The Digitalization of the Knowledge Workplace

Implications to Manage Work in the Future

Part A

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Foreword

How do you want to work in the future?

This question is as compelling and relevant as ever. The increasing importance of information technology in all areas of life has reached the professional sphere. In recent years, new digital technologies and innovations have triggered vivid structural changes at the workplace. Many of these technologies have their origin in the consumer market, but now knowledge workers use them for professional purpose in the course of normal business. This significant technological trend has confronted organizations with challenges regarding information security, IT-supported processes, and employee productivity.

Against this background, Sebastian Köffer develops a set of theoretical models, concepts, and relationships to describe the trends. These models have already guided other researchers in studying digital innovation at the workplace. Furthermore, the author compiles interesting results about developments at the digital workplace based on various empirical datasets. To this end, Sebastian addresses several research gaps of our discipline, particularly with respect to the interplay between the private and the professional space of knowledge workers. Finally, Sebastian derives a set of practical recommendations that make the thesis an interesting read for managers of knowledge workers.

The results of his work were primarily achieved in practice-oriented research projects funded by the German Federal Ministry of Education and Research. The presented thesis provides valuable contributions to the information systems discipline as well as valuable insights for executives seeking to develop or evaluate strategies on digital workplace design and how knowledge workers work in the future.

Münster, September 2016 Prof. Dr. Dr. h.c. Dr. h.c. Jörg Becker

Acknowledgements

"If you screw up your studies, you can always become a butcher". This thesis marks the end of this lifelong fallback scenario for my professional career. Despite the fact that I refused to follow my parents' professional footsteps, I am incredibly grateful for their enduring support, both financially and personally, and I am certain that they will always be on my side, regardless of what I will do in future and how stupid this might be.

The sentence "without you, I wouldn't have made it" has never been as true as for this thesis. I had the pleasure to work with amazing people that constantly inspired and motivated me to find a way forward. I want to give credit to my fantastic co-authors for their creative input and writing effort. Thank you for championing my borderline articles to acceptable ones. Looking at the publication list, it is obvious that this thesis is inseparably linked with Kevin Ortbach. I already miss the time we spent together in the dual-use space of private and professional purpose. I could not think of a better office companion to work with.

Special thanks go to my academic mentors Björn Niehaves and Iris Junglas. As leader of the "WeChange" project, Björn encouraged me from the first day to learn the methodological skills to conduct research that I am keenly interested in. Thank you for the guidance and the appreciation of my work. Iris not only acted as thesis supervisor but also as language expert, travel guide, bicycle host, taxi driver, and even as a reliable provider of accommodation. Thank you for letting me part of the Florida State community. Go Noles!

I am very grateful to all colleagues at the European Research Center for Information Systems who help to create the academic spirit, which is characterized by freedom, helpfulness, and friendship – something that cannot be taken for granted when doing a PhD. As representatives of many others, I would like to mention Armin Stein, Nico Clever, and Michael Räckers. Finally, I want to thank my supervisor and "Chef" Jörg Becker for his continuous thesis support and the preservation of this encouraging and enjoyable research environment.

I wish that this thesis may inspire other people to conduct a PhD in a University environment. For me personally, this time was certainly one of the best experiences in my life.

Münster, September 2016 Sebastian Köffer

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Abbreviations

AMCIS	Americas Conference on Information Systems
BISE	Business Information Systems Engineering
BYOD	Bring Your Own Device
BYOS	Bring Your Own System
CAIS	Communications of the Association for Information Systems
CNF	Conference Paper
COBO	Company-owned Business Only
COPE	Company-owned Personally Enabled
Correl	Correlation
CRM	Customer Relationship Management
CYOD	Choose-Your-Own-Device
ECIS	European Conference on Information Systems
ERCIS	European Research Center for Information Systems
ERP	Enterprise Ressource Planning
HMD	Handbuch der maschinellen Datenverarbeitung
ICIS	International Conference on Information Systems
IS	Information System
IT	Information Technology
JNL	Journal Paper
P	Publication
PACIS	Pacific Asia Conference on Information Systems
PLS	Partial Least Squares
R^2	Percent of variance explained (r-squared)
RO	Research Objective
RQ	Research Question
SEM	Structural Equation Modeling

Part A

"We have only just begun to explore the next generation of technologies that will transform our lives in ways we can't even begin to imagine."

- Barack Obama

1 Motivation: Designing the digital knowledge workplace

1.1 How do we want to (manage) work in the future?

President Obama is arguably the most tech-savvy president in the history of the United States. When Obama acquired a tablet computer for work in 2011, the press interpreted the use as a sign of the proliferation of consumer technologies in government institutions (Rosenwald, 2011). In fact, a short time later the White House supported the use of consumer technologies by publishing a "toolkit to support federal agencies to implement 'Bring Your Own Device" (BYOD) programs (White House, 2012).

Organizations and the White House alike face technological advances in the consumer market as well as demographic changes that raise questions for managers of knowledge workers[1]. The share of knowledge workers in organizations has steadily grown – and so has the range of technologies they are working with (Davenport, 2011). It is often argued that organizations must act proactively and embrace the changing nature of digital knowledge work (D'Arcy, 2011; Stieglitz & Brockmann, 2012; van Heck et al., 2012). Moreover, new devices and applications in the consumer market force organizations to re-evaluate their current information technology (IT) infrastructure frequently (Köffer, Ortbach, et al., 2015).

In his seminal piece on "Enterprise 2.0", McAfee (2006) raised the hopeful question "Do we finally have the right technologies for knowledge work?" (p. 21). Ten years later, and years after the first smartphones have been spotted in the workplace, "it seems that we are still far from answering the question with an undisputable 'Yes'" (Köffer, 2015, p. 1). Despite the emergence of Enterprise 2.0 tools, such as wikis, portals, and social media, email communication has likewise increased with record-breaking figures every year (Radicati, 2014). But most likely, email is not the best tool for many of the myriad purposes for which most knowledge workers use it (Kane, 2015).

In general, the link between IT and productivity is often quite elusive, like described in the classic "productivity paradox" of decades ago (Brynjolfsson, 1993). More specifically, it is apparent that many organizations struggle with the adoption of digital workplace technologies. Davenport (2011) resumed that there is little evidence that massive spending on personal

[1] The term "knowledge worker" refers to Drucker (1959) who insisted on the increasing importance of knowledge work for the productivity of the economy. Knowledge workers have been defined as workers with "high degrees of expertise, education, or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge" (Davenport, 2005, p. 10).

computing, knowledge management systems and much else has increased knowledge worker productivity.

The digital workplace has evolved to a broader concept that mirrors the various technological work innovations through the digitization of many areas of life. Gartner (2016b) states the digital workplace "enables new, more effective ways of working; raises employee engagement and agility, and exploits consumer-oriented styles and technologies." For the purpose of the thesis, the notion is extended to "digital knowledge workplace", i.e. the digital workplace for knowledge workers. Taking into account the digital workplace definitions from Gartner (2016b) and Tubb (2013), the digital knowledge workplace is defined as *the collection of digital tools and applications in the workplace that allows knowledge workers to be more productive.*

Against this background, this thesis investigates the notion of the digital knowledge workplace in more detail. The thesis analyzes the consequences of actual digital trends on knowledge work with a special focus on the proliferation of consumer technologies. Based on the findings, managerial implications are derived and discussed to find an answer to the question "how do you want to (manage) knowledge work in the future?"

