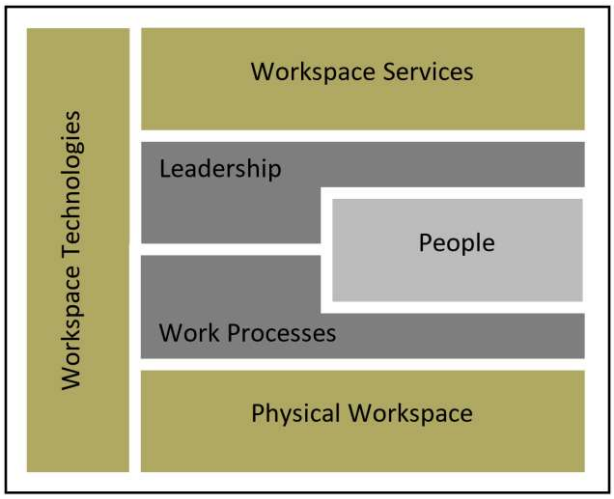

Figure 5: Performance-Oriented Office Ecology Model Based on Kämpf-Dern and Konkol (2017: 212)

DURABILITY The durability of a resource contributes directly to its value, as fewer investments are needed to replace it. According to Amit and Schoemaker (1993), one of the major managerial decisions when acquiring or developing assets is to balance the trade-off between durability and specialization. As discussed above, a specialized resource can be of great value by reducing imitability. As businesses and markets change over time, this specialization may become a challenge since the resource increasingly addresses challenges insufficiently.

In the case of WPD, the physical elements, such as real estate, furniture etc., are usually purchased to last a longer period of time than the employees and processes associated with the workplaces (Schriefer, 2005). Thus, some of these elements can have an impact on business for

up to 70 years (CABE - British Council for Offices, 2005). When implementing new WPD, this durability needs to be considered during the anticipation of future demands. Thus, I posit:

Proposition 5: To ensure the durability of workplace design, companies anticipate future developments.

VERSATILITY "Any single resource provides an array of potential services that can be utilized and combined in novel ways" (Nason & Wiklund, 2018: 36). Hence, versatility refers to the possibility of using resources for different purposes. As the characteristic "overlap with strategic industry factors" suggests, finding the best set of resources for a specific industry or purpose is a managerial challenge. Especially in case of underutilized resources, an entrepreneurial manager will always find a productive application. Thus, obtaining resources that can be exploited in different situations may provide a sustained competitive advantage and a certain flexibility (Lockett et al., 2009; Penrose, 1959). According to Nason and Wiklund (2018), resource versatility enables firms to react quickly to business opportunities and grow faster than the competition. This external adaptability can result from internal flexibility (CABE - British Council for Offices, 2005). Hence, with "incompletely versatile resources, the number of things a firm can profitably get into is much more limited" (Penrose, 1959: 178).

In the case of WPD, versatility may, for example, support different work practices. In their case study research, Sheikh et al. (2018) identify three different types of entangled digital and physical workspaces in a case of software developers. These three types occur depending on the task at hand and are set in the same office environment.

Modern technology enables such a versatility. Most of the specifications required in different workplaces can be achieved by generic tools, such as personal computers equipped with specific software applications or multi-purpose furniture (Schriefer, 2005). Thus, I posit:

Proposition 6: Firms integrate flexible elements in their workplace design to ensure versatility.

3.3 Empirical Data

In the following section, I present the empirical data I collected on the characteristics of strategic WPD. First, I introduce the case study approach and the process of data collection. I then discuss each of the cases individually and comparatively.

3.3.1 Methodology and Sample

There have been only few studies linking specific resources to firm strategy. Most of this research focuses on single industries and conceptualizes quantitative relationships. To assess the complexity of WPD, scholars call for interpretive approaches such as case studies (Bluhm et al.,

2011; Kim, 2014; Mitchell-Ketzes, 2003). The case study design is particularly relevant to investigate a contemporary phenomenon (Keplinger et al., 2012).

Barney—who is probably the most influential figure in resource-based research—shares this notion: "[I]n the long run, going inside a sample of firms and collecting data about resources and strategies directly seems likely to be more important for the development and evolution of resource-based research." (Barney & Mackey, 2005: 5)

I answer this call by providing four cases on WPD projects. To overcome industry-specific boundaries, I opted for a sample of firms from different industries. Case Studies on public administration settings were excluded as the requirements for competitive behavior of these organizations are different. For cases on workplace design in public administration, see, for example, Kampschroer et al.(2007); Obenreder, Atkinson, Herz, McClam, and Quan(2006), or Kim(2014). Selection criteria for the cases were as follows: To qualify as a case, the firm should have started a project on workplace (re-) design recently or completed such a project. To make interactions between resources, management, and other entities observable, the company should exceed a certain size, which I defined as more than 1,000 employees—non-SMEs according to the European Commission (2015). Initially, I conducted a pilot study consisting of interviews with representatives of nine firms working on workplace design projects. From these nine firms, five turned out to be either at the beginning of their respective redesigning processes or unable to provide the necessary insights (e.g., due to privacy concerns).

To operationalize competitive advantage, the observed firms should be successful in their respective markets/niches. All the four remaining firms have been in their respective markets for forty years or longer, so I assume that they had achieved sustained competitive success.

Table 9 provides an overview containing the key characteristics of these four firms. I collected the data over a period of two years based on direct observations, internal and external documents, and interviews. This triangulation approach, which was combined with thorough and transparent documentation and involved several researchers in data collection and interpretation, ensures a high level of data quality (Bluhm et al., 2011; Yin, 2018).

	Case Study 1 (The Monument)	Case Study 2 (The New Work Coach)	Case Study 3 (The Experiments)	Case Study 4 (The Complete Makeover)
Founded Industry	<1970 Mechanical engineering	<1980 Consulting	<1950 Mechanical engineering	<1960 E-commerce
Yearly Turnover	>€400 mn (2017)	>€150 mn (2017)	>€500 mn (2018)	>€1 bn (2018)
Employees Worldwide	>1,500	>1,000	>2,000	> 15,000
Employees at the Site Observed	1,200	700	60 (two departments)	6,000
Market Presence	50% market share	Top 10 in Germany	50% market share	Top 10 in Germany
Major Strategic Challenge	Servitization, Industry 4.0	Costs in real estate, technological requirements	Software Solutions, low cost competitors	Digitalization, e-commerce, lack of skilled staff
WPD approach	Two major projects initiated by management affecting the whole organization	New offices for one location, affecting furnishing, processes, and practices. New work approaches becoming a core competence	Three minor projects within departments affecting furniture and practices. Iterative development in other parts are planned.	One major change project developing over several years affecting buildings, processes, practices, culture, and image
Duration of WPD project	5 years	7 years	2 years	6 years
Sources	5 interviews, 3 observation days, 2 documents	2 interviews, 2 observation days, 9 documents	5 interviews, 2 observation days, 5 documents	2 interviews, 1 observation day, 11 documents

Table 9: Overview Containing Facts and Figures of the Analyzed Firms

3.3.2 Cases/Individual Analysis

The following case analyses are based on 24 semi-structured interviews (avg. 1 hour) and field observations (documented on 131 pages of field diary). I analyze and present the cases in an embedded multiple-case design (Yin, 2018) as depicted in Figure 6. As Firms 1 and 3 each worked on several WPD projects simultaneously, I included those projects as embedded units of analysis within the respective cases.

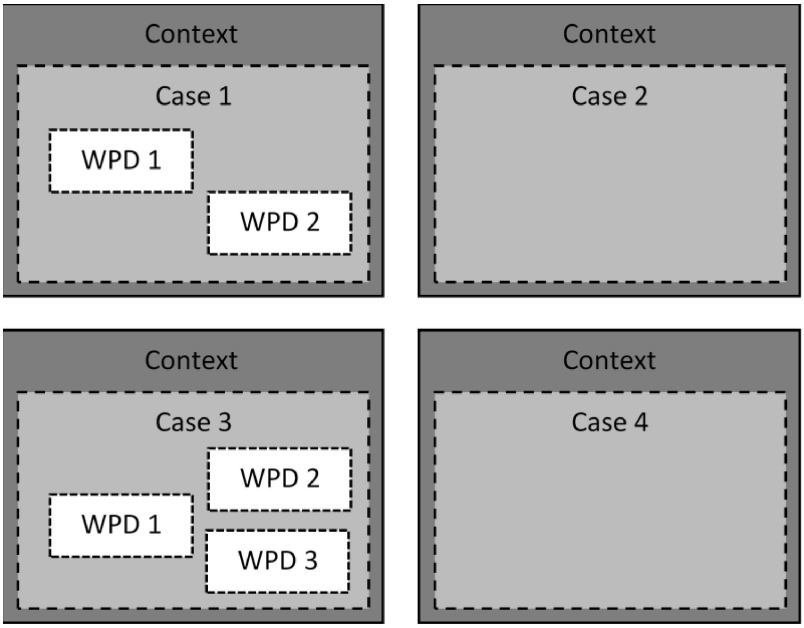

Figure 6: The Case Study Design for this Study is an Embedded Multiple-Case Design according to Yin (2018: 48)

CASE 1 (THE MONUMENT) The mechanical engineering company in Case 1 initiated a major change process after the financial crisis in 2010 to diversify the portfolio and face future trends of servitization and disruptive technological changes. In the course of this process, management decided to build new offices (unit of analysis WPD 1) and new production facilities (WPD 2). Both projects were driven by top management members—one of them states the design goal as "I don't know why things shouldn't be beautiful," thus highlighting the focus on the aesthetic appearance of the buildings and design elements.

While the two projects were initiated parallel in 2015, the detailed requirements differ. Based on previous process times and job descriptions, a project leader developed a new production layout and improved processes as a basis for the production building. Due to space restrictions in the former buildings, the improvements could not be implemented before. He involved shop floor workers in the design process by conducting interviews and assessing reports to gather the necessary information. In the meantime, the top managers took charge of planning the office building. They worked closely together with architects to develop the exterior and interior design. During the early stages, employees contributed their ideas and requirements in workshops. The major goals for the new building were derived: face-to-face-communication, transparency, interdisciplinary cooperation, and autonomy. To achieve these goals, the whole building is designed in an open manner, including activity based working practices with short paths between teams, and equipment for paperless information storage.

CASE 2 (THE NEW WORK COACH) The firm in Case 2 is a consultancy firm focused on corporate strategy. The starting point for the introduction of a new WPD in Case 2 was the relocation of one branch. Several challenges arose in face of the move. The new location is rather unattractive for existing employees due to longer commuting times; however, the rivalry in the market is high and retaining well-trained and motivated staff is essential. In addition, rental prices at the new location are high and further increases are expected. To ensure space- and cost-saving potentials, hot desking and activity-based working practices were introduced. Furniture and working processes were adapted accordingly. Interior designers helped to equip the different working areas. In order to save employees a long commute, flexible working methods and home office solutions were increasingly offered. Management intensively communicated the changes throughout the whole process as the project leaders aimed at a shift in mindset and culture to ensure a smoother adoption. After a while, the firm had developed expertise on new work practices and design to such an extent that consultants successfully started to offer it as consultancy product to their clients.

CASE 3 (THE EXPERIMENTS) The mechanical engineering corporation in Case 3 is a market leader in their field of expertise. Like most of their competitors, the firm faces global competition, major technological changes, and disruptive business models in the market. In contrast to the other cases, this firm pursues different independent projects on WPD. Three distinct design approaches can be identified: creative spaces (WPD 1), rooms for a business development unit (WPD 2), and offices for an administrative department (WPD 3). Each of the projects was started due to reorganization measures and is seen as an experiment conducted independently.

In the course of creating the creative spaces (WPD 1), several rooms were designed to increase communication and creative thinking: central coffee corners for spontaneous meetings, project rooms adjoining production facilities for varying R&D teams, and an office for strategic management meetings equipped with charts showing the current product portfolio, market trends, and technology roadmaps.

To develop new digital business models (WPD 2), a business development team was founded. One of their first tasks was to turn a former production area into their office. A low budget, used furniture, and no constraints on design should ensure an entrepreneurial spirit. The team opted for used equipment, and specialized tools and software to support their agile processes.

Due to some restructuring measures, two administrative departments were assigned to a new building and had to come up with a layout for sharing the space (WPD 3). Based on a survey they conducted within the teams, they chose a traditional open space layout with some shared activity-based areas.

Management envisions to improve and scale up the successful elements of the projects to other departments. However, specific plans are yet to be made.

CASE 4 (THE COMPLETE MAKEOVER) The firm in Case 4 is a globally successful e-commerce provider facing challenges in severe competition and finding skilled personnel. As there was an imminent need for renovation in one location, management took the chance to turn the renovation into a major change project. The renovation thus turned into a cultural reinvention over the course of seven years as the responsible managers realized how much these modernization measures contributed to improving work processes and employer attractiveness. A dedicated project team cooperated with a team of architects and designers to address the implementation of new furniture and digital systems, the introduction of new processes, and the generation of massive communication to facilitate an accompanying change in company culture.

3.4 Discussion

In the following section, I discuss the results in a cross-case-analysis (Yin, 2018) and then compare the cases and subsequently summarize the implications based on the characteristics identified above.

3.4.1 Cross-Case Analysis

Although each of the firms I studied pursues a different approach regarding WPD with differing results, based on the RBV I found that all characteristics play a role in managing WPD as a strategic resource (see propositions).

VALUE In all cases, efforts were made to directly realize cost savings potentials—mostly by reducing (office) space and introducing desk sharing approaches. These approaches in turn support communication among employees and interdisciplinary cooperation. The business development team in Case 3 (WPD 2) successfully developed business model innovations to increase the firm's product portfolio. In their new workplace, the team was able to develop these innovations faster than in a usual office setting, as the WPD supports agile work practices and smooth communication. "To develop new business models […] you must be able to romp around a little.", as one of the team members describes it. Case 2 poses an exception in terms of value generation. The firm developed the expertise internally and gathered experience to convert it into a product. This approach is certainly not the rule but enhances the value of the resource WPD. Therefore, the data is consistent with *Proposition 1.*

RARENESS/SCARCITY As described above, physical WPD is not rare. This assumption can be supported by empirical evidence. The firms purchased most of the design elements from regular furniture providers. In some cases, designers and architects supplied individual pieces of art or other elements. However, it is not these elements per se that contribute to the competitive advantage, but rather how they complement the resource bundle of WPD and create limited imitability in the course.

OVERLAP WITH FIRM STRATEGY WPD was not purposely developed as part of corporate strategy in any of the cases. Thus, I could not observe a tight fit as described by Miles and Snow (1984). However, all units of analysis show some alignment of the firms' WPD with corporate strategy, which could be characterized as minimal fit.

In Cases 1 and 4, the overlap with strategic industry factors was most prominent. In both firms, the redesigning processes were integrated into major change projects due to competitive challenges. These challenges refer to increasing digitalization efforts and thus the threat of new business models. The respective WPD approaches facilitate agile and digital approaches with open spaces, modern flexible work practices, and striking architectural components. These elements and their strategy-supporting potential developed over time. Specifically, the final WPD in Case 4 evolved in an iterative process over several years.

The unit of analysis of the business development team in Case 3 shows similar dynamics. Again, the current market challenges posed the starting point for the WPD. To support agile working processes and radical innovations, the WPD should be open, simple, and foster an entrepreneurial spirit. When this approach works, management intends to implement it in other parts of the firm.

Hence, *Proposition 2* cannot be fully supported yet. However, based on the observations I assume that a tighter fit will be achieved over time through feedback loops between the firms' strategy and their respective WPD.

INIMITABILITY The cases show ambivalent results regarding the inimitability of WPD. Especially in two of the three units of analysis in Case 3, several interview partners mentioned the necessity of WPD elements to be imitable, as their implementation in other parts of the organization is intended. While this aspect seems to contradict the theoretical assumptions, the very same case highlights how WPD can be embedded in the processes and culture. The managers of the observed administrative departments (WPD 3) conducted surveys to integrate the staff's needs into the design. The office inhabitants had the opportunity to design the new offices in a smaller scale in workshops. The business development unit (WPD 2) even selected their own furniture. In the other cases, I could observe similar workshops or communication measures. In this way, the workplaces are designed to fit the individual needs and practices. This aspect leads to a certain degree of uniqueness and limited imitability. Again, this inimitability will supposedly increase over time.

While the inimitable or non-substitutable aspects of WPD lie in the details in office design, these aspects are more obvious in production facilities. The firm in Case 1 designed the whole building around the machinery and the workflows. As a result, the data is consistent with *Proposition 3.*

COMPLEMENTARITY As mentioned earlier, all observed workplace designs were implemented for a specific reason, such as a strategic reorientation or moving to a new location or new buildings. These events were the starting point for a greater set of measures. I could observe all elements suggested by Kämpf-Dern and Konkol (2017) as depicted in Figure 5 at some point. As my observation focus was on physical workspce and workspace technologies, these design elements are most prominent here. Changes in leadership were mentioned least.

Cases 2 and 4 provided the most noteworthy results regarding complementarity. In these cases, management introduced new processes and practices as well as new technologies along with other equipment. Communication campaigns intended to foster cultural changes followed. While in Case 2, these measures were introduced by management as a set from the very beginning, in Case 4 the necessity for the different aspects emerged gradually over time. At the beginning, the IT-equipment was updated, while renovations of some of the buildings started at the same time. Due to new interior design and the opportunities the equipment offered, some new work practices, such as hot desking or mobile working, emerged. Once the workers' council became aware of these changes, they sought new regulations as well as employee-protection agreements. During all these processes, the responsible project managers noticed that this new

design fits the current strategy very well and addresses some of the challenges associated with the new digital business models, such as agile work practices or attracting new talents. This example is thus consistent with *Proposition 4*. However, the other cases lead to a more heterogenous conclusion: In Case 2, a rather holistic set of measures was also planned; however, not all intended WPD elements are being accepted as expected. For example, a workplace-booking software remains unused as employees tend to return to their usual workplace every day. In Case 3, on the other hand, the design elements have been rather limited from the beginning. In all three units of analysis, the firm provided new furniture and decoration, but new hard- and software was only introduced for the business development team. When asked, the interview partners of this firm admitted that further purchases and measures are necessary to exploit the full potential of the new designs.

DURABILITY The cases contain only a few hints of the relevance of the durability of workplace design. In Case 2, the anticipation of rising rents at the location led to a reduction of office space from the beginning. One manager responsible for the building design in Case 1 stated: “I want people in 25 years’ time to look back and admire our design decisions.”

In all cases, professional furniture and robust design elements were used, which are usually more durable than others. However, despite repeated requests concerning the furnishings, no contact person was able to recall a concrete statement on the projected durability during the planning processes or after. From these observations, I understand that on the one hand, designers implicitly assume that WPD needs to last an extended period of time, but on the other hand, this period is neither specified during the planning period nor is the design consciously designed to achieve this goal. Thus, case data was not consistent with *Proposition 5.*

VERSATILITY Versatility plays a major role in all cases. In every unit of analysis on WPD in offices, layouts including flexible desking was implemented to some extent. Furthermore, other tools, such as whiteboards, mobile monitors, or folding walls, serve as makeshift walls and partitions in some cases. Mostly, the reason for this was the rising demand for flexible work practices on the part of employees or the introduction of agile practices by the employers.

Case 1 provides further insights on versatility on a greater scale: The firm is currently planning a production facility with mobile workstations for assembly to enable flexible manufacturing while keeping the assembly line running. Moreover, one of the interview partners described why versatility will play an even greater role in the future: due to company growth, the current office building is already becoming too small. Thus, management is planning an extension. Adjoining it to the current building will cost extra, as walls will have to be torn to allow a seamless passage. Instead of building overcapacity in the next construction stage, the building will incorporate an

interface for easy extension in a third stage. As a result, the cases are consistent with *Proposition 6*.

Towards the end of the observation period, all firms have been challenged by a new situation: The Corona Virus (SARS-CoV2). The pandemic spread of the virus forces firms in nearly all countries worldwide to take measures to protect their staff while keeping business running. Versatile WPD offering mobile office solutions, seamless digital communication, or even zoning in buildings and facilities might provide the crucial competitive advantage to survive the crisis.

EXPRESSION The cross-case analysis provided another frequently mentioned characteristic: the symbolic function of workplace design. This aspect has not yet been discussed by RBV scholars, but is a common theme for sociology or architecture researchers (Berg & Kreiner, 1990; Vilnai-Yavetz et al., 2005). Besides supporting business strategy and realizing cost-saving potential, in all cases the decision-makers intended to send a message to their staff, their customers, or other stakeholders.

In Case 1, management opted for a glass wall between the shop floor and the office building, i.e., the two units of analysis. This is one element of communicating unity among employees. Another was to design the building in a manner allowing everybody uses the same entrance—from the shop floor worker to the manager.

In Case 2, one of the project managers expressed the goal for interior design to be perceived as a 'cool employer' by candidates and employees. As a result, modern tools, colorful furniture, and themed conference rooms were created.

In Case 3, the symbolic function is most prominent in the business development unit. Here, management intended to establish a new department developing ground-breaking innovations in an agile and customer-centric manner—following the example of start-ups. To create this entrepreneurial spirit for the team, a small budget was provided for the team members to design their office. As a result, they procured used equipment and IKEA furniture (as a real start-up would). The team spirit grew strong, as they are proud of their accomplishment, and some members even contributed gadgets from their own homes.

The firm in Case 4 even took the symbolic effects one step further. One of the major goals for the firm's WPD was to become an attractive employer. The dedicated design team employed modern artwork, stylish furniture, and an inviting exterior design. These visual elements as well as the accompanying workshops and initiatives are marketed heavily online and offline in blogs, podcasts, newspapers, and other media to increase visibility. Thus, based on these results, Expression can be added as another characteristic and I posit:

Proposition 7: Firms express cultural and strategy-related messages using workplace design.

3.4.2 Summary

After analyzing each case individually and in comparison, I found strong consistency between workplace design and the resources enabling sustained competitive advantage as previously investigated by management scholars. Several researchers have discussed the importance of relating firm performance and market strategy (Chan et al., 2007; Kämpf-Dern & Konkol, 2017; Mitchell-Ketzes, 2003; Prince, 2019). However, the characteristics of rarity, inimitability, and non-substitutability seem to play a lesser role with WPD. Creating a unique WPD merely out of physical elements is nearly impossible and does not seem to add value in the cases I examined. However, by viewing WPD as a bundle of different elements and aligning them with other crucial parts of the firm, such as processes, culture, strategic goals, can create social complexity and therefore an inimitable working environment.

Especially in fast changing market environments, agile work practices play a major role. To support them and continue to create value, WPD must support these changing needs by providing versatility.

I identified Expression as an additional characteristic not previously discussed in the context of RBV. The symbolic dimension of WPD is widely discussed in sociology and architecture and played a major role in all of the cases.

Based on these observations, it also becomes clear that the various characteristics influence each other. To create value, WPD must complement the implementation of a firm's strategy—in the course of which it becomes difficult to imitate. Versatile WPD elements help to adjust to such a strategy and express its direction. I developed a preliminary model based on these different characteristics as depicted in Figure 7.

3.5 Conclusion

With data from four cases, I was able to show that firms can manage WPD as a strategic resource and which characteristics of WPD are most important to obtain competitive advantage. These findings suggest that firms should consider shifting from a cost-oriented perspective and instead view WPD as a resource contributing to sustained competitive advantage. To do so, firms should consider WPD in terms of its value, alignment with strategy, inimitability, complementarity, versatility, and expression.

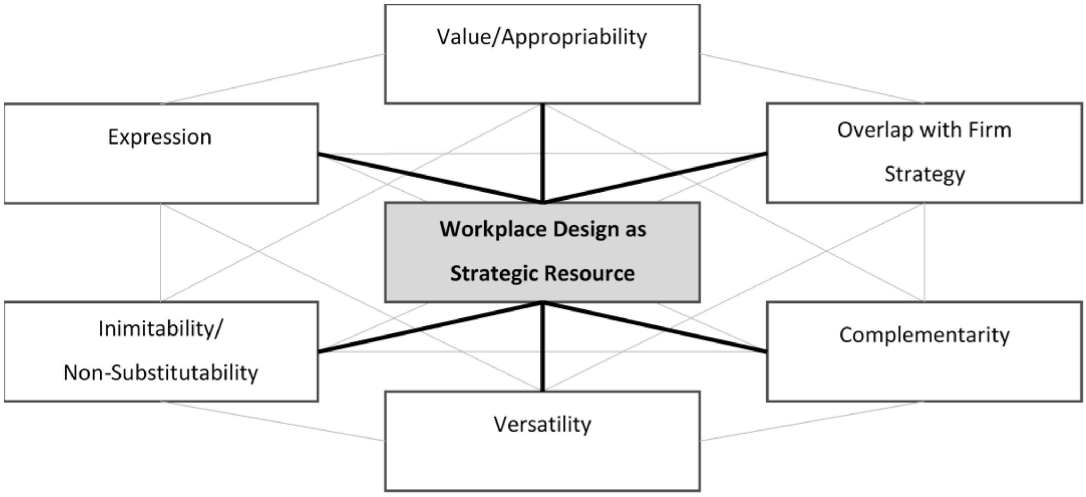

Figure 7: To Contribute to Sustainable Competitive Advantage, WPD Should Meet Several Characteristics

3.5.1 Limitations

To link WPD to a firm's strategy, I based my arguments on the RBV as a theoretical framework. While the RBV has been criticized for being tautological in its assumptions (Lockett et al., 2009) it is the first choice for management scholars due to its simple, yet intuitive linking of a firm's resources to market strategy.

The RBV describes an inside-out perspective on strategizing and has often been criticized for neglecting market mechanisms and other external factors influencing a firm. While the focal point of the RBV is the resources within a firm, I argue that external mechanisms should also be considered. One aspect addressing this issue is the question of whether a resource provides an overlap with industry factors, i.e., provides advantage for the industry the firm is competing in (Amit & Schoemaker, 1993). The concept of strategic fit also provides the logical connection of the firm's resources and its competitive environment (Miles & Snow, 1984). I have discussed both facets in this paper.

The RBV also has been criticized for the methodological reasons. Resources leading to sustained competitive advantage oftentimes include—at least to some extent—organizational learning and capabilities. This aspect makes them difficult, if not impossible to observe and measure (Lockett et al., 2009). As discussed above, successful WPD is very complex and deeply embedded in a firm's processes and culture. Capturing the characteristics and crucial aspects is therefore also difficult. To address this problem, I opted for the case study approach. Due to this research design, I was able to point out interrelationships and management decisions while emphasizing the most important aspects.

Of course, this methodology is not without fault. While allowing a closer look at the units of analysis, unrestrained generalization is not possible. The choice of units of analysis for the cases

served the purpose to provide insights into the (socially) complex resources. Cases studies are not representative samples. However, I chose this methodology to gain an initial understanding of the role WPD plays in competitive strategy.

In addition, as a qualitative approach, this case study research is vulnerable to bias while collecting and interpreting the data. To address this issue, I opted for a triangular approach in data collection including interviews, observations, and documents. During the analysis phase, I also discussed the data iteratively with several other researchers to avoid biases. The method of cross-case analysis also provides a rather structured approach (Yin, 2018).

3.5.2 Future Research Directions

In analyzing the cases, I assumed that competitive advantage was achieved due to the companies' overall and enduring success in their respective markets. A closer look at the market figures as well as comparing the case firms' strategies to those of their competitors might bring further insights beyond the relationship of WPD and strategy. Furthermore, examining the firms over an extended period could reveal further interactions and developments.

The presented cases illustrate the workplace strategies in individual locations. I did not address the challenge of managing several locations. Including this aspect in future research may add an additional dimension (Heeroma et al., 2012). Cultural aspects on an international level add to the complexity of WPD. Investigating cultural-specific requirements for WPD opens up a whole new research area.

With the present research project, I provide a starting point for the integration of workplace design as a resource in competitive strategy. The framework I developed could be used to assess the identified characteristics with a quantitative survey to ensure representative results. In particular, the newly discovered resource characteristic 'Expression' should be evaluated for other resource bundles as well.

3.5.3 Practical Implications

Despite the limitations of this study, this paper provides implications for managerial purposes. Based on the identified characteristics, I formulate the following six options for managing WPD for competitive advantage:

1. Create value by supporting business processes.
2. Align the WPD with business strategy.
3. Achieve inimitability by integrating the design in other processes.
4. Consider complementarity with other resources, such as leadership style, practices, processes, culture, technology, and others.
5. Ensure versatility by including flexible elements.
6. Express the firm's culture and vision.

The specific characteristics of workplaces are of great importance; however, the process of implementing these elements plays a crucial role. Integrating employees in the implementation process or allowing readjustments can enhance motivation and empowerment (Schmid & Auburger, 2020; Sheikh et al., 2018). In the long run, the integration of the workplace setting, work processes, and the employees' stake in it can build a unique resource bundle and become a base for competitive advantage.