1.2 Research objectives

This thesis identifies four major research topics that information systems (IS) research investigates with a close relation to the digital workplace: 1) Collaboration tools and collaborative work, 2) Compliance with information security policies, 3) Mobility and mobile work practices, and 4) Stress and overload from technology use. This thesis draws on these related fields to investigate consequences of digitalization trends for individuals and organizations.

As regards individuals, IS research lacks insight about systems that reach beyond the scope of organizationally centered systems (Sawyer & Winter, 2011; Vodanovich et al., 2010). For example, individual performance effects of technology use are still under-researched. Yun et al. (2012) note that despite the proliferation of smartphones in private and professional spaces, little research has been conducted to investigate their impact, and that "mobile information systems have not been formalized in terms of job performance evaluation schemes" (p. 142). As technological power, such as sophisticated work devices, "continues to march downward … finally reaching a single individual, IS interests waned" (Baskerville, 2011b, p. 251). Similarly, there is a lack of insight why some employees can successfully manage work and life boundaries while others cannot (Duxbury et al., 2014).

As regards organizations, managers of knowledge workers are interested in better understanding the influence of digital trends on employee performance and innovation. Thus, executives have begun to actively seek to minimize security threats while simultaneously leveraging the potential benefits of modified IT policies, such as innovation, job satisfaction and productivity (Steelman et al., 2016). IS research has a long tradition to analyze determinants of productivity, job performance and innovation in the context of research on post-adoption of technologies. However, many studies do not yet take into account essential characteristics of the digital workplace trends, such as mobility, consumer-oriented styles, or the higher technological competence of today's knowledge workers (Köffer, Ortbach, et al., 2015).

This thesis aims to analyze the consequences of digital workplace trends by drawing on established IS theories. In this sense, the thesis sets out to "explore the boundaries of … known IS theories", i.e. whether those theories still hold regarding digital workplace trends (Baskerville, 2011a, p. 11). IS research needs to understand how users introduce digital tools in the workplace and how organizations can incorporate their practices (Leclercq-Vandelannoitte, 2015). Without a systematic understanding of such practices, organizations will be unable to derive managerial implications for embracing the digitalization of the knowledge workplace. Thus, the first research objective of this thesis is:

RO.1: *To investigate the consequences of digital knowledge workplace trends for individuals and organizations.*

The discourse about designing the digital knowledge workplace is hard to grasp for researchers and practitioners since there is yet no particular research stream on the topic. The potentially positive effects of the digitalization on the productivity of knowledge work have engendered an intensive debate among practitioners about how to embrace the digital trends. This thesis aims to consolidate the managerial implications of the academic body of knowledge. Own empirical studies about the use of digital tools and applications in the workplace complement the consolidated findings. In doing so, the thesis pursues the following second research objective:

RO.2: *To formulate implications to managing knowledge work in the digital workplace of the future.*

In formulating the research objectives, this thesis responds to several calls for research by other scholars. Amongst others, Sawyer & Winter (2011) point out that the IS scholarly community has only a small voice to investigate digital workplace trends with societal relevance,

particularly regarding the design of IS. Yoo (2010) calls for research that sheds more light on the use of consumer technology in the private realm. Vodanovich et al. (2010) encourage research on ubiquitous IS that span office-home boundaries and different user generations that will transform traditional IS. Similarly, Middleton et al. (2014) proposes research that investigates the negative aspects of further embedding of mobile computing into daily lives. Finally, Tilson et al. (2010) calls for research on digital infrastructures that the dynamics of decentralized work structures create, enabled through modern mobile services.

1.3 Thesis structure

Part A (Sections 1-6) gives an overview of the conducted research, presents the main results, and discusses managerial implications. Part B (Section 7-14) contains the individual studies which were carried out as part of this cumulative thesis.

Part A of this thesis is structured as follows. After the motivation of the research topic, the formulation of the research objectives, and the thesis structure (Section 1), the next section describes the major trends of the digital knowledge workplace (Section 2). The overall research design and used data pools are presented in Section 3. Next, Section 4 outlines the main results on the consequences of digital workplace trends (RO.1). The section also addresses the related theoretical work that serves as background for the conducted empirical studies. Section 5 discusses the managerial implications (RO.2) to managing the digital knowledge workplace that could be derived from the individual studies in the thesis. Part A ends with a summary of the contribution of this thesis and an outlook on future research opportunities (Section 6). Therein, the implications for managers from individual studies will be consolidated with enfolding literature.

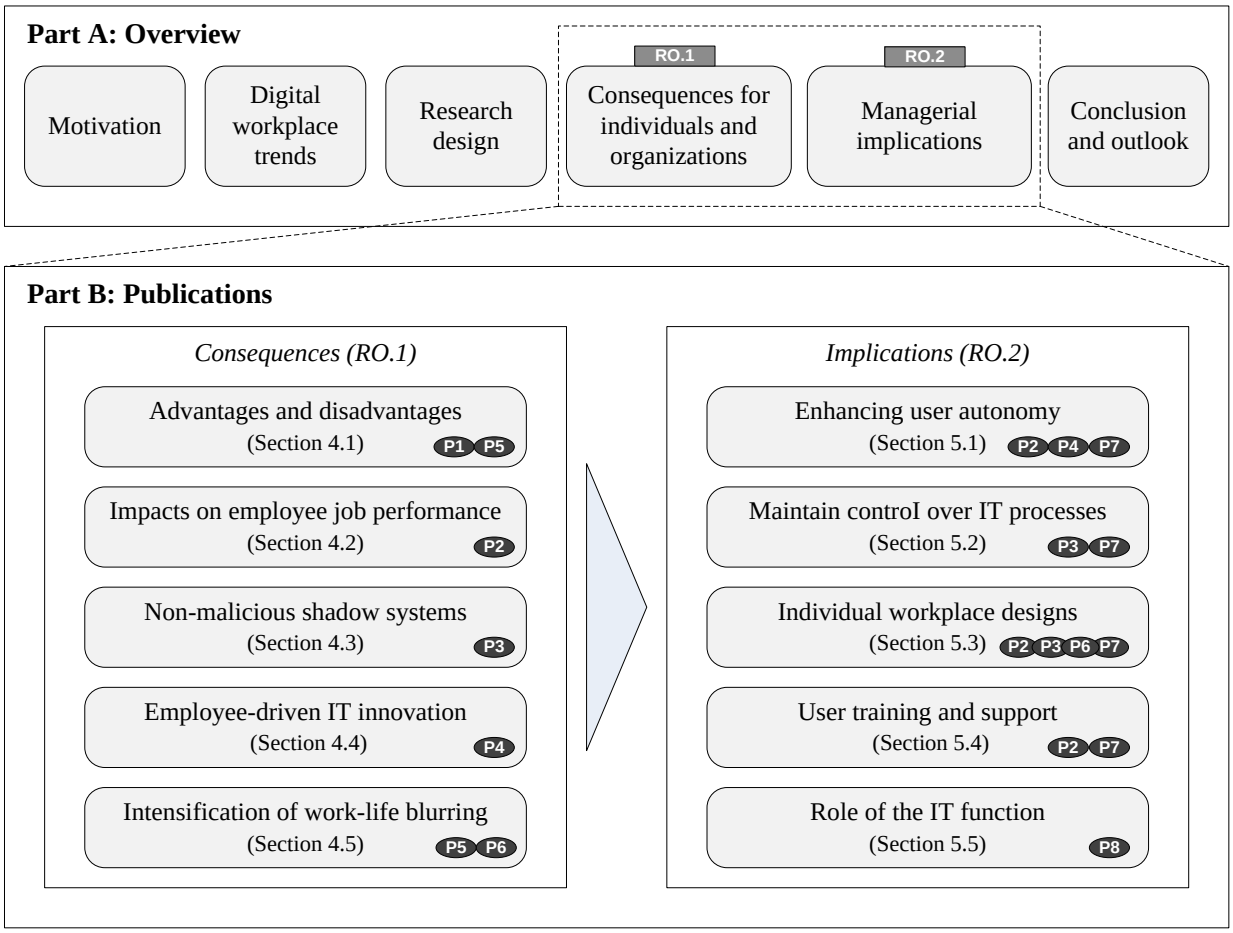


Figure 1.1 Thesis structure and related publications

Part B contains a total of eight publications and presents the findings of Section 4 and Section 5 in more detail. Table 1.1 lists these publications using an identifier, a full citation string, and the outlet, which is either a conference (CNF) or an academic journal (JNL). All articles (P1-P8) have been published. The outlets of these articles include journals such as *Business Information Systems Engineering (BISE)* and *Communications of the Association for Information Systems (CAIS)*, as well as completed research papers from the proceedings of major IS conferences such as the *International Conference on Information Systems (ICIS)*, *European Conference on Information Systems (ECIS)*, *Pacific Asia Conference on Information Systems (PACIS)*, and *Americas Conference on Information Systems (AMCIS)*.

The articles in Part B are not ordered chronologically but arranged in a way that represents the overall research process and their contribution to addressing the research objectives. Except one, all articles have been written with co-authors. That is why the articles use the first-person plural throughout Part B with few exceptions. As the research was conducted and published in various outlets over the course of four years, the articles may differ slightly with

respect to terminology and language. All articles have been reformatted to match the layout of this thesis to achieve consistency. This reformatting includes a unification of table and figure layouts, citation style, headline capitalizations, abbreviations, and case study pseudonyms. As the articles were integrated into the overall structure of this thesis, the numbering of sections, tables, and figures was also adapted.

Table 1.1 List of publications in part B

	Publication	**Outlet**
P1	Niehaves, B., Köffer, S., & Ortbach, K. (2012). IT Consumerization – A Theory and Practice Review. In Proceedings of the Americas Conference on Information Systems (AMCIS), Seattle, USA.	CNF
P2	Köffer, S., Ortbach, K., & Niehaves, B. (2014). Exploring the Relationship between IT Consumerization and Job Performance: A theoretical framework for future research. Communications of the Association for Information Systems (CAIS), *35*(1), 261–283.	JNL
P3	Ortbach, K., Köffer, S., Bode, M., & Niehaves, B. (2013). Individualization of Information Systems - Analyzing Antecedents of IT Consumerization Behavior. In Proceedings of the International Conference on Information Systems (ICIS). Milan, Italy.	CNF
P4	Köffer, S., Ortbach, K., Junglas, I., Niehaves, B., & Harris, J. (2015). Innovation through BYOD? - The Influence of IT Consumerization on Individual IT Innovation Behavior. Business & Information Systems Engineering (BISE), *57*(6), 363–375.	JNL
P5	Köffer, S., Anlauf, L., Ortbach, K., & Niehaves, B. (2015). The Intensified Blurring of Boundaries between Work and Private Life through IT Consumerization. In Proceedings of the European Conference on Information Systems (ECIS). Münster, Germany.	CNF
P6	Köffer, S., Junglas, I., Chiperi, C., & Niehaves, B. (2014). Dual Use of Mobile IT and Work-to-Life Conflict in the Context of IT Consumerization. In Proceedings of the International Conference on Information Systems (ICIS 2014), Auckland, New Zealand.	CNF
P7	Köffer, S. (2015). Designing the digital workplace of the future – what scholars recommend to practitioners. In Proceedings of the International Conference on Information Systems (ICIS 2015), Fort Worth, TX, USA.	CNF /JNL[2]
P8	Köffer, S., Fielt, E., & Niehaves, B. (2015). IT Consumerization and its Effects on IT Business Value, IT Capabilities, and the IT Function. In Proceedings of the Pacific Asia Conference on Information Systems (PACIS), Singapore.	CNF

[2] A modified version of this article has been published in German language in the journal HMD – Praxis der Wirtschaftsinformatik (Köffer & Urbach, 2016).

2 Digital workplace trends

2.1 Digitalization of the knowledge workplace

Digitalization penetrates all areas of life. As regards knowledge work, digital tools create new ways of working, collaborating and communicating. The number of IS-mediated tasks has further increased for many job functions and the emergence of smart devices has significantly impacted work processes. Mobile phones have evolved from simple communication tools to smart versatile computers (Jung, 2014).

Lower knowledge barriers, pervasiveness and the availability of smart devices and applications in the market have led to a boom of smartphones, broadband Internet access at home, and mobile phone networks (Leclercq-Vandelannoitte, 2015). Falling costs for devices and wireless services rates have ensured that IT tools are omnipresent (Baskerville, 2011a). It has become the norm for people to carry technologies like smartphones, tablets, and laptop computers almost everywhere they go (Vodanovich et al., 2010).

People have embedded mobile phones deeply in their everyday life regarding them as "an essential component of modern life" (Jung, 2014, p. 299). Rather than just adopting a product, the smartphones resembles a part of personal IT identity. In contrast to many other technologies, a smartphone is typically a personal device that is used by a single individual. Thus, it is not available for use by friends, co-workers, and members of the family (Arnold, 2003).

Moreover, the last years have seen an immense increase of software application use, such as social media. Meanwhile, 2.3 billion social media users were measured worldwide, representing 31 percent of the global population. In western European countries, this share increases to 48 percent (We Are Social, 2016). In an organizational context, social media applications serve as an enabler of internal collaboration and interaction. They are the ideal tools for knowledge workers to build work relationships (D'Arcy, 2011).

Moore (2011) proposes that enterprise IT is undergoing a fundamental shift from systems of record to systems of engagement. Such systems are characterized by enhanced interactions and collaboration of its decentralized users that are ultimately beneficial for the organization. Similarly, Vodanovich et al. (2010) delineate the difference between ubiquitous IS and traditional IS. While traditional IS purely helped to improve the productivity of organizations, ubiquitous IS support interactivity and connectivity – two factors that are today as important as functionality.