This complexity leads to another important notion—many firms have a dedicated department that is responsible for maintenance and real estate, namely, facility management. This department often acts on an operational basis to provide the workplace-related resources (people, technology, property). To ensure alignment with strategy and complementarity with other resources, facility managers also need to work on a tactical and strategic level (Then, 1999). Other departments, such as human resources, organizational development, procurement, IT, need to be involved alongside the strategic management team.

The results of this study show that WPD can contribute to competitive advantage twofold:

Firstly, as a specialized environment, it enables workers and employees to work efficiently and effectively, thereby improving production processes directly. In addition, managing the workplace strategically has an immediate impact on real estate costs.

Secondly—and more implicitly—a strategically designed workplace can be a higher-order resource (Wibbens, 2019). Possessing one resource can enable a firm to acquire further resources at a lower cost (Wernerfelt, 2011). Applying this notion to her WPD, a strategic approach enables a firm to effectively enhance corporate image, employer branding, employee satisfaction, and other intangible resources. This in turn can influence performance in various ways: more success in recruiting and retaining talents, communicating or enhancing strategic goals.

Only by acknowledging the complexity and interdisciplinarity of WPD can its full potential be exploited in the long run.

4 Paper 3: The Strategic Relevance of HRM and its Activities in Times of Digital Transformation:A Mixed-Methods Study in Germany

4.1 Introduction

The strategic role of human resource management (HRM) within company structure has been continually changing since its beginnings (Wright & Ulrich, 2017). The current advance of digital technologies and the resulting digital transformation present HRM with one of its greatest challenges to date (Fenech et al., 2019; Larkin, 2017). On the one hand, administrative and repetitive human resource (HR) processes such as payroll accounting or maintenance of master data are becoming automated or standardized through digital technologies (Marler & Parry, 2016; Parry, 2011). Furthermore, core HR activities such as recruitment, selection, development, or performance assessment of employees are increasingly supported by big data, artificial intelligence (AI), cloud computing, or digital platforms. The impact of these technologies allows the shift of HR responsibilities to other functions and line managers while demanding technological skills from HR managers (Parry & Battista, 2019).

On the other hand, the general working environment and thus the demands on HRM are also changing. The digital transformation is behind the automation of cognitive routine tasks, the accompanying change in the skills requirements of the staff, and the flexibilization of work models (Autor, Levy, & Murnane, 2003; Berkery, Morley, Tiernan, Purtill, & Parry, 2017; Frey & Osborne, 2017; Wolffgramm, Corporaal, & van Riemsdijk, 2018). In this new working world, HR is confronted with the need to cope with all these changes and to adapt all measures accordingly in order to accompany the digital change of the organization as a strategic partner in the future (Kane, Palmer, Philips, Kiron, & Buckley, 2015). Scientific research can support practitioners in accomplishing this task (Wright & Ulrich, 2017).

So far little attention has been paid to a holistic analysis of the strategic relevance of HRM and its activities in relation to all levels of impact of the digital transformation—particularly one that includes a longitudinal dimension (Guthrie, Spell, & Nyamori, 2002; Jiang, Lepak, Hu, & Baer, 2012; Tambe, Cappelli, & Yakubovich, 2019; Wright & Ulrich, 2017). Thus, in the present paper we seek to answer the following research question:

How does digital transformation affect HR activities and thus the strategic relevance of HR?

To achieve this goal, we use a novel mixed-methods approach observing the actual development of HR activities. For this purpose, we analyze the HR-relevant areas in the annual reports of

companies listed in the German stock index of the largest 30 companies (DAX30) over the last ten years using text mining and a qualitative content analysis. To interpret the results, we also conducted interviews with four HR managers from the companies studied.

The study contributes to current research by providing a comprehensive data analysis on HR activities in all relevant industries with a longitudinal character.

4.2 Digital Transformation affecting HRM and its activities

Strategic HRM and its activities aim to provide a suitable workforce in accordance with company goals. Empirical data suggests these HR activities support company performance significantly—especially when in alignment (Combs et al., 2006; Ichniowski et al., 1997). These activities—and subsequently their strategic relevance—are massively influenced by the introduction of digital technologies (Bondarouk & Brewster, 2016; Ruël, Bondarouk, & Looise, 2004; Tambe et al., 2019). The extent of this shift transforming HR into a strategic business partner is controversially discussed in the literature (Charan, 2014; Fenech et al., 2019; Jesuthasan, 2017; Ulrich, 2014). To address this concern, we will examine the influence of digital transformation on HRM and its activities in the following sections.

4.2.1 Digital Transformation of HRM

"Digital transformation is the transformation of business processes, operations and structures in order to exploit the benefits of new technology." (Fenech et al., 2019: 166). Thus, digital transformation does not only have far-reaching effects on almost all aspects of our society, but also has a major influence on the role, processes, and practices of HRM (Baesens, Winne, & Sels, 2017; Strohmeier, 2007; van den Heuvel & Bondarouk, 2017).

Enabled by these new technologies, more and more sophisticated systems supporting and automating HRM tasks are available (Larkin, 2017; Marler & Parry, 2016). This application of HR information systems is referred to in the literature as electronic human resource management (eHRM) (Marler & Parry, 2016; Ruël et al., 2004; Ruël, Bondarouk, & van der Velde, 2007; Strohmeier, 2007).

Marler and Parry (2016) found that the use of eHRM and the strategic role of HR have a positive reciprocal effect on each other—while the use of eHRM has a stronger impact on the strategic involvement of HRM than vice versa. Hussain et al. (2007) provide similar insights: Their results support the view that the use of information systems increases the strategic value of HR. Parry (2011) also emphasizes that while the use of eHRM can lead to more strategic activities for HR employees, there is also a risk of these activities merely being shifted into technology-supporting roles.

However, Gardner, Lepak, and Bartol (2003) as well as Fenech et al. (2019) show that HR managers, contrary to expectations, do not have to spend more time on transformational tasks but on IT-supporting tasks if a higher degree of new technologies is used. Furthermore, Marler and Fisher (2013) stress that there is little empirical evidence that eHRM is related to organizational performance and strategic relevance.

A rather recent technological advancement within eHRM is the use of big data and artificial intelligence to analyze and forecast HR developments as a basis for strategic decision making—HR analytics. As such applications allow the analysis of the complex relationships between HR activities and business outcomes, an increase in the strategic value of HRM in this regard can be expected (Tambe et al., 2019; van den Heuvel & Bondarouk, 2017).

4.2.2 Major HR Activities Affected by Digital Transformation

As outlined above, previous empirical results reflect different findings regarding digital change and the effects it has on the strategic relevance of HRM. To achieve a more detailed understanding of the mechanisms, we investigate the influence of digital transformation and its technologies on the eight different HR activities we derived from the literature: organizational design, staffing, human resources development, performance management, remuneration, employee relations, health management, and policies (Adamovic, 2018; Jackson et al., 2014; Noe et al., 2016).

ORGANIZATIONAL DESIGN New technologies affect all parts of a company, which is why a constant adaptation of organizational structures and processes accompanied by HRM is necessary—even more so during the digital transformation (Strohmeier, 2007; Tambe et al., 2019).

The internet, mobile devices, and cloud solutions make it easier to work independently of time and location. Flexible work options are becoming increasingly important for meeting the needs of employees (Berkery et al., 2017; Parry & Battista, 2019). As a result, working models such as part-time, virtual teams, flexible working hours, or remote working activities are becoming important components in the digital transformation. HR must evaluate in which environment and in which way staff can perform their tasks most successfully (Adamovic, 2018).

All change projects aiming to adapt the organizational structure or the HR departments' processes need to be accompanied by structured change management. According to Parry and Battista (2019), HR can take on the role of navigating and coordinating the organizational change triggered by digital transformation.

Finally, within organizational design, corporate culture is an important component affected by digital transformation. A survey by the Capgemini Digital Transformation Institute shows that

most complications during digital transformation are related to corporate culture (Buvat et al., 2017). Thus, HR is increasingly confronted with the need to establish common values and norms as well as technology acceptance.

STAFFING HR analytics provide an opportunity to use a large amount of data on demographics, employee turnover, job requirements, or performance indicators and to make forecasts (Baesens et al., 2017; Tambe et al., 2019; Williams, 2009). Analyzing such large amounts of data supports HR managers in making sophisticated assumptions about the future demand for employees and their necessary skills as well as about careers and succession planning. This task gains further importance during the digital transformation due to a shift in skills (Autor et al., 2003; Frey & Osborne, 2017). Related applications range from electronic recruitment, such as job portals, web-based job postings, or social media, to the use of cloud-based services for personnel planning. Chapman and Webster (2003) show that digital technologies can help to reach a larger pool of applicants while reducing costs and time. Thus, digital developments enable HR planning to become a strategic factor for the organization (Lawler & Mohrman, 2003; Parry & Battista, 2019; Wolffgramm et al., 2018).

HUMAN RESOURCES DEVELOPMENT As outlined above, digital transformation requires a change in the skills and competences necessary for many jobs. It is the task of HRM to identify these jobs in HR planning and to subsequently upskill the affected employees. Thus, obsolete functions can be replaced, and retrained staff can be kept in the company (Parry & Battista, 2019; Wolffgramm et al., 2018).

Furthermore, digital trends influence the way in which employees learn new skills. E-learning includes initiatives ranging from the mere provision of training materials online to the use of various technologies for interactive course design or communication (Stone, Deadrick, Lukaszewski, & Johnson, 2015; Welsh, Wanberg, Brown, & Simmering, 2003). Cloud based solutions and mobile devices enable employees to access learning content and communicate with other participants at any time (Velev, 2014). Introducing e-learning provides greater flexibility and convenience for participants as well as increased efficiency at lower costs compared to traditional training methods (Ensher, Nielson, & Grant-Vallone, 2002; Welsh et al., 2003).

PERFORMANCE MANAGEMENT The performance management system should align all employee activities with the goals of an organization in order to measure performance-related data. Linking the measurement data with further training measures, remuneration, and other incentives plays a decisive role (Becker & Gerhart, 1996; Dyer & Reeves, 1995).

Digital technologies support performance management both in measuring appraisal content and structuring the feedback process (Cardy & Miller, 2005; Fletcher, 2001). On the one hand, the measurement of appraisal content can be simplified by using online tools or wearables (Parry & Battista, 2019). Data collection is thus more frequent and less conspicuous in an automated process based on minimal input from the people being assessed. On the other hand, computer-assisted methods simplify the formulation or creation of the performance evaluation in the feedback process (Cardy & Miller, 2005). The digitalization of performance management thus promises increased efficiency, cost and time savings, and better adaptation of individual employee development paths. However, the potential of electronic performance systems has not yet been fully exploited in practice. Concerns about the increasing interpersonal distance, the acceptance of automated assessments, and data privacy limit the current exploitation of digital possibilities (Ensher et al., 2002; Stone et al., 2015). Nevertheless, empirical data predicts a key strategic role for performance management in the digital transformation (Schrage, Kiron, Hancock, & Breschi, 2019).

REMUNERATION The largest areas of application for digital technologies in remuneration are the automation of salary processing, the adjustment of salary structures, and the administration of compensation and additional performance incentives (Stone et al., 2015).

Payrolling was one of the first HR processes to be automated. The main reasons for this trend can be found in the uncomplicated reduction of administrative costs and time (Johnson & Gueutal, 2011; Stone et al., 2015). Today's digital technologies enable optimized compensation planning processes, individual compensation plans, transparent compensation histories, and performance bonuses (Dulebohn & Marler, 2005; Hogg, 2019; Stone et al., 2015). The growing proportion of additional performance incentives (e.g., retirement and health care) is increasingly being administered by employees themselves in self-service systems (Johnson & Gueutal, 2011). Thus, these HR portals shift the transactional tasks to line managers and employees, which can reduce the need for HR employees by up to 50% (Gueutal & Falbe, 2005). While the digital transformation affects remuneration activities massively, automating many tasks in this area leads to a declining role of HR from a strategic point of view.

EMPLOYEE RELATIONS The tasks of HR in employee relations include the coordination of employee representatives and councils as well as other communication channels, such as employee surveys (Pfeifer, 2014). Particularly in a country like Germany, where co-determination rights and guidelines are regulated in a more extensive and employee-friendly manner than in any other European country, employee participation plays a decisive role (Niedenhoff, 2005; Pfeifer, 2014). In this respect, HR acts as a mediating link between employee and employer. This role gains importance in change processes, such as the digital transformation. Furthermore, digital communication tools and social media platforms improve internal communication between the parties (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2013; Morgan, 2014; Parviainen, Tihinen, Kääriäinen, & Teppola, 2017). A transparent exchange of information and active involvement of employees in the decision-making process are important factors to ensure their motivation and satisfaction (Morgan, 2014).

HEALTH MANAGEMENT The health status of its employees is of considerable interest to organizations. By promoting the well-being of employees at all levels, HR can help to develop a committed and satisfied workforce that is more performance-oriented and has lower absenteeism and turnover rates (Baptiste, 2008).

The following approaches mainly refer to mental and physical health, as the social aspect is closely linked to the employee relationship, which we discussed above. Using technologies for constant availability has become common in today's world of work, with far-reaching consequences for mental health and work-life balance (Derks & Bakker, 2010). For example, the increasing overlap between private and working life can lead to work overload, negative emotions, and increased stress (Butts, Becker, & Boswell, 2015; Derks & Bakker, 2010; Schlachter, McDowall, Cropley, & Inceoglu, 2018). All of these aspects can have a negative impact on employee well-being, which is thus reflected in lower work performance and increased absenteeism costs (Guest, 2017). As mental illness is the most common and costly illness in the workplace, it can be assumed that ensuring mental well-being is of particular importance in the digital transformation. HR therefore has the responsibility to increase awareness about technology use and well-being. In terms of physical health, sensor systems and wearables offer the opportunity to record, identify, and evaluate safety-related incidents and physical health data (Parry & Battista, 2019; Stinson, 2019). Thus, HR needs to be actively involved in the implementation of digital health systems to support employees in their physical health (Holland & Bardoel, 2016).

POLICIES The consequences of the digital transformation described above require constant adjustments to personnel policies and procedures. Particularly in the area of employment models and occupational health and safety, new challenges arise for HR to implement complementary guidelines in order to ensure ethically correct treatment of those employed (Holland & Bardoel, 2016). With the increasing possibilities of flexible working, a growing gig economy characterized by independent contractors, freelancers, and self-employed individuals is developing (Bughin, Manyika, & Woetzel, 2017; Parry & Battista, 2019). HR can establish itself as a strategic business partner when implementing guidelines for employment models that simultaneously exploit the flexibility of these forms of work and do not disadvantage workers (Parry & Battista, 2019).