Digitalization also changes the locations of work. Sophisticated mobile devices allow knowledge work to take place anytime, anyplace (Davis, 2002). Some companies even think of partially or entirely eliminating traditional offices (Mulki et al., 2009). In many cases, the barriers to knowledge work in terms of time and space are no longer determined by technological constraints. Instead, "we may be entering an area in which human frailties begin to slow down progress from digital technologies" (Tarafdar et al., 2014, p. 61).

Interestingly, ongoing workplace developments can be seen as the second wave of user-liberating working styles enabled by technological innovation at the consumer market (Harris et al., 2012). In the 1980s, privately-owned microcomputers were carried into the office and plugged into the wall sockets, starting the era of end user computing with personal computers in organizations (Benson, 1983). The triggers for both waves are similar: A new generation of users, the need for more proper information, as well as the inability of the IT departments to satisfy the demands of the end users (Rockart & Flannery, 1983).

There are likely more waves to come, meaning that the digitalization of the knowledge workplace is far from finished, as perhaps best witnessed in the trend towards (big) data analytics. More analytical focused knowledge workers (data scientists) make use of advanced statistical analysis tools that might question the role of humans in future (Davenport, 2011). In a next step, researchers may identify the knowledge work that might be 'outsourced' to the algorithm and the knowledge work that might continue to require human judgment (Newell, 2015).

Various researchers predict that the next automation wave in the digital workplace will extremely impact the employability of knowledge workers. Unlike previous automation waves, which were confined to the replacement of routine work and low-skilled personnel, analytical machines will take away decisions from knowledge workers, and thereby provide better choices, faster, and more reliable (Davenport & Kirby, 2015).

2.2 New workforce generation

Literature asserts that actual developments at the digital knowledge workplace relate to a new type of workforce generation. It is assumed that younger generations – sometimes referred as digital natives – use technologies differently and more often than older generations (Dell & Intel, 2011a). Prensky (2001) delineates between two user types, proposing that digital natives' technology use considerably differs from their older counterparts – digital immigrants. For instance, "with mobile phones, digital immigrants favor speaking to people whereas digital

natives prefer speed texting" (Vodanovich et al., 2010, p. 712). Many reports and studies overtook this classification of generations.

No general cut-off date is used to distinguish between digital natives and digital immigrants, i.e. the used dates vary considerably "somewhere between the end of the 1970s to the end of the 1990s" (Wang et al., 2013, p. 410). In fact, it is likely that people who were born from 1984 onwards have been exposed more often to Internet-based technologies as well as mobile phones from an early age (Jones & Czerniewicz, 2010). For example, almost throughout the entire world, younger people own considerably more often a smartphone than senior citizens (Pew Research Center, 2016)[3]. As a result, digital natives are often described as highly literate, experiential, and social regarding the use of technologies (Vodanovich et al., 2010).

Wang et al. (2013) disagrees with the sharp distinction made between digital natives and digital immigration and argues that a continuum of technology adeptness better represents their differences. Instead of grouping the workforce just by age as a single criterion, some people are likely to be more native than others, depending on their experience (Vodanovich et al., 2010). Thus, the users' engagement in digital work is influenced by demographical, psychological, organizational, and social factors, i.e. age is just one of the many aspects. Over time, the ability of users to perform efficient digital knowledge work is dynamic and will change depending on the actual use of technologies (Wang et al., 2013).

In any case, it is likely that the digitization of all areas of life has made all age groups more aware of technology in the consumer market and the workplace. By 2020, over 50 percent of the workforce are expected to be a member of the so-called group of digital natives (UK Commission for Employment and Skills, 2014). The enhanced IT literacy of knowledge workers leads to increased IT competence outside the IT department that can be valuable for organizations. It allows a deeper involvement of knowledge workers with technical expertise to evaluate IT-based business opportunities and may also increase the satisfaction with IT implementations (Davis, 2013).

However, as younger users have a higher digital literacy on average, the discrepancy between user demands of IT provision and what the company can provide may be higher for them. The inability of organizations to meet workers' demands has motivated many employees to bypass IT departments by using their own tools to get their job done (Harris et al., 2012). People are

[3] Pew Research Center (2016) surveyed that the share of smartphone owners with age between 18 and 34 is higher than for people that are 35 and older. This finding was consistent in all 35 surveyed countries. One of the biggest differences in age groups was found in Germany, where 92 percent of 18-34 aged persons own a smartphone, while only 50 percent do so among the 35+.

unwilling to accept every technology the IT department forces them to use for work. Studies have shown that IT provision at the workplace has become an important criterion for employer attractiveness, especially for younger workers (Cisco, 2011; Weeger et al., 2015).

The perceived discrepancy between digital natives and digital immigrants is also likely to be influenced by the workforce expansion, both in age range as well as cultural background (Dell & Intel, 2011a). For instance, medical advancement has extended the working life up to the age of 65 and older. As a result, four generations of knowledge workers are expected to work side by side in the digital workplace (UK Commission for Employment and Skills, 2014). The combination of the group of digital natives and more senior generations offers huge opportunities for knowledge transfer in both directions (Dell & Intel, 2011a; Ortbach et al., 2014).

In turn, the heterogeneity of the workforce bears potential for conflict between generations. The speed of technological change is an important driver of generational differences (Dell & Intel, 2011a). It places a younger cohort at a perceived advantage to compete in the job market, pressuring older workers to constantly updating their skills (UK Commission for Employment and Skills, 2014). It is unclear whether the enhanced digital competence of the actual workforce generation will enable better lifelong learning or, in turn, lead to an another vicious circle, producing a new digital divide between generations (Wang et al., 2013).

2.3 Mobility and connectivity at work

Studies estimate the share of unique smartphone users to be approximately 50 percent of the global population with strong rises in recent years[4]. The International Telecommunication Union (2015) estimates that mobile broadband penetration will reach 47 percent in 2015, representing 3.46 billion users – a value 12 times higher since 2007. The share of web page views from mobile phones has reached 39 percent in 2016 – a 21 percent increase from the year before. In turn, page views from laptop and desktop computers have dropped from 65 to 56 percent (We Are Social, 2016).

According to Pew Research Center (2016), 72 percent of adults in the United States and 60 percent of European adults own a smartphone. As a response to the apparently insatiable appetite for the next feature-rich devices, smartphone providers launch new gadgets with improved features and more applications frequently (Middleton et al., 2014). Thus, IT adoption

[4] In the survey by Pew Research Center (2016), 43 percent of adults say that they own a smartphone. Mobile use figures are significant higher in richer economies. We Are Social (2016) analysts count 3.79 billion unique mobile users, representing 51 percent global penetration.

patterns appear nowadays similar to those of new fashion trends (Sun, 2013). This speed of innovation makes it hard for organizations to keep pace.

The opportunity to work from anywhere has created the notion of mobile workers.(Cousins & Robey (2015) define mobile workers as "people who spend time traveling and working in different locations, who use mobile technologies in their work, and whose work involves some level of knowledge intensity and communication with others" (p. 35). Mobile workers have broken down the difference between "a workplace and a place that is distinct from work" (Arnold, 2003, p. 244).

While first smartphones were confined to a limited number of people, they now have "become a critical tool rather than nice to have" (Dery & MacCormick, 2012, p. 161). Smartphones have enabled good mobile work practices through better interfaces and user-friendly touchscreens. For example, while responding to emails on classical cell phones was rather a cumbersome task, it is fairly easy to do with smartphones. As a result, using smartphones people are not only enhancing their reachability but also their workableness (Köffer, Anlauf, et al., 2015).

Dery & MacCormick (2012) point out the value of technology at the workplace has shifted from pure mobility to being always connected to work information sources, with no chance to escape. Cultural norms of professional communication have changed to an always-on mentality and interactions between mobile workers can take place untethered to any location (Mazmanian et al., 2013). Achieving a state of productivity that supports both productivity and personal well-being requires connective choice, i.e. the free decision "if, when, and how much to connect" (Dery et al., 2014, p. 559).

At the same time, constant connectivity induces higher expectations on the productivity of knowledge workers (Ayyagari & Grover, 2011). It is very likely that the pressure to be more productive is an important stressor for knowledge workers (Tarafdar et al., 2011). Connectivity also inevitably results in an increasing demand for communication with co-workers, customers, and suppliers. It is not uncommon that knowledge workers spend more than 75 percent of the time in a usual work week on meetings, phone, and email that are typically seen as non-productive behaviors (Cross & Gray, 2013).

Arnold (2003) warned at an early stage against negative consequences from mobile technologies that could ultimately be perceived by its user "not as liberating agent, but as a leash" (p. 244). Research on mobile technologies has characterized the role of consumer technologies to be paradoxical. On the one hand, they enable flexibility and independence, but, on the other,

constraints and dependencies (Arnold, 2003; Jarvenpaa & Lang, 2005). Individuals are struggling to respond to the demands of mobile technologies (Groysberg & Abrahams, 2014). However, it seems that more and more people value the benefits of connectivity higher than potential drawbacks. For most mobile workers surveyed by Middleton & Cukier (2006), the mobile device "was not a leash but a liberator" (p. 256).

IT has facilitated work-life blurring ever since. In the 1990s, telework broke up spatial boundaries between the private home space and the workplace (Gray et al., 1993). However, the emergence of mobile technologies is a critical enabler of work-life blurring, especially for knowledge workers (Reyt & Wiesenfeld, 2015). Still existing spatial boundaries became obsolete with the emergence of mobile technologies facilitating working from anywhere at any time (Davis, 2002). The "constant connectivity provided by information and communication technology encroaches on the personal space of individuals" (Ayyagari & Grover, 2011, p. 848). For instance, accessing work emails from a privately-owned device can enhance productivity, but, in some situations, infringe upon personal life (Middleton & Cukier, 2006). However, the spillover effects also occur the other way round, i.e. the importance that technology has gained in people's private lives naturally spills over into the work domain (Baskerville, 2011b).

The spillover between private and professional life has resulted in the fact that many employees do not want to use different devices and applications for work and private matters anymore. One global survey reported that 61 percent of smartphone users want to dual-use one device for both work and home – 39 percent want to possess two phones (Schadler, 2013). Accordingly, for the purpose of this thesis, dual-use is defined as *the use of a single IT device or application for both private and work activities*. Thereby, dual-use does not necessarily imply the use of privately-owned IT since the use of company-provided IT for private purposes equally qualifies as dual-use (Köffer, Ortbach, et al., 2015).

2.4 IT consumerization

IT consumerization is used to describe the proliferation of technologies in the workplace, which originate in the consumer market, to be used for professional purposes (Köffer, Ortbach, et al., 2014). It has been postulated as one of the most important IT trends and gained much attention among practitioners (Niehaves et al., 2012). By taking a look at empirical statistics, the trend particularly refers to the use of laptops, netbooks, tablets, and smartphones on the hardware side, and social media, cloud storage, and web conferencing on the software side (Cisco, 2011; Gens et al., 2011).

It is argued that IT consumerization embodies more than consumer technologies diffusion, but a chance for considerable productivity gains (Moore, 2011) including the digitalization of many processes that have been non-digital before (Golden, 2011). The trend "reflects how enterprises will be affected by, and can take advantage of, new technologies and models that originate and develop in the consumer space, rather than in the enterprise IT sector" (Gartner, 2016a). In fact, consumer technologies provide some obvious opportunities to increase employee performance, for example, by transferring privately-acquired IT competence to the workplace (Köffer, Ortbach, et al., 2014). At the same time, productivity gains are questioned. For instance, consumer technologies are often used at work for non-work related activities, such as writing personal messages or cyberloafing (Schalow et al., 2013).

The term IT consumerization was first coined by Moschella et al. (2004), who recognized that the same devices and applications are used by businesses and consumers alike. Here, 'dual-use' was viewed as defining aspect meaning that "increasingly, hardware devices, network infrastructure, and value-added services will be used by both businesses and consumers" (p. 2). Later, the term IT consumerization has been used ambiguously in the extant literature. In an effort to structure the amorphous nature of the term, Harris et al. (2012) suggest three distinct perspectives: a market, an individual, and an organizational perspective:

- In taking a *market perspective*, IT consumerization describes that tools, originally developed for the consumer marketplace, gradually find their way into organizations. Thus, the origin or intended target market of the IT tool is at the center of this perspective. Public clouds, social media, and smart mobile devices are just a few examples that have their roots in consumer offerings and are increasingly adopted by enterprises. As a result, a distinction between consumer and enterprise IT is increasingly difficult.