4.3 Methodology

To review the assumptions derived from the literature, we used a mixed-methods approach consisting of a text mining analysis combined with a qualitative content analysis and interviews. The entire process is depicted in Figure 8.

As the basis for our analysis, we use secondary data, specifically the annual business, sustainability, and non-financial reports published in English by the top 30 DAX companies for the period from 2009 to 2018. Investigating large-sized companies helps to achieve future-oriented insights on the topic, as they show a more mature use of digital technologies in HRM (Parry, 2011), while the overall application of the systems can be compared to SMEs (Hussain et al., 2007). The DAX30 consists of the thirty largest companies in the German economy and thus serves as a benchmark. For our analysis, we considered 27 of the 30 companies, as the other three were not part of the DAX for the majority of the observation period. Since the most important industries are represented, the generalizability of the results improves. Having extracted all employee-related chapters of HR in the reports, the research basis thus comprises text sections from a total of 444 documents.

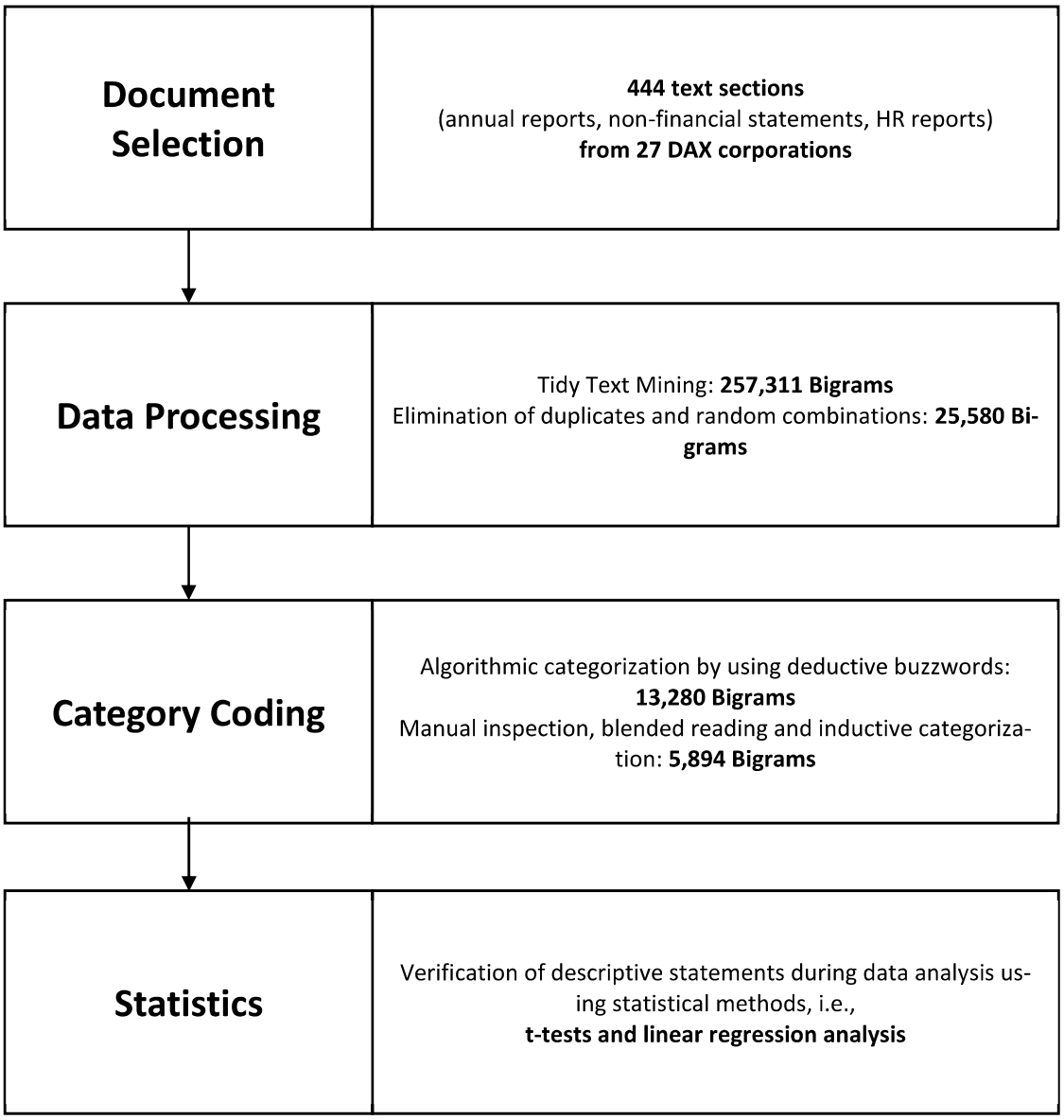

Figure 8: Process of Mixed-Methods Analysis

4.3.1 Text Mining and Qualitative Content Analysis

After reading and tidying the data using R, we determined the total number of grams (214,105) and bigrams (257,311) (R Core Team, 2019). To assess the distribution of assertions regarding strategic considerations or text sections in connection with digitalization, we filtered the grams according to the terms “digit*“ and “strateg*“, which resulted in 3,889 grams.

We then continued filtering the bigrams in several steps to prepare the data for analyzing the HR activities:

1. removal of words with more than 16 letters (mostly URLs)
2. merging of multiple responses
3. removal of bigrams with below-average frequency (<3), as these are most likely random word combinations

The result is 23,580 bigrams. To narrow down the number of bigrams to those directly related to HR activities, we applied a filter containing terms that we derived deductively from the literature research. We complemented these initial terms iteratively by assessing the remaining bigrams several times. Each resulting filtering term is assigned to one category based on the HR activities resulting from the literature. The categories and terms used are shown in Table 10.

HR Practice	Keywords
Organizational Design	organization, organisation, design, cultur, power, team, autonom, selfmanaged, flex, group, structur, change, strateg, process, transform, vision, mission, goal, improve, value, knowledge
Staffing	staff, plan, workforce, recruit, select, hire, hiring, employer, promot, career, succession, successor, turnover, retention, attrition, talent, graduat, candidat, student, university, retir, fluctuat
HR Development	develop, train, educat, learn, mentor, coach, skill, course, qualif, vocational, study
Performance Management	performance, apprais, feedback, monitor
Remuneration	compensat, bonus, profit, stock, shar, incentive, pension, reward, salar, remunerat, pay, wage, benefit
Employee Relations	relation, union, representativ, council, bargain, collective, trust, grievance, communication, survey, newsletter, security, respect, pulse
Health Management	wellbeing, health, safety, medical, family, worklife, balance, occupat, medical, parental, accident, injur, care, sickness, stress, private, child, sport, hse, illness, sick, protect, maternity
Policies	divers, equal, polic, legal, rights, female, sexual, disable, gender, bisexual, gay, lesbian, contract, woman, women, harm
Others	employee, data, digit, hr, personnel, employment, people, analyt, idea, leader, future, satisf, competenc, work, job, cost, expens, generation, integrat, asset, demographic, guid, time, innovat, counsel, online, zero, informat, office, workplace, leave, engag, empow, satisf, committ

Table 10: Keywords used in Text Mining Active Search

We manually checked this automatic assignment and extended it by developing inductive categories and subcategories inspired by a qualitative content analysis using a blended reading approach until all bigrams were assigned (Günther & Quandt, 2016; Schreier, Stamann, Janssen, Dahl, & Whittal, 2019). To ensure high quality in this step, two researchers carried out the assignment independently of each other. The agreement of 85.77% in category-assignment shows

an unambiguous allocation of the bigrams and a highly selective choice of categories. In those cases where there was disagreement, a third independent researcher carried out a blind assignment to one category and sub-category. The result is 5,894 bigrams in 8 categories and 39 subcategories.

We used t-tests and linear regressions to derive conclusions on trends and correlations from the categories and terms. Significance levels (p-values) are mentioned in the following paragraphs after each observation.

4.3.2 Validation of the Results Through Interviews

To achieve a better understanding of and help interpret the outcomes from the text mining, we discussed the results with HR managers from the respective company. We conducted interviews with four HR managers from the DAX30 companies, namely, Allianz SE, Bayer AG, Continental AG, and Deutsche Telekom AG. We chose these company representatives as they all reflect a different stage during digital transformation. Again, a qualitative content analysis helped in assigning the relevant content to the respective HR activities (Schreier et al., 2019).

4.4 Results and Discussion

In the following section, we first present and discuss the results of the text analysis of digitalization efforts and then the strategic relevance and the development of HR activities.

4.4.1 Digital Transformation and HR's Strategic Relevance

As discussed above, previous empirical results could not paint a clear picture of whether digitalization efforts lead to a more strategic position for HRM (Fenech et al., 2019; Gardner et al., 2003; Hussain et al., 2007; Marler & Parry, 2016).

To gain insights into this issue, we first analyzed in which year companies started to communicate their digitalization efforts (=year zero). We determined the respective year using a t-test analysis on the relative number of grams containing "digit*". Figure 9 depicts year zero on the x-axis. Those t-test results providing no significant results (at least on levels of p=.05 and p=.1) for a specific year can be found in the left column. To define the digitalization intensity, we calculated the increase of these terms over time using linear regression analysis (see Table 11).

	Pioneers	Enthusiasts	Followers	Laggards	Followers/ Laggards
Enthusiasts	0.1283				
Followers		0.0266			
Laggards			0.0016		
Enthusiasts/Followers/ Laggards	0.0129				
Pioneers/Enthusiasts/ Followers				7.3390E-05	
Pioneers/Enthusiasts					0.0004

Table 11: P(T<=t) two-tail (Two-Sample Assuming Unequal Variances); Values for comparing the different groups

The digitalization intensity is applied on the y-axis. The bubble size is determined by the average relative number of terms containing "strateg*" and thus indicates the strategic relevance. To structure our analysis, we clustered the companies depending on their respective year zero and digitalization intensity into "Pioneers," "Enthusiasts," "Followers," and "Laggards."

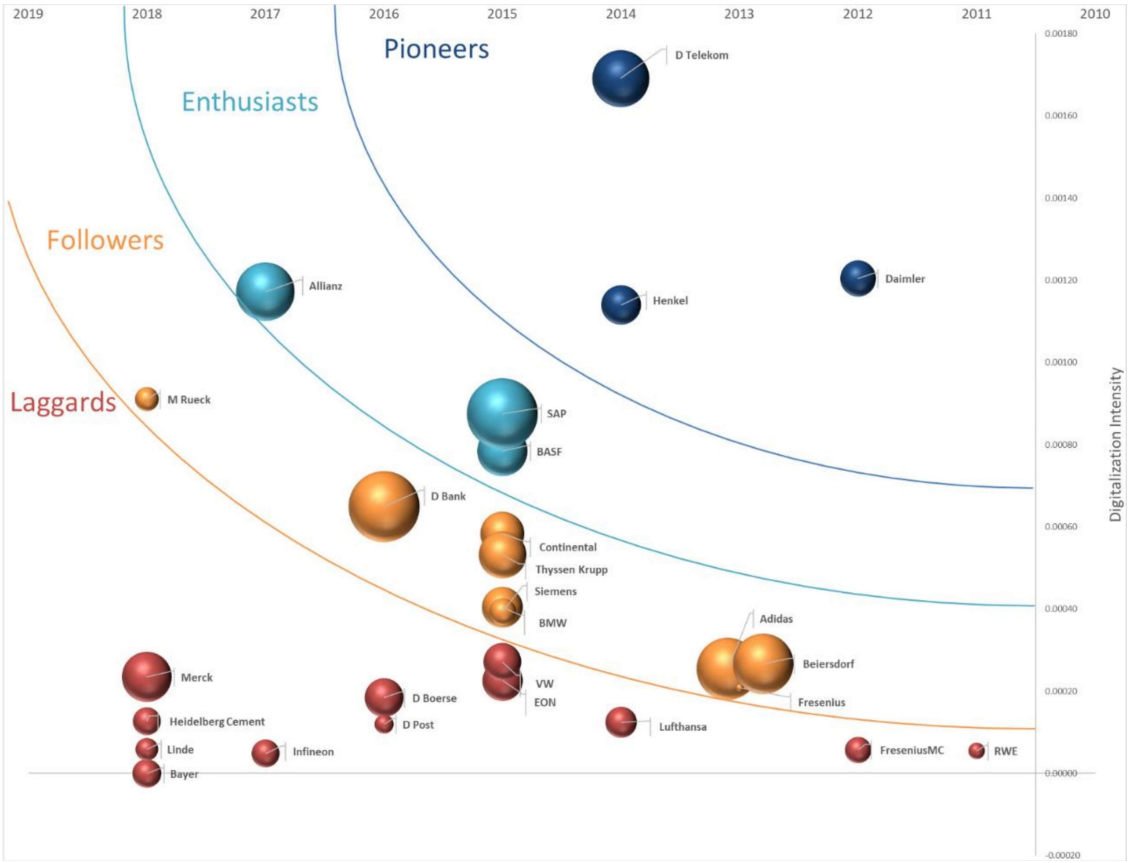

Figure 9: Bubble Chart Depicting the Intensity of Digitalization Efforts over Time including Strategic Relevance (x-axis: year zero; y-axis: digitalization intensity; bubble size: average rel. number of "strateg")*

Regardless of the digitalization measures, the relative values of strategy-related terms stagnate over time, leading to the initial assumption that the digital transformation does not enhance

HR's strategic relevance for most companies. However, another t-test reveals that the Laggards discuss strategic HR activities significantly less often (p=.01). To investigate the relationship between strategic relevance and digitalization intensity, we compared the groups of Laggards, Followers, Enthusiasts, and Pioneers, thus representing different levels of digitalization intensity.

Some of the companies stand out and deserve to be discussed in more detail: While most of the automotive companies started communicating their digitalization efforts in 2015—which is the overall average—Daimler already started in 2012; the annual reports reveal the early start of a global digitalization initiative in 2011 (Daimler AG).

Furthermore, it seems unusual that the consumer goods manufacturer—an industry not traditionally among technology leaders—Henkel is a Pioneer. However, further research shows that at that time, Kasper Rorsted held the role of Chairman of the Board. He is well-known for his IT affinity, and it appears that digital topics were more centralized in the company and thus in the company reports (Sarsam, 2008).

4.4.2 HR Activities and Their Development

To ensure a structured presentation of the results on HR activities, we will discuss them in the same order as previously introduced, although this order does not reflect their relative frequency—and thus importance—in the dataset. The order of importance (with the most frequently mentioned practice in 2018 first) is: Health management, HR development, staffing, policies, employee relations, organizational design, remuneration, and performance. Figure 10 provides an overview of all core activities and their relative frequency over time.