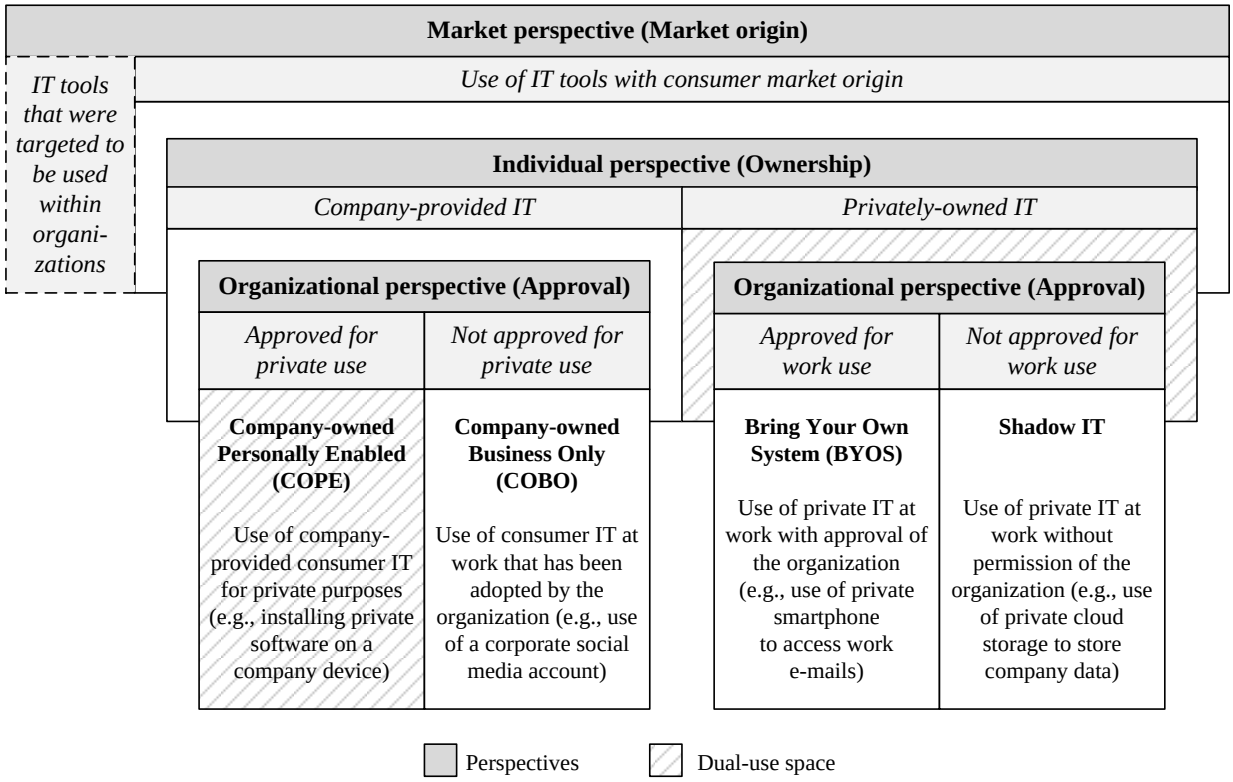
- In taking an *individual perspective*, IT consumerization describes that individuals transfer their IT experiences from their private realm into the workplace (Harris et al., 2012; Moschella et al., 2004). Owning a broad range of IT tools as part of their personal life, employees are prone to expect the same functionality and ease of use from tools provisioned by the enterprise (D'Arcy, 2011). Thus, the ownership of the IT tool is at the core of this perspective. It defines IT consumerization as bringing privately-owned IT to the enterprise and using it for business purposes.

- From an *organizational perspective*, IT consumerization captures that organizations have either formally approved the use of privately-owned IT in the workplace, reject its use, or found alternatives along the spectrum of both extremes. As an extension to the sep-

aration by Harris et al. (2012), this thesis also captures the organizational perspective for company-provided IT. Here, it can be distinguished whether company-provided IT is released for private use in addition to professional use. Thus, the permission to use a certain IT tool within the dual-use space of private and professional overlap takes center stage in the organizational perspective.

- Descriptions adapted from Köffer, Ortbach, et al. (2015)

Figure 2.1 illustrates the conceptualization of IT consumerization throughout the three perspectives. It can be noted that, for the purpose of this thesis, private use of IT with privately-owned systems, as well as IT tools that do not stem from the consumer space, are out of scope, e.g., ERP systems.



- adapted from Köffer, Ortbach, et al. (2014)

Figure 2.1 Conceptualization of IT consumerization

As regards the organizational perspective, IT consumerization is often associated with strategies, such as BYOD, where companies allow private ownership of IT for business purpose, sometimes even supported with free to use budgets (Harris et al., 2012). It is important to note that software, such as apps for mobile devices, are an essential part of IT consumerization. Thus, the term BYOD is misleading and should rather be termed "Bring Your Own System" (BYOS) (Baskerville & Lee, 2013). In contrast to the conceptualization in Figure 2.1, some

authors associate BYOS with the behavior of individuals, irrespective of the approval by the organization. By using this conceptualization, every use of privately-owned IT for work will be considered as BYOS.

However, many organizations hesitate to permit privately-owned IT use in the workplace into at all, mainly because of data security concerns (Niehaves et al., 2012). Using privately-owned devices increases the chance that private and corporate data get intermingled, and/or that accessing privately-held software accounts on cloud services may lead to data storage outside the organizational jurisdiction (ENISA, 2012). Strategies that adopt consumer technologies into the IT portfolio of the company but allow their professional use only have been termed "Company-owned Business Only" (COBO). Nevertheless, to give employees a say regarding IT selection, companies may allow employees to choose among a pre-approved set of IT devices, sometimes referred to as "Choose Your Own Device" (CYOD). Also, companies may release company-owned IT for private use, referred as "Company-owned Personally Enabled"-strategy (COPE).

Literature widely acknowledges that IT consumerization has put pressure on organizations, in particular when designing digital workplaces for knowledge workers (Andriole, 2012a; D'Arcy, 2011). Koch et al. (2014) note that values of consumer technologies are considerably different from the classical values that are represented by the IT function. For instance, while consumer technologies are characterized by a variety of flexible tools and applications, the IT function naturally promotes standardization and harmonization to reduce costs.

Also, the impressive growth of public social websites, like Facebook and Twitter, has pressurized organizations to take their employees' changing communication behavior into account. Knowledge workers request intra-organizational social software applications (Kügler et al., 2015). Hence, IT consumerization has been called "one of the biggest tests [...] for business and IT executives within the next five years (Harris, Ives, et al., 2011, p. 10)."

2.5 Individual information systems

As a result of the increased availability of powerful consumer technologies on the market, individuals are increasingly operating individual IS, described as "activity systems in which individual persons, according to idiosyncratic needs and preferences, perform processes and activities using information, technology, and other resources to produce informational products and/or services for themselves or others" (Baskerville, 2011a, p. 3). Hence, individual IS are no off-the-shelf solutions but rather specifically tailored to the individual's idiosyncratic needs

and preferences. However, its components are usually off-the-shelf consumer technologies that are readily available but delimited by the individual's social and geographical horizon (Baskerville, 2011a).

Meanwhile, individual IS have reached a level of complexity that is comparable to organizational IS. As a central premise, an individual IS is targeted towards serving the exclusive information needs of an individual. In his description of an exemplary individual IS, Baskerville (2011a, 2011b) draws the picture of various IT devices and software applications with high interoperability. It is important to note that experiential design is a constituting characteristic of an individual IS. Thus, individuals frequently adopt and "disadopt" consumer technologies (e.g., smartphone apps) from the market in a trial-and-error manner.

While their original focus was on private activities, ranging from entertainment and communication to administrative tasks, individual IS are increasingly used for professional activities as well. In this context, Baskerville (2011a) identifies two subsystems of an individual IS: 1) the personal activity system, which relates to all activities performed for private purposes, and 2) the professional activity system, which refers to activities performed for work purposes.

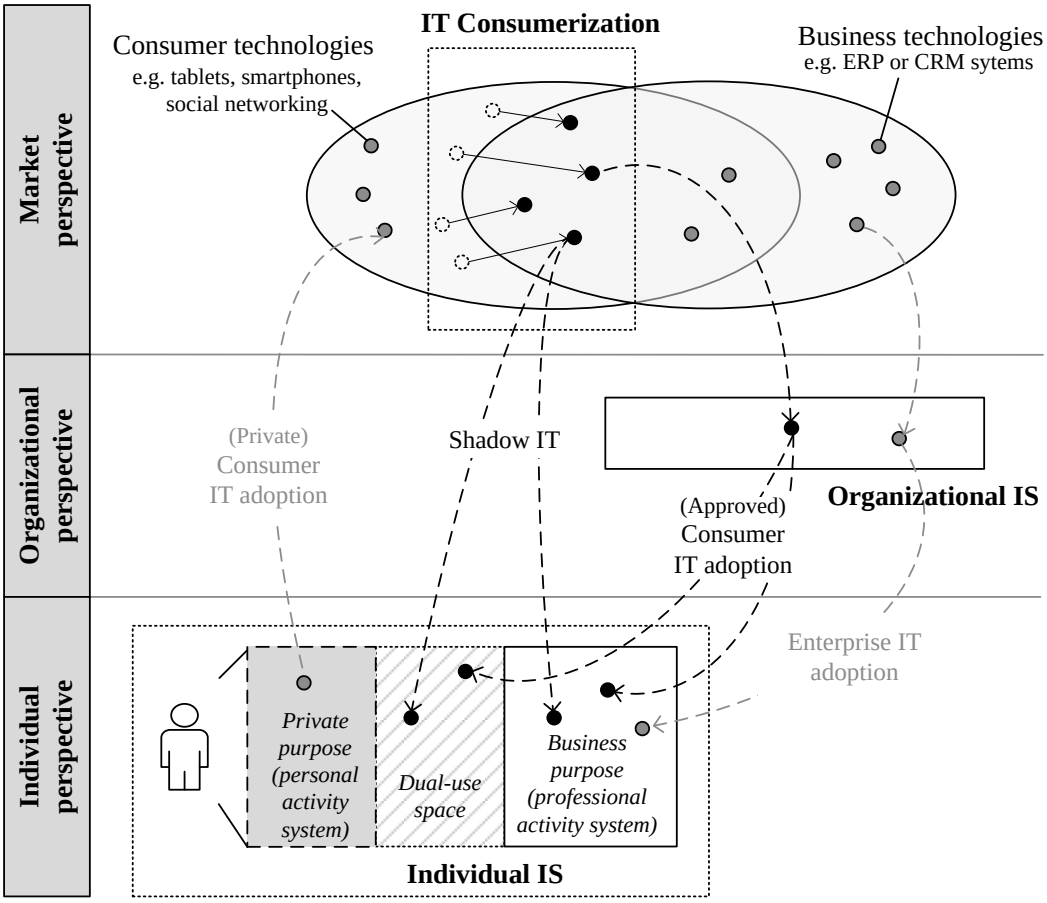
Following Ortbach (2015), the composition of an individual IS is characterized by an interplay of three aspects that link the individual IT identity, the social IT identity and the components of the individual IS:

1. An increasingly self-determined composition of the individual IS based on idiosyncratic needs and preferences of the individual. Individuals have nowadays strong bindings to their personal hard- and software, e.g., a particular preference for a device manufacturer for aesthetical reasons and convenience (Sun, 2013).

2. A decreasing but still existing influence of the social context on the composition of the individual IS. For instance, institutional constraints, e.g., strict guidelines and limited connectivity to organizational systems as well as compatibility aspects, e.g., access to work systems or exchange with family members (Gass et al., 2015).

3. A balancing effect of socialization that realigns idiosyncratic preferences using a continuous exchange of the values, attitudes, morals, knowledge, and skills related to IT (Gass et al., 2015). Over time, an individuals' IT identity will be influenced by the social context and vice versa.

The conceptualization and IT individualization is illustrated in Figure 2.2 along the perspectives of IT consumerization. The figure shows that private consumer technologies adoption for private purposes and enterprise IT adoption is part of the individual IS. However, such procedures can be considered as standard IT adoption processes that have already been studied extensively. Thus, there are not the focus of this thesis and grayed out.



- adapted from Ortbach et al. (2013)

Figure 2.2 Conceptualization of IT Individualization

Individual IS and IT consumerization have an obvious close relation. By referring to the market perspective, IT consumerization is the macro trend of adopting consumer technologies for professional applications. On the micro level, the organizational IS comprises technologies from the consumer and enterprise space.

The composed individual IS comprises both the adoption of consumer technologies by individuals (bottom-up), as well as the provision of company-adopted consumer technologies (top-down) (Ortbach et al., 2013). First, individuals adopt consumer technologies with permission of the company, either exclusively for business purposes to the professional activity systems

(COBO), or to the shared dual-use space between the personal and professional activity system (COPE). Second, individuals may add consumer technologies as shadow IT to their professional activity system or dual-use space, i.e., without the permission of the organization.

3 Research design

3.1 Mixed method research strategy

The overall research strategy in this thesis follows a mixed method approach. Mixed method approaches are seen as desirable in IS research with respect "to understanding and explaining complex organizational and social phenomena" (Venkatesh et al., 2013, p. 22). Similarly, Creswell (2014) argues that by using mixed method strategies, researchers "gain a more complete understanding of the research problems" (p. 216).

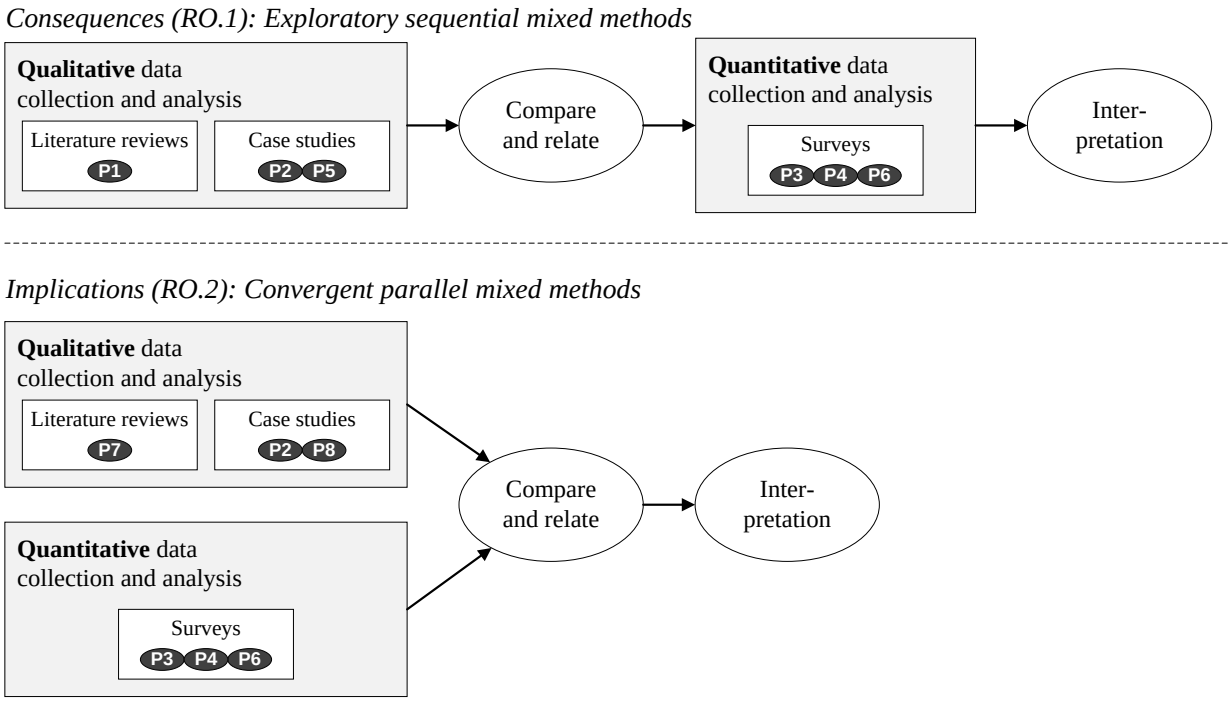
In contrast to the often synonymously used term multi-method research, which can be carried out by using either qualitative or quantitative methodologies (Mingers, 2001), mixed method research strategies require the use of both quantitative and qualitative approaches. Thereby, quantitative and qualitative research methods are used either concurrently or sequentially within a single research inquiry (Venkatesh et al., 2013). Thus, different studies may be conducted independent of each other, or findings from one approach inform the other.