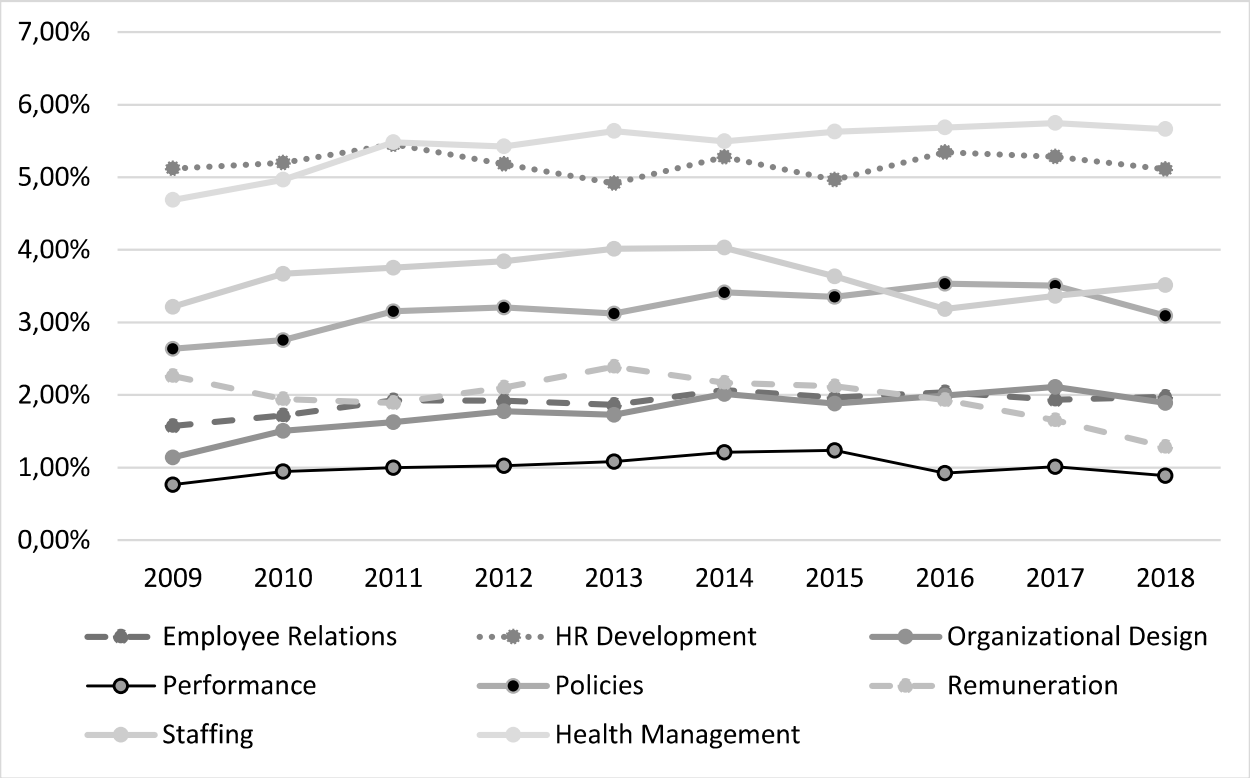

Figure 10: Relative Frequency of Terms of Major HR Activities over Time

Unless otherwise specified, we present the relative values in each core activity to take the respective text lengths into account.

ORGANIZATIONAL DESIGN The number of terms pertaining to organizational design rose significantly (p=.05) over time, which is in line with insights from the literature (Buvat et al., 2017; Kane, Palmer, Phillips, & Kiron, 2015). The major contributors to this trend were activities related to company culture and organizational development. The examples of Volkswagen, ThyssenKrupp, and Allianz illustrate the trends:

Until 2014, all areas except process management remained at a relatively low level in the reports of Volkswagen. Specifically, culture, change management, and work design experienced a significant increase in 2015 (p=.05)—which was also Volkswagen's year zero. The period after 2015 is characterized by two circumstances: Firstly, Dieselgate shook the whole industry (Niesen, 2017), and secondly—amidst the uproar—CHRO Karlheinz Blessing took office in January 2016. One of his first tasks was the reduction of several hundred jobs as well as a level-headed presentation of the company internally and externally (Eckl-Dorna, 2015). In addition to the digitalization efforts, this situation led to an increased need to work on culture and organizational structure at Volkswagen. We also observed an increased focus on corporate culture issues in the same period at ThyssenKrupp. This merely temporary increase could be linked to

the strategic realignment of "one steel," which focused on change management, culture (change), and employee success (ThyssenKrupp, 2015).

The interview with an Allianz representative also pointed to a major digital transformation project in the insurance company's HR. While it started as early as 2015, with a planned duration of three years, the project turned out to be more complex than expected. As a result, all areas related to organizational design rise with a delay in 2017 (=year zero) except the terms related to HR structure

STAFFING Staffing was the third most frequently mentioned HR practice after health management and HR development in 2018. However, the high level remained unchanged over time, which contradicts the assumptions made in the literature. While scholars assume an increase in recruitment and HR planning due to digital transformation, the analyses show a decrease in values around year zero in 2015 and 2016 (Lawler & Mohrman, 2003; Stone et al., 2015; Williams, 2009). A possible explanation could be that the digital transformation shifted these tasks towards line managers and, consequently, they were less communicated by HR (Whittaker & Marchington, 2003). Our interview partner from Continental provided a slightly different explanation: While the digital activities in employer branding and recruiting continue to intensify, communicating them in reports declines, as the public interest shifts to other areas over time.

Adidas stands out particularly in the analysis of company-specific differences. The fields of activity all followed a similar development, which peaked in 2011/2012, declined sharply until 2016, and then surged again. As we identified Adidas' year zero to be in 2013, this development seems rather unusual; however, other dynamics within the company might provide an explanation: In 2016, Adidas launched a new strategy: 'creating the new,' and Kasper Rorsted took office as CEO (Eberhardt, 2019). As at Henkel before, his work seems to have had a strong impact on the digital transformation and HR focus at Adidas.

A similar interesting process is illustrated by the frequency analyses of Siemens. All subcategories of staffing surged in the years 2013—2014. As we identified Siemens' year zero to be 2015, this development does not seem to be related to digitalization efforts. However, this temporary increase may be related to the appointment of Janina Kugel as CHRO in 2013 (Löhr, 2014).

HUMAN RESOURCES DEVELOPMENT While the overall trend in the area of HR development remains steady, one measure within this field differs. As literature and practice suggest that in times of transformation, innovative and informal teaching and learning methods have a higher priority, this is reflected by a significant (p=.005) increase of terms relating to e-learning in the annual reports (Schuchmann & Seufert, 2015). As this value remains on a comparatively low level, the increase is not reflected in the overall trend.

As a Pioneer in the digitalization timeline, Deutsche Telekom exhibits increasing values in nearly all HR development areas—especially training, elearning, and skill management. During the interview with one of the HR managers, the high relevance of these activities was confirmed as they are a major part of a comprehensive digitalization strategy encompassing the whole corporation. Otherwise, we can assume that programs for skill development are increasingly digitalized, while formal training formats remain on a high level and informal formats on a low, but steady level.

PERFORMANCE MANAGEMENT HR activities regarding performance management, such as KPIs or feedback processes, remain steadily on a low level during the observation period.

Contrary to the assumptions from literature, we could not identify an overall increase in performance management and its fields of activity (Cardy & Miller, 2005; Parry & Battista, 2019). The text mining analysis actually confirms the fact that the potential of performance management in companies is not yet fully exploited despite the technological possibilities (Ensher et al., 2002; Stone et al., 2015).

REMUNERATION The values regarding remuneration remain steady on a relatively low level over time. This result is in line with the insights derived from previous research insofar as that it does not gain strategic attention (Gueutal & Falbe, 2005; Johnson & Gueutal, 2011). It should also be noted that this trend is not only influenced by the digital transformation, but also by social views, as the relevance of compensation and benefits is declining in employees' view (Wong, 2017). Taking these dynamics into account, it is surprising that the values are not declining.

EMPLOYEE RELATIONS Activities maintaining the relationship with the employees remain constant on a medium level. Activities concerning unions and workers' councils constitute the major part of the mentioned terms. These results indicate that HRM continues to focus on formal relationships and regulated council work despite digital opportunities in platform-based communication tools.

On a company-level, Lufthansa emerges as the company with the highest values on average regarding employee relations. These are reflected in the high and rising values of employee participation and labor unions. Unions have a traditionally strong standing in the aviation industry in general. As the culture transformation project launched in 2012 at Lufthansa included an initial reduction of staff, relationships with employee representatives gained additional importance (Mazareanu, 2020). We also observed a change at the Volkswagen automotive group in 2015. While there was no further communication about employee representation in previous years, the figure jumps to a high level from that point on. We suspect that due to Dieselgate, the mediation between employee and employer receives a higher strategic value in the HR department. Furthermore, a connection to the appointment of personnel manager Blessing seems logical as he is well-known for his successful mediation between employer and employee (Eckl-Dorna, 2015).

We observed a similar development at Henkel from 2016. Values regarding employee representatives, knowledge management, and communication soar (p=.001). Hans van Bylen took office in that year and might have contributed to this development (Henkel AG & Co. KGaA, 2019).

HEALTH MANAGEMENT Terms and categories regarding health management stagnate during the observation period. While the necessity of work life balance, workplace design, etc. is widely discussed, data shows that HR attributes merely a fraction of attention to these activities compared to health and safety.

This effect is particularly noticeable in industrial companies such as Beiersdorf, BMW, Continental, Daimler, HeidelbergCement, RWE, and ThyssenKrupp. At BASF—where the focus on physical

work would suggest a similar development—all well-being-related values are at a low between 2012 and 2017. During this time, Margret Suckale held the position of CHRO and may have contributed to the overall strategic focus (Changes in the Board of Executive Directors of BASF, 2016). Although it is intuitively understandable that occupational safety and physical health issues play a greater role in these companies than in those from the service sector, the results in general are contrary to the findings of the literature, as researchers assume an increasing trend in the areas of work life balance or psychological well-being (Butts et al., 2015; Derks & Bakker, 2010; Schlachter et al., 2018). Only Deutsche Boerse and Muenchner Rueckversicherung show equally high or higher results in work life balance.

POLICIES The relative number of terms on policy-related activities is constant, with a slight upwards trend. This trend can mainly be attributed to a growth in the areas of diversity and equality. In the traditionally male dominated finance and insurance industry, the increasing emphasis on equality is especially noticeable. Overall, regulations, employment models, and CSR activities remain constant on a low level. These trends contradict the theoretical assumptions as we expected regulatory measures to gain in relevance.

However, some companies register growth in the area of regulations: Muenchener Rueckversicherungs-Gesellschaft, Infineon, and Linde all multiply their values over the observation period. On close reading, most of these terms refer to measures towards policies ensuring equality, well-being, and flexibility. These findings are in line with the literature (Holland & Bardoel, 2016; Parry & Battista, 2019).

4.5 Conclusion

In this paper, we used a longitudinal approach to investigate the strategic relevance of HRM during the digital transformation. We provide new insights for HR managers as well as a promising research methodology. We also increased the generalizability of our research by using secondary data from several industries. By linking of qualitative and quantitative aspects by means of a statistical analysis of data obtained via text mining as well as a qualitative content analysis and blended reading approach supported by interviews, the methodological procedure represents a novelty in HRM research.

We can summarize our findings into three categories: First, while some of the corporations are first movers in deploying digital technologies in HR, many are still lagging; we refer to them as Pioneers and Laggards, respectively. Other companies adopt digital technologies early after the Pioneers (Enthusiasts) or follow suit (Followers). We can link a lack of HR's strategic relevance to Laggards.

Second, while we can assume the linkage mentioned above, we cannot establish this relationship between digital transformation and all HR activities on a company level. However, the figures show that a strategic change is taking place in terms of which activities are strongly focused on in the corporate reports. This leads us to the conclusion that companies focus on certain activities during their respective transformation process.

Third, the reason for these strategic shifts can often be explained by other internal and external factors, such as management responsibilities or market developments. Particularly noticeable here was the change in personnel at the management board level, for example CHRO Janina Kluge joining Siemens, CHRO Zhengrong Liu 2014 at Beiersdorf, or CEO Kaspar Rorsted's work at Henkel and Adidas. The companies react to their individual market environment with specific HR activities. This does not support the main paradigm in the literature that digital technologies shape HRM and HR activities (Kavanagh & Thite, 2009; Marler & Parry, 2016; Ruël et al., 2007; Strohmeier, 2007).

In summary, we answer our research question as follows: The digital transformation has arrived in most HR departments of the examined companies and has caused noticeable changes. However, these changes and their effects on strategic relevance are rather selective in most companies. Our results thus complement the demand for multidimensional models that can map and research strategic HRM (Martín-Alcázar, Romero-Fernández, & Sánchez-Gardey, 2005; Wright & Ulrich, 2017).

4.5.1 Limitations and Research Agenda

Despite the far-reaching findings for the strategic relevance of HR, we must point out some limitations of our research. Due to available data and assumed representativeness of DAX corporations, we focused only on the biggest German companies. Further research is necessary in small and medium sized companies or other corporations to reach a full understanding. In addition, cross-border comparisons constitute a promising field for gaining insights on international and intercultural differences.

Furthermore, while providing both quantitative and qualitative insights, our methodology contains some limitations. They can be categorized on a linguistic, communicative, quantitative, and qualitative level.

First, on the linguistic level, we used an active keyword search of the identified HR measures in the text mining analysis. While we defined the keywords iteratively based on the texts, it is possible that we could not identify certain bigrams due to linguistic peculiarities of some companies and therefore risked a distortion in the frequency analyses.

Second, DAX corporations communicate with the public and their stakeholders via several channels. They use not only annual and sustainability reports, but also increasingly websites, social media, newspaper articles, or their own HR reports. For example, the interview with an HR manager of Bayer provided an explanation for not mentioning digitalization measures in the reports at all: As the annual reporting documents address stakeholders, they are not used as a channel to communicate specific technological and structural innovations in HR at all. The analysis of annual and sustainability reports thus limits the perspective on HR activities. A promising field of research is therefore the inclusion of different corporate channels. The methodology used here can be used and extended by Web Mining.

Third, on the quantitative level, we conducted the study based on t-tests and linear regression analyses only. In order to identify conspicuous features of the DAX as a benchmark and of the individual companies, this approach served the requirements of our mixed-methods approach well; however, we recommend that future work focuses on quantitative data with robust correlations and causalities of the existing variables and interprets them accordingly. Adding internal and external factors as well as mediators to such studies may provide interesting insights on the relevance of these influences compared to technology impact.

Finally, limitations with respect to our qualitative categorization can be identified. The classification of the bigrams is largely based on the allocation by previously defined keywords. While we took several precautions, such as blended reading and three researchers categorizing independently, we assume that there is still some room for improvement. Here, too, we recommend further research to substantiate our results through thorough data analysis.

4.5.2 Practical Implications

The largest companies in the German economy can be classified into different dimensions due to the timing and intensity of their digital transformation, as depicted in Figure 9. The chart reveals major differences between Pioneers, Enthusiasts, Followers, and Laggards. This classification can help practitioners to assess their company or HR department regarding the progress of digitalization and to derive strategic measures on this basis. Managers can thus use the chart as a tool to assess the maturity of the transformation and the strategic relevance of HR in the public relations of a company.

In many cases, we found volatile developments in the corporate communication. While in some cases, these irregular phenomena can be attributed to a change in management or market requirements, in other cases, we must assume a lack of strategic planning. While we analyzed external communication, the underlying internal processes are probably equally inconsistent.

As mentioned above, the diesel scandal in Germany and other environmental disruptions have affected HR activities in the past. It can be expected that both technological progress and external pressure from future crises, such as the SARS-CoV2 pandemic, will increase in the future. Thus, a structured approach with a clear vision is the first step towards implementing digital technologies transparently and successfully to support the strategic role of HR.

All in all, this study helps both to reduce the gap between research and practice and to reveal a new starting point in strategic HRM research, thus answering the call of Wright and Ulrich (2017). HRM faces the challenge of assessing and effectively using its strategic role and the strategic importance of its measures in the digital transformation. In this respect, we hope that HR will be aware of the strategic potential of all its tasks in the future to support and shape the technological advancement of the whole company.

5 CONCLUSION

In this dissertation, I study the impact of workplace technologies on an individual (Research Question 1) and on strategy level (Research Question 2). These investigations are embedded in a field of tension consisting of technology, workplace, people, and strategy (Figure 1). Building on the foundation of digital transformation and how it affects workplaces, I employ different frameworks and research streams, such as motivation research (Deci & Ryan, 1985; Hackman & Oldham, 1976; Herzberg et al., 2017/1959; Maslow & Stephens, 2000), the RBV (Amit & Schoemaker, 1993; Barney, 1991; Penrose, 1959; Wernerfelt, 1984), and SHRM research (Combs et al., 2006; Delery & Roumpi, 2017; Ichniowski et al., 1997; Seeck & Diehl, 2016) to answer the research questions. By combining these theoretical frameworks, I address the currently insufficient understanding of the impact of workplace technologies on an individual and strategic level (Delery & Roumpi, 2017; Parker & Grote, 2020; Vial, 2019; Wadu Mesthrige & Chiang, 2019). While motivation research serves as an ideal construct to assess the individual effects of workplace technologies (Paper 1), the RBV provides the tools to connect workplace design to strategic outcomes (Paper 2). HRM accompanies employees during technology implementation and gains strategic attention (Paper 3), thus being particularly interesting for both levels.

Within each paper, I used a different methodology to achieve the best results. In the co-authored Paper 1, we applied a Comprehensive Literature Review to enhance rigor and structure when assessing the role of workplace technologies in motivation research (Onwuegbuzie & Frels, 2016). To capture the complexity of workplace design as a strategic resource in Paper 2, I opted for a multi-case analysis based on interviews, observations, and documents (Yin, 2018). In Paper 3, Frederik Pscherer and I developed a novel multi-method approach analyzing annual reports with text mining and qualitative content analysis before validating the results with semi-structured interviews (Lemke & Wiedemann, 2016; Sandelowski & Barroso, 2007; Schreier et al., 2019; Silge & Robinson, 2017).

While we addressed more specific objectives and research questions in the three papers of this dissertation, I outline their overall contribution in this chapter. In Section 5.1, I summarize the main findings of the three papers and their contribution to answering the overarching research questions. In Section 5.2, I highlight the contributions of the dissertation to literature on motivation research, the RBV, the SHRM research stream, and on workplace technology. I provide managerial implications in Section 5.3 and an overview of the limitations and avenues for further research in Section 5.4. I conclude the dissertation in Section 5.5 with a brief outlook.

5.1 Summary of the Main Findings

In the co-authored **Paper 1**, Prof. Dr. Michael Dowling and I review the current field of motivation research focusing on the role of workplace technologies. The results of a Comprehensive Literature Review as recommended by Onwuegbuzie and Frels (2016) provide insights on a heterogenous field of research. Sixty-seven publications show that this topic is predominantly discussed in the western countries. More than half of the authors conducted their research in the United States. While this geographical concentration holds especially true for the early years, over the span of more than four decades the focus has extended to other industrial nations, such as Malaysia, Australia, or China (see Figure 11).

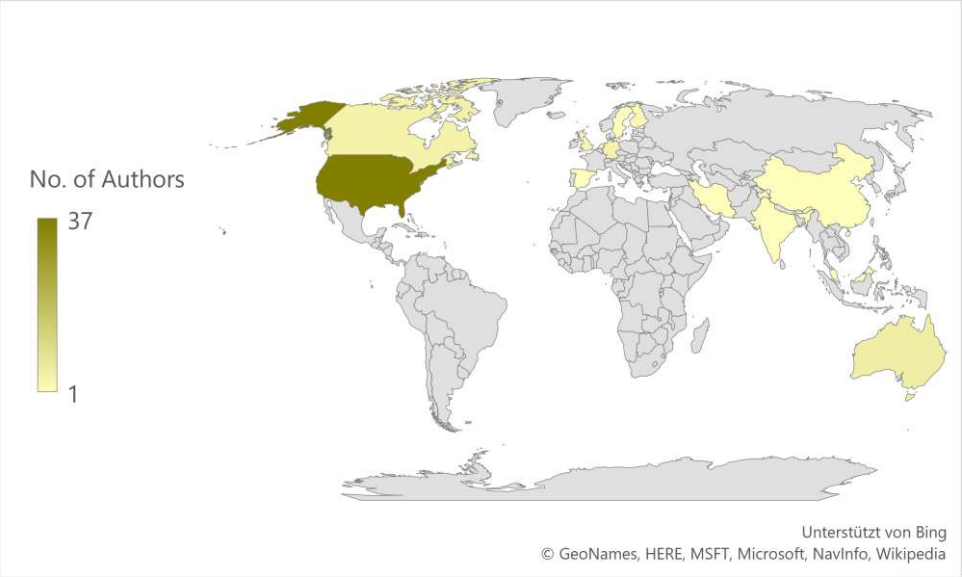

Figure 11: Map of the Origin of the Authors Worldwide Shows a Focus on Industrial Nations

We observed a similar trend with regards to the disciplines dealing with workplace technologies and employee motivation towards the nowadays heterogeneous field. The early works have mostly been published in leading (organizational) psychology journals, such as "Organizational Behavior and Human Performance"[6] or "Journal of Applied Psychology" and management journals, such as "Administrative Science Quarterly" or "Academy of Management Journal" (Ferris & Gilmore, 1984; Greenberg, 1988; Karasek, 1979; Rousseau, 1977, 1978). Today, modern subfields, such as human resource management, facility management, or technology research have also discovered the topic for themselves (Janneck et al., 2018; Liu et al., 2018; Pacauskas & Rajala, 2017). An overall breakdown of the disciplines is shown in Figure 12.

[6] Nowadays published as "Organizational Behavior and Human Decision Processes".

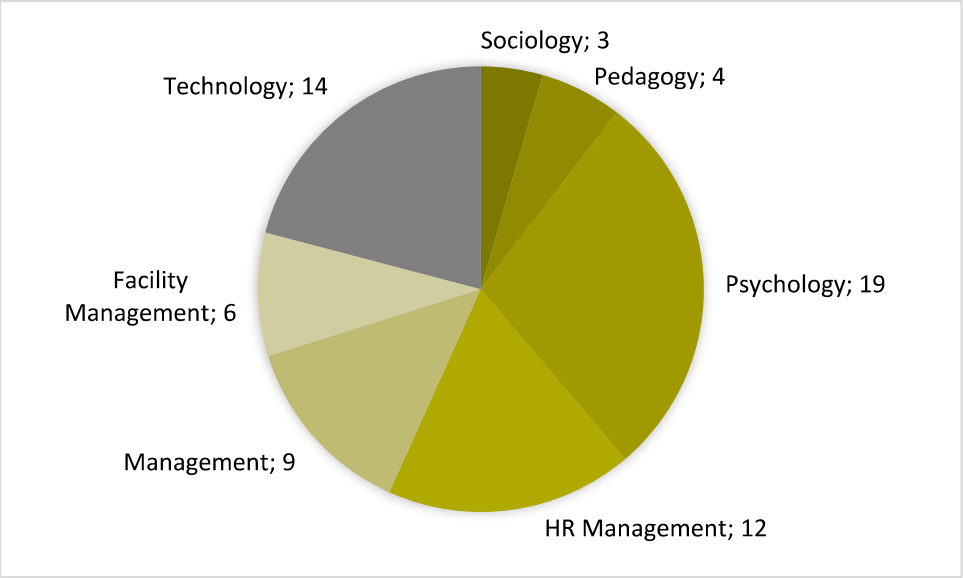

Figure 12: While the 67 Publications Cover Various Fields, Most of Them are Found in the Humanities

This heterogeneity is also reflected in the content of the research. The publications differ greatly in their understanding of workplace technologies and the use of diverse motivation theories. However, we were able to identify four perspectives on how workplace technology affects employee motivation. Technology can be perceived as 1. background music, 2. hygiene factor, 3. motivator, and 4. influencer of mediators. We find that while perceiving technology as background music is still a widespread concept in motivation research, those studies modelling technology as an influencer of mediators provide the most thorough research designs in the highest-ranking journals on average (JCR rating of 5.0 compared to 3.0 and 2.2 for technology as hygiene factor and motivator, respectively). The resulting categorization helps to assess current works and paves the way for future research. Based on that, we derive a research agenda and offer potential research questions. For example, developing a taxonomy can allow a better understanding of workplace technologies to be achieved and serve as a universally applicable basis for future research. In addition, the inclusion of independent variables moderating and mediating the relationship between workplace technologies and employee motivation in quantitative multi-level models is worth exploring.

In **Paper 2**, I show how workplace technologies can have the properties to contribute to sustainable competitive advantage. In contrast to the currently predominant conception that WPD is merely a cost factor, I apply the RBV to discuss further potentials of modern WPD (Barney, 1991; Kämpf-Dern & Konkol, 2017; Kampschroer et al., 2007; Wadu Mesthrige & Chiang, 2019). The resulting insights are based on a multi-case approach (Yin, 2018). I can conclude that WPD can be viewed as a resource bundle as defined in the RBV, as it meets the requirements and characteristics postulated by Penrose (1959), Barney (1991), Amit and Schoemaker (1993), and others.

However, after analyzing the cases against this theoretical background, I find peculiarities in certain areas: While resources providing *value* often do so by increasing productivity or saving costs, WPD does not only provide value directly, but also indirectly by affecting other resources, such as employee behavior or employer branding. Thus, WPD is a so-called higher-order resource (Wibbens, 2019). As a result, *complementarity* is particularly important. Implementing new WPD does not only affect hardware elements, but also processes, regulations, leadership, company culture, and others (Becker & Gerhart, 1996; Kämpf-Dern & Konkol, 2017; Levin, 2005). The results of the case analysis revealed another central trait of WPD for providing sustainable competitive advantage: *Versatility*. Enabling flexible processes, working from everywhere, and autonomous employees can create agility and resilience during crises—such as the CoV2-19 pandemic—or exploit business opportunities. Finally, my research reveals another characteristic neglected by the RBV: *Expression*. Workplace technologies have a symbolic character (Vilnai-Yavetz et al., 2005). Both during the implementation process and after, employees and other stakeholders interpret the design. Management can, for example, communicate appreciation or provide visible impulses for change projects (Gallos, 2017).

Fred Pscherer and I draw on SHRM research in **Paper 3** to gain further insights into technology implementation on the strategic level. Our mixed-methods approach provides both quantitative and qualitative insights on the role of HRM during the digital transformation. We can identify four groups of companies with regards to their overall HRM digitalization efforts: Pioneers, Enthusiasts, Followers, and Laggards. While the Pioneers started their digital transformation as early as 2012 (Daimler AG), others show very low and/or late digitalization efforts (Merck, HeidelbergCement, Linde). Although we cannot establish an overall correlation with strategic relevance, we can link a lack of HR's strategic relevance to Laggards. These results are in line with the findings of Gardner et al. (2003), Marler and Fisher (2013) as well as Fenech et al. (2019), who postulate that HR managers do not have to spend more time on transformational tasks but on IT-supporting tasks if a higher degree of new technologies is used. Our results on company- and HR activity-level are similarly heterogeneous. The HR activities on equality, for example, more than double during the observation period (+0.86 percentage points). This significant development is positively correlated with the overall digitalization intensity (rel. number of 'digit*' in DAX) with R^2=.57. On a company-level, however, the development of equality activities varies between -0.64 percentage points (E.ON) and 5.31 percentage points (Deutsche Boerse). We find similar results in all other activities. While a certain heterogeneity can be expected due to the broad range of industries and company structures, the extent is surprising. We explain this finding with two aspects: First, the digital transformation is in different stages in the companies—as explained above, we cluster them into four categories. Second, we find different digitalization

approaches within. Thus, the companies place varying emphasis on individual HR practices and activities. Our research also shows that some of these variances can be explained by other internal and external factors, such as personnel changes in management or market developments. Particularly noticeable here was the change in personnel at the management board level, for example CHRO Janina Kluge joining Siemens in 2015, CHRO Zhengrong Liu being hired by Beiersdorf in 2014, or CEO Kaspar Rorsted's work at Henkel and Adidas. The companies react to their individual market environment with specific HR activities. This finding does not support the main paradigm in the literature that digital technologies shape HRM and HR activities (Kavanagh & Thite, 2009; Marler & Parry, 2016; Ruël et al., 2007; Strohmeier, 2007). To sum up, we find that the digital transformation has arrived in most HR departments and triggered noticeable changes. However, these changes and their effects on strategic relevance are rather selective.

Paper 1	**Paper 2**	**Paper 3**
Research became more diverse over time regarding • Country of origin and • Discipline.	The *value* of WPD goes beyond cost-saving potentials. *Rareness* and *Inimitability* are not actively pursued but result from social complexity over time.	Companies can be categorized into *Pioneers, Enthusiasts, Followers* and *Laggards* with regards to HRM digitalization maturity.
The *concept of workplace technologies* is not uniform.	WPD is a resource bundle containing *Complementary* elements and is interdependent with other organizational aspects.	Laggards' HRM is significantly correlated to a *lack of strategic relevance*.
Technology can be perceived as 1. background music, 2. hygiene factor, 3. motivator, and 4. influencer of mediators.	WPD needs to be *Versatile* to adapt to changing environments. The symbolic aspect of WPD adds the characteristic of *Expression*.	Relevance of HRM *activities varies massively* among companies. Relevance of certain activities can often be explained by *other external influences* other than digital transformation.

Table 12: Overview of the Key Findings of the Three Papers

Overall, the results in this dissertation profit from a multi-method approach consisting of a Comprehensive Literature Review, a multi-case study, and a mixed-method approach based on text

mining, a qualitative content analysis, and interviews. I can now compile the findings from the three papers to answer the two overarching research questions.

Research Question 1: *How do (digital) workplace technologies influence employees?*

Based on the results from Papers 1 and 3, I can approach this research question from two perspectives. Firstly, Paper 1 provides insights into the current research on the role of workplace technology in motivation research. While the field is a fragmented one, and researchers remain divided on the question of how the mechanism technology affects employee motivation, the inclusion of mediators seems to be the most promising approach. We can identify fourteen mediators based on different motivation theories and methodological approaches. The most frequently mentioned ones were technologies that provide Autonomy/Control to the employee, require Skill Variety, and satisfy needs. The theoretical constructs can be found in the Job Characteristics Model (Hackman & Oldham, 1976), the Self-Determination Theory (Deci & Ryan, 1985), the Job Demand-Control Model (Demerouti & Bakker, 2011; Karasek, 1979), and content based motivation theories, such as Maslow's Hierarchy of Needs (Maslow & Stephens, 2000). Other schools of thought do not include mediators, but assume a direct positive (Greenberg, 1988; Mitchell, 1997) or negative relationship (Herzberg et al., 2017/1959; Ryan & Deci, 2000) between technology and employee motivation or they view workplace technology merely as 'background music' (Baard, Deci, & Ryan, 2004; Kanfer & Ackerman, 2004).

Secondly, Paper 3 focused on the strategic role of HRM in times of digital transformation. However, our results also provide insights relevant for answering Research Question 1. The use of technology not only changes the role HRM plays in terms of strategy, but also how people are managed. The literature describes profound changes in the areas of staffing, personnel development, health management, and performance management. Self-service applications, mobile technologies, and artificial intelligence promise individualized processes and an enhanced employee experience (Hogg, 2019; Marler & Boudreau, 2017; Parry, 2011). However, our results show no significant increase of these activities in the companies' annual reports. Furthermore, during our interviews HR managers confirm potentially disruptive technological innovations in single projects or locations. Yet it is precisely such technologies that have the potential to influence the mediators identified in Paper 1.

Research Question 2: *What role do workplace technologies play in corporate strategy?*

I answer this question based on the results regarding WPD from Paper 2 and the digital transformation from Paper 3. Incorporating the RBV in Paper 2, I discuss workplace technologies as

part of the resource bundle workplace design. My findings show that WPD exhibit all characteristics of resources contributing to sustained competitive advantage (Amit & Schoemaker, 1993; Barney, 1991; Penrose, 1959). The multi-case analysis shows that complementarity with other resources and the newly found characteristic 'Expression' are of particular importance. Integrated into the corporate strategy and implemented holistically, WPD can serve as a communication medium, increase performance, and influence other resources.

In Paper 3, however, we use the example of the HR function and show that in many cases the use of technology is only loosely dependent on the corporate strategy and is not implemented across the board. Similar to the Case 'The Experiments' from Paper 2, interviews with HR managers reveal that the new (workplace) technology oftentimes is implemented in separate projects. While this approach allows an individualized adaptation to the needs of each department or location, the contribution to the strategy of the entire company remains small.

5.2 Contributions to Theory

In the following sections, I sum up my contributions to different research areas. Each paper applied a different focus and thus contributed to motivation theory (Section 5.2.1), the Resource-Based View (Section 5.2.2), and strategic human resource management research (Section 5.2.3) respectively. All papers, however, provide insights into the overarching frameworks in workplace technology research (Section 5.2.4).

5.2.1 Contribution to Motivation Theory

In Paper 1, in particular, we provide important contributions to motivation research. With our structured approach, we developed a comprehensive map of the field with regards to the role of workplace technology. We identified four schools of thought as depicted in Figure 13.

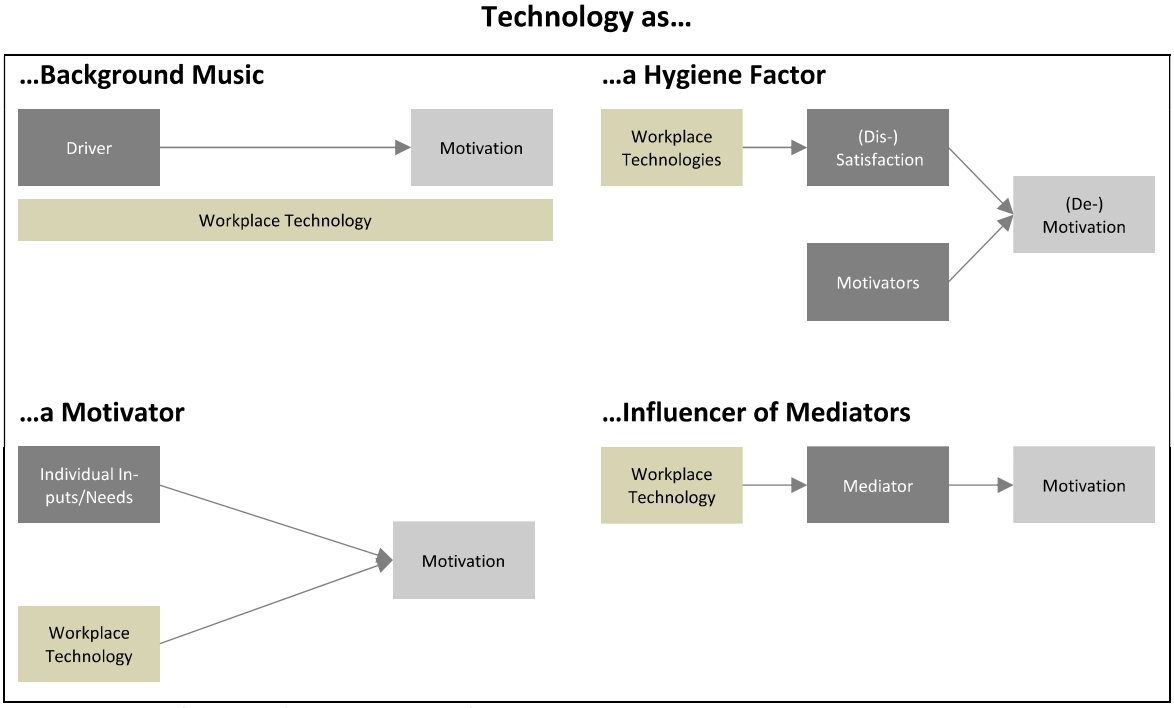

Figure 13: Four Schools of Thought can be found in Motivation Research Regarding Workplace Technology

The main paradigm is treating **technology as background music**. Popular works following the Hawthorne Studies from the 1920s focus on individual drivers and cognitive processes (Landsberger, 1968; Levitt & List, 2011; Mayo, 1949). While those authors mention 'the workplace,' 'workplace attributes,' or 'environment' in general, they lack detailed operationalization (Karanika-Murray & Michaelides, 2015; van den Broeck et al., 2016; Wong et al., 2008). This is also not necessary since this stream of research generally acknowledges technological aspects, but does not consider them further. Accordingly, workplace technologies only play the role of background music. In addition to this dominant view, in our literature analysis, we identified 67 works that emphasize a more central role of technology alongside employee motivation. Here we were able to distinguish three further perspectives.

Some researchers view **technology as hygiene factor**. This paradigm follows popular works such as Herzberg's Two factor Model, the Job-Demands-Control-Model, and publications on ergonomics (Demerouti & Bakker, 2011; Karasek, 1979; Knight & Westbrook, 2015; Siemens, 2005; Taylor, 2015). What they all have in common is that they tend to ascribe negative effects to workplace technologies, such as leading to dissatisfaction, health issues, or stress. On the other hand, some publications consider **technology a motivator**. They assume a direct (and positive) impact on employee motivation (Das, 1999; DeVoe & Prencipe, 2001; Miller et al., 2001; Pierce et al., 1984). The last stream of research views **technology as an influencer of mediators**. These publications assume a mediated relationship between workplace technology and employee motivation. The two Job Characteristics 'Autonomy' and 'Skill Variety,' as well as individual needs

are the most frequently mentioned mediators (Amabile, 1993; Housand & Housand, 2012; Parker et al., 2017b; Schmid & Auburger, 2020).

While all schools of thought contain interesting aspects that deserve to be investigated further, we assume that viewing technology as an influencer of mediators is the most promising one. Compared to the other perspectives, publications assuming mediators more often apply rigorous methods and are published in journals of higher quality on average.

5.2.2 Contribution to the Resource Based View

The RBV has been one of the major management frameworks from its very beginning. Since then, scholars have applied the framework to several areas, such as human resource management (Boxall, 1996; Colbert, 2004; Delery & Roumpi, 2017; Wright, McMahan, & McWilliams, 1994), total quality management (Powell, 1995), organizational identity (Rockwell, 2019), or supply chain management (Nandi, Nandi, Moya, & Kaynak, 2020). However, assessing WPD in terms of the RBV is not among them.

To fill this gap, I utilize the RBV to investigate the connection between WPD and firm strategy in Paper 2. Based on a multi-case analysis, I assess WPD projects with regards to resource characteristics postulated by 'classic' RBV-research (Acedo et al., 2006; Nason & Wiklund, 2018). WPD as a resource bundle, as defined in the RBV, meets the requirements and characteristics postulated by Penrose (1959), Barney (1991), Amit and Schoemaker (1993), and others. As Table 13 shows, most of the characteristics stemming from the Penrosean Theory of the Growth of a Firm, Jay Barney's VRIN-concept, and Amit and Schoemaker's framework overlap with my findings.

Penrose (1959)	**Barney (1991)**	**Amit/Schoemaker (1993)**	**Schmid (2020)**
	Value	Value	Value
		Appropriability	
		Overlap with strategic industry factors	Overlap with firm strategy
	Rareness	Scarcity	
	Inimitability	Inimitability	Inimitability
	Non-Substitutability	Limited Substitutability	Non-Substitutability
Complementarity of Capabilities		Complementarity	Complementarity
		Durability	
Versatility			Versatility
			Expression

Table 13: Characteristics Exhibited by WPD Compared to Common Characteristics Found in RBV

My research showed that WPD creates **value** directly and indirectly. For example, optimizing room layout can lead to more efficient processes and thus cost savings (Allard & Barber, 2003; Becker, 2004; Chan et al., 2007; Housman & Minor, 2016; Kämpf-Dern & Konkol, 2017). In one of the cases, the WPD was even turned into a value proposition, thus creating turnover directly. In Case 2, the firm uses the experience gained from internal workplace transformation processes and technologies and turned it into a product. Additionally, in all cases, the firms appropriate the value more indirectly. As a 'higher-order resource,' WPD influences other resources, such as employees, firm culture, or technology usage/proficiency (Wibbens, 2019). This interdependency becomes even clearer when looking at the characteristic **complementarity**, as postulated by Penrose (1959) and Amit and Schoemaker (1993). WPD researchers have already described different interacting dimensions when implementing workplace technologies, such as Kämpf-Dern and Konkol (2017) in their Performance-Oriented Office Ecology Model. In my multi-case analysis, I find several elements beyond Kämpf-Dern and Konkol's framework: workplace technology (including IT-equipment and furniture, among others), processes and practices, regulations, interior design, room layout, firm culture, and employer branding. This is an extensive, but certainly not exhaustive list. Nevertheless, these findings illustrate the complexity of WPD and the need for holistic planning and implementation. This complexity in turn enhances yet another characteristic enabling WPD to contribute to a sustained competitive advantage: **Inimitability** (Barney, 1991). When workplace technology is embedded in the processes, employees develop skills and capabilities by handling these technologies. Extensive communication during the implementation period also influences acceptance and, over time, firm culture (Heeroma et al., 2012; Röcker, 2010). Barney (1991) and Amit and Schoemaker (1993) describe these effects as 'social complexity' and 'historical uniqueness.'

The form and composition of the individual WPD elements should **overlap with firm strategy**. Amit and Schoemaker (1993) discuss this characteristic as 'overlap with strategic industry factors,' thus emphasizing the fit with the market the firm operates in. In my research, I find that this aspect is an important one; however, not only is the market relevant, but also the strategy pursued by the firm. For example, Nason and Wiklund (2018) show that the relevance of the characteristics differ depending on whether the firm aspires to growth or exploitation of unique opportunities. As a result, I renamed this characteristic 'overlap with firm strategy' to highlight the relevance of the individual firm strategy. New market opportunities might require a firm to reevaluate its strategy. Thus, the **versatility** of resources is essential in order to be agile in such situations and exploit them. My research provides examples such as flexible desking, mobile office furniture, or even expandable buildings to accommodate quickly changing circumstances.

However, the relevance of some of the characteristics differs compared to other resource bundles. **Rareness/scarcity** plays a subordinate role in the case of workplace design. As the elements of the resource bundle are usually physical mass products such as furniture, computers, software packages, or production equipment, they are not rare by definition (Barney, 1991). Similarly, the case analysis showed that **durability,** as described by Amit and Schoemaker, (1993) is not actively considered by most managers. While the workplace technology needs to last over an extended period of time, this period is neither specified during the planning period nor is the design consciously developed to achieve this goal. While the last two characteristics turn out to be less important in the case analysis, my research reveals an additional characteristic not discussed in RBV literature before: **Expression**. The symbolic dimension of workplace technology is a common theme for sociology or architecture researchers (Berg & Kreiner, 1990; Vilnai-Yavetz et al., 2005). This symbolism expresses intentions and qualities of those who implement it (Gallos, 2017). In all cases, the WPD communicates a strategic change, goal, or vision. The content of this message may be intentional or unintentional.

In summary, my research makes an important contribution to understanding the role of firm resources. Combining WPD research with the RBV is a novel approach to assess the strategic relevance of workplace technology. With my qualitative approach, I answer the calls for an approach that can capture the complexity of resources in the business environment (Barney & Mackey, 2005; Bluhm et al., 2011; Kim, 2014; Mitchell-Ketzes, 2003).

5.2.3 Contribution to SHRM Research

Research in human resource information systems (HRIS) or electronic human resource management (eHRM) is not new (Anderson & Rohrscheidt, 2016; Lado & Wilson, 1994; Parry, 2011; Tambe et al., 2019). However, most publications merely focus on the overall contribution of the function (Becker & Gerhart, 1996; Parry, 2011), specific technologies (Tambe et al., 2019), or individual HR activities (Chapman & Webster, 2003). We answer the calls for a holistic and fine grained analysis of HRM and its activities with a longitudinal dimension (Guthrie et al., 2002; Jiang et al., 2012; Tambe et al., 2019; Wright & Ulrich, 2017). Our results thus complement the demand for multidimensional models that can map and research strategic HRM (Martín-Alcázar et al., 2005; Wright & Ulrich, 2017). Previous research is divided on how the use of technology affects the role of HR within the organization. On the one hand, authors, such as Hussain et al. (2007), Parry (2011), or Marler and Parry (2016) find that the use of eHRM increases the strategic value of HR. On the other hand, Gardner et al. (2003), Marler and Fisher (2013), or Fenech et al. (2019) argue that HR managers‘ responsibilities shift towards supporting tasks and thus lose strategic relevance.

Our data hints towards a slow and patchy adoption of technologies in HRM. The interviews reveal some lighthouse projects within the companies but overall a rather passive role. Thus, our findings support the research from Fenech et al. (2019), and we find that HRM's role in the digital transformation is that of a user instead of a driving force.

5.2.4 Contribution to Workplace Technology Research

With the three papers, I answer the call for contemporary empirical research on organizational and workplace-related contexts, especially workspace design (Barley & Kunda, 2001; Colbert et al., 2016; Kampschroer et al., 2007; Waber et al., 2014). Researching the topic from a technology management-oriented point of view adds a new perspective to the growing industry- and design-dominated area (Vischer, 2007). By including frameworks and research results from different disciplines, I provide a multilayered picture in this dissertation. By collecting and defining various terms, such as workplace technologies, workplace design, eHRM, and HRIS, I create a basis on which future researchers can build. In Paper 1, we additionally compile an unprecedented overview of workplace technologies and related terminology. In doing so, we address the lack of a clear understanding of terms and the distinction between them.

In Papers 2 and 3, I/we also add to the strategic perspective on workplace technology. Incorporating WPD in company strategy was previously discussed by Then (1999), Kampschroer and Heerwagen (2005), and Kim (2014), among others. My research departs from previous approaches by providing both qualitative and quantitative data on the role of workplace technologies. Thus, I created a fine-grained picture of technology characteristics on both an individual and strategic level.

5.3 Practical Implications

My research provides a basis for managerial decisions as most of the currently available recommendations are mere progress reports (Montealegre & Cascio, 2017). The following courses of action are particularly relevant for decision makers in the areas of company strategy and technology implementation. I group the implications into two stages: Planning and implementing new workplace technology.

During the **planning phase**, benchmarking one's technological maturity, aligning future workplace technology projects with strategy, choosing suitable technology, and incorporating employees in the process are relevant aspects. In Paper 3, we provide an overview of the digitalization intensity in HRM of DAX corporations during the last 10 years. The chart reveals major differences between Pioneers, Enthusiasts, Followers, and Laggards. This classification can help

practitioners to assess their own company or HR department regarding the progress of digitalization and to derive strategic measures on this basis.

WPD needs to be incorporated into company strategy as shown in Papers 2 and 3. Depending on the strategy, a specialized working environment is necessary to create or uphold a unique market position. Since WPD is a higher-order resource, not only the particular technology but also its complementarity plays a major role in the strategic alignment (Wernerfelt, 2011; Wibbens, 2019). Thus, a strategic approach enables a firm to effectively enhance corporate image, employer branding, employee satisfaction, and other intangible resources. This in turn can influence performance in various ways: more success in recruiting and retaining talents, communicating or enhancing strategic goals (Paper 2). In Paper 3, we found volatile developments in the corporate communication regarding technologies and digitalization efforts. While in some cases, these irregular phenomena can be attributed to a change in management or market requirements, in other cases, we must assume a lack of strategic planning. While we analyzed external communication, the underlying internal processes are probably equally inconsistent. Such volatility can be avoided by aligning WPD with company strategy rather than individual employees or managers.

When planning new workplace technology, the choice of technology is essential. In this stage, management should already consider the effects on individuals, i.e., employee motivation. The literature shows that by choosing suitable technology, job characteristics, ergonomics, and needs satisfaction can be facilitated to motivate employees and thereby increase productivity and output quality, or achieve other strategically relevant outcomes (Paper 1). This contributes to value creation and appropriability for the company (Paper 2).

Practitioners can enhance the impact on individual performance by including employees in the planning process. Employee participation provides control and thus improves employee motivation (Paper 1). Allowing them to choose from a range of features and to arrange furniture, or introducing ‘Bring your own Device’-policies are easy ways to enhance belonging, individual needs satisfaction, motivation, and empowerment (Becker & Steele, 1995; Miller et al., 2001; Zhang Zhang, Mouritsen, & Miller, 2019).

Upholding employee participation throughout the **implementation phase** for new workplace technology is equally important. However, managers should consider additional aspects during this phase. Workplace technologies are part of a resource-bundle and should complement other organizational features, while the expressive character of WPD should not be underestimated but facilitated during implementation. At this point at the latest, the responsibilities within the company should be clarified.

As mentioned above, workplace technologies are more than individual tools. The empirical data in the second and third papers reveal a rather patchy implementation of workplace technologies and designs in many cases. While introducing new technology in separate projects holds advantages, such as the opportunity to address needs on an individual or departmental level, such projects often lack the strategic link on a greater scale. Thus, a holistic implementation including strategic implications and possible scalability is essential. Workplace technologies must be in alignment with firm strategy and complement other aspects such as company culture, leadership style, individual skills, etc. (Paper 1). In the long run, the integration of the workplace setting, work processes, and other organizational features can build a unique resource bundle and contribute to a sustained competitive advantage (Paper 2).

Leadership style and company culture can influence how new WPD is perceived by employees. In Paper 2, I find that 'Expression' is a crucial characteristic for supporting competitive advantage. The perception of technologies determines whether employees sense them as opportunities or threats (Bala & Venkatesh, 2013; Cascio & Montealegre, 2016; Parker & Grote, 2020; Schmid & Auburger, 2020). Practitioners can utilize this aspect during the implementation phase. They can specify which message should be sent with the new WPD. Roll-out campaigns, managers as multipliers, or the clear communication of strategy and vision can support the message and, in turn, support far-reaching strategic realignments.

Although I have called the accountable parties 'managers' up to now, a more detailed assignment of responsibilities should take place. Chan et al. (2007) show different strategic interests within the company depending on the stakeholders. While the financial management focuses on the cost perspective, organizational design aspires to socio-physical strategies. Facilities management and information technology focus on hardware aspects, such as buildings and IT tools. Keeping the respective goals in line with each other and company strategy is essential for the future success of the WPD (Miles & Snow, 1984). The HR department might provide a feasible solution to connect the individual effects of workplace technologies with strategic leverage. In many companies, HR managers provide internal services regarding regulations, skill management, or organizational development, thus accompanying processes affected by new technology (Paper 3). Empowering HR to manage implementation processes can both enhance their strategic role and contribute to WPD complementarity (Paper 2) while focusing on the individual employee (Paper 1).

The planning and implementation processes are not one-off activities. Just like the corporate strategy, the WPD strategy and its elements should be continuously evaluated and iteratively

adapted to new circumstances. Versatile workplace technologies can provide the crucial element to enable an agile reaction to changing demands (Paper 2). The current SARS-CoV2 pandemic, for example, represents a situation in which the versatility of WPD is put to the test (Marr, 2020). Those firms that were able to quickly adapt to the new situation created a strategic advantage. While in many firms mobile office solutions, seamless digital communication, or even zoning in buildings enables the firms to uphold their business, other firms even adjusted their processes and production technology to produce masks, ventilators, or disinfectant (Orth, 2020).

5.4 Limitations and Future Research

Although I attached great importance to a structured approach and a mix of methods in my dissertation, it has some limitations, which in turn offer great potential for future research. In the following section, I point out data restrictions, methodological limitations, as well as potential conceptual research gaps.

The **data** on which the results in Papers 2 and 3 are based concentrates on non-SMEs and corporations in Germany. This focus enables us to gain in depth and detailed insights. However, the international generalizability is consequently limited. Thus, I call for future researchers to provide comparative empirical data across borders. Different regulations and historical backgrounds as well as cultural aspects may lead to different perceptions of workplace technologies in other environments. Similarly, the comparison to the role of workplace technology in SMEs offers the opportunity to gain insights into the influence of company size-related differences, such as flat hierarchies or fewer resources.

While comparative studies can increase generalizability, the inclusion of additional data sources offers the opportunity to generate deeper insights into the complex design of WPD and the impact of workplace technologies. In my dissertation, I already combined different sources to gain advantages from triangulation (Yin, 2018). However, my focus on technology and internal structures (regarding both the employee in Paper 1 and the company in Papers 2 and 3) disregards relevant external and non-technological aspects. One of the central findings in Paper 3 hints towards strong effects of management change and market shocks. In order to capture these influences, it is helpful to include other data sources, such as financial data, market developments, or organizational structures.

Triangulation also helps to ensure the highest possible quality of data; however, I cannot completely exclude a certain bias. For example, the choice of digital databases in Paper 1 may lead to a distortion regarding the date and origin of the investigated publications. In Paper 3, the

annual reports were particularly interesting as an object of investigation because they were written for a purpose other than research, thus avoiding a response bias—as, for example, when using interviews alone. On the other side, however, this also leads to the results being distorted in a different direction in the subsequent analysis: Since the addressees of the annual reports are primarily stakeholders, in some cases, they contain a distorted picture of the use of technology.

Similar to the data, I have also taken a mixed approach in the choice of **methodology** in order to exploit the advantages of both qualitative and quantitative research. A certain bias in data analysis—similar to the selection of data—cannot be avoided. For example, in Paper 1, we did not include all existing publications on the role of technology management in motivation research. It would have been virtually impossible to do so, considering the long history of motivation research. However, selecting the structured approach of the Comprehensive Literature Review provided us the opportunity to filter more than 200,000 search results and take those addressing the topic into account. While a certain amount of subjectivity cannot be denied, the transparency in our method offers the opportunity to detect it and interpret the results in an individual manner. To address the bias in Paper 2, I opted for the previously mentioned triangular approach in data collection through interviews, observations, and documents. In all three papers, I also discussed the data iteratively with my co-authors and several other researchers to avoid biases.

As already suggested in the section on data restriction, I encourage future research to replicate our approaches. Analyzing our data from the literature review, cases, and text mining with new methods could provide new and exciting insights. Furthermore, adding new data sources will help to increase the robustness of the results I present in this dissertation.

The field of tension outlined in Figure 1 represents a large area with many opportunities for research. Naturally, I am not able to address all of them at once in my dissertation. Since my three papers focus on the effects of workplace technologies, other aspects and influencing factors are omitted. However, these in turn offer innovative opportunities to create a more holistic understanding of the **theoretical** field.

In Papers 1 and 3, we find that while workplace technologies have a considerable influence on individual employees and strategic relevance, other aspects can affect this relationship. Parker et al. (2017b) provide a multi-level framework of potential influences on WPD. I will highlight only some of them: As my research is limited to German companies—as explained above—taking cultural differences into account can be a potential research area. Future research can reproduce my analysis in other countries or in companies with different locations (Ferris &

Gilmore, 1984; Heeroma et al., 2012). Another aspect resurfacing repeatedly in the papers is leadership. The way managers introduce new workplace technology influences its perception. In Paper 2, I include this characteristic in the newly developed framework as 'Expression,' and in Paper 3, we find that a new manager can significantly influence the role of HRM during digital transformation. Other organizational aspects particularly relevant in the results of Paper 1 are processes or reward systems (Seeck & Diehl, 2016; Wright & Cordery, 1999), extrinsic workplace attributes, e.g., pay, job security (Amabile et al., 1986; Deci & Ryan, 1985; Taylor & Westover, 2011), or tasks (Hackman & Oldham, 1976; Luczak et al., 2012; Medsker & Campion, 2001). Socioeconomic aspects, such as age or gender, constitute yet another element on an individual level. These factors can influence both the ease in handling technology and how new technology is perceived (Barford & Hester, 2011; Rožman et al., 2017; Venkatesh, Thong, & Xu, 2012; Wong et al., 2008). Some authors have already made promising advances in modelling external influences interacting with technologies. Parker et al. (2017b), Parker and Ohly (2008), Diefendorff and Chandler (2011), Taylor (2015), and Humphrey et al. (2007) propose multi-level frameworks including some workplace design characteristics and individual outcomes. These frameworks offer insights into interdependencies between individual, organizational, and external factors. Providing new empirical data on these complex relationships can be an exciting opportunity for future research.

In my dissertation, I find a heterogeneous field regarding the understanding of workplace technology and design. It will be essential for future researchers to have a clear terminology for different technologies. Only in this way can misunderstandings be prevented and clear demarcations be created. I address this gap by contributing clear definitions and a collection of terminology in the form of an overview in Paper 1 (Table 6). Researchers can build on this and introduce common taxonomies based on technological features. Understanding the characteristics of different technologies will help to better assess their effects on an individual, organizational, and strategic level not only for existing but also for future WPD.

5.5 Concluding Remarks

With this dissertation, I shed light on the role of workplace technologies both for the individual and company strategy. In doing so, I employ frameworks from motivation research, the Resource-Based View, and research on strategic human resource management. My methodologies include both qualitative and quantitative approaches to address existing research gaps with new insights. My dissertation departs from prior works by combining different perspectives and employing novel approaches. The major findings include a clear map of motivation research with regards to the role of technology, an extended RBV framework highlighting WPD characteristics,

and an insight into the current status of digital transformation in HRM of German DAX companies.

For practitioners, my dissertation strengthens the awareness of both the individual effects of workplace technology and its strategic relevance. Against the background of current technological developments, the war for talents, as well as increased demands on the resilience of corporate strategies and individual employees, it is more important than ever to understand workplace design as an essential part of a company. In particular, due to the sudden changes in the challenges posed by the SARS-CoV2 pandemic, the return to a 'new normal' will be a major step towards a world of work that previously seemed a long way off. However, the purposeful use of workplace technologies can pave the way for this. Thus, it is in the best interests of management to understand their companies' WPD as a racetrack to enable their employees' optimal performance.

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