With respect to the topic of this thesis, Venkatesh et al. (2013) states that mixed methods designs are a powerful mechanism to deal "with the proliferation of numerous non-work related systems and social media, and the availability of myriad IT-enabled devices that have now made IT an integral part of individuals' life" (p. 24). This thesis uses literature reviews and case studies as a qualitative and survey research as a quantitative research method. Overall, two literature reviews, four case studies, and three surveys were conducted.

Different mixed methods are used to investigate the two research objectives (see Figure 3.1). The investigation of RO.1 followed an explanatory sequential mixed method design. Thereby, qualitative studies are conducted first to develop better measurement instruments for subsequent qualitative studies (Creswell, 2014). More specifically, the research started with a qualitative study, i.e. a literature review (P1) and several interpretive case studies were conducted (P2, P5). Later, the quantitative studies (P3, P4, and P6) built on the results of the initial studies. In doing so, quantitative studies used several measurements concepts that were first discovered in the qualitative case studies.

The investigation of RO.2 followed a convergent parallel mixed methods design. Thereby, different perspectives drawn from qualitative and quantitative data are merged to show how the data converges and diverges (Creswell, 2014). In deriving the managerial implications, all data from qualitative and quantitative studies were merged and compared side-by-side in the

discussion of this thesis. In combining the qualitative and quantitative data, complementary views of the same phenomena – the digital knowledge workplace – can be gained from the data analysis (Venkatesh et al., 2013). The literature review conducted in P7 served as validity test of the drawn implications, through a triangulation of the empirical findings with the previously conducted empirical studies (both quantitative and qualitative).



- adapted from Creswell (2014)

Figure 3.1 Mixed methods research design for research objectives

The following sections summarize the research design of the single studies. Please refer to part B for detailed descriptions of the research methodologies.

3.2 Literature reviews

Analyzing prior studies using a thorough and sophisticated literature review is the foundation for any academic project (vom Brocke et al., 2009; Webster & Watson, 2002). The two literature reviews in this thesis (see Table 3.1) both follow the guidelines for structured literature reviews as proposed by Webster & Watson (2002). More specifically, both reviews used a keyword search to identify candidate publications. The selected publications were then used to describe key concepts that were uncovered by the review.

The first literature review in P1 (Niehaves et al., 2012) derived advantages and disadvantages of the IT consumerization trend for individuals and organizations. At the time of the search, there were no published academic studies on IT consumerization and BYOD. Therefore, the review included mostly practitioner reports about empirical surveys on the topic. Most of the reports were published by market analysts or consulting companies. To derive concepts, the full text of the reports was analyzed line by line using grounded theory methodology, i.e. iterative open and selective coding as proposed by Strauss & Corbin (1998).

The second review in P7 (Köffer, 2015) was a mixed review of technology affine academic-practitioner journals and prestigious academic top journals. Since the purpose of the review was the extraction of managerial implications, the first step was a screening of academic-practitioner journals[5]. This screening led to the identification of four research topics on the digital workplace of the future. In the second step, a systematic review of top journals from the IS and management discipline on the four research topics was conducted. In the course of analyzing the articles in the result set, managerial implications were extracted and grouped into broader concepts. Articles that did not provide any concrete implications for practice (e.g., theoretical pieces or research editorials) were excluded from the result set.

Table 3.1 Overview of literature reviews

Publication	P1	P7
Target	Practitioner reports	Academic-practitioner studies and academic studies
Aim	Derivation of advantages and disadvantages of IT consumerization for individuals and organizations	Summary of scientific managerial implications on the digital workplace of the future
Search procedure	Web search on empirical studies on IT consumerization, excluding opinion pieces	Database search on technology-affine academic-practitioner journals and prestigious scientific journals (A-journals)
Analyzed studies	18	79
Method of analysis	Detailed text analysis using iterative open coding and selective coding	Derivation of four research topics on the digital workplace as well as extraction and grouping of managerial implications into concepts according to the research topics

[5] Academic-practitioner journals, such as MIT Sloan Management Review, Harvard Business Review, or MIS Quarterly Executive, can be seen as channel to transfer scientific knowledge to practice (Straub & Ang, 2011).

3.3 Case studies

Case study research is defined as "an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p. 13). It is a common research approach for theorizing on a research topic, which is currently in its early stage (Eisenhardt, 1989). As existing theories cannot be translated easily to the changing concepts of the digital knowledge workplace (cf. Section 1.2), case studies represent an appropriate methodology to develop descriptive and integrative models about the topic (Galal, 2001).

This thesis uses interpretative qualitative case study data from four organizations to identify consequences and implications from consumer technologies (see Table 3.2). To this end, the cases were selected because the subject of interest was transparently observable (Eisenhardt, 1989), for instance, through a recent introduction of consumer technologies in the IT infrastructure of the organization.

Table 3.2 Qualitative cases under investigation

Industry	Manufacturing	Consulting	City administration	District administration
Pseudonym	MANUFACT	CONSULT	CITY	DISTRICT
Number of employees	>2000	>900	~2500	~850
Period of data collection	02/2012	09/2012	11/2012	11-12/2012
Words of transcript	51,546	33,769	60,248	98,006
Interview time	~585 min	309 min	~585 min	942 min
Number of interviews	13	10	13	17
Position of interviewees	Executives, department heads, sales representatives	Consultant, Consultant managers, back-office workers	IT staff members, Human Resources staff, division heads, delegate assistants	IT staff members, delegates, district administrator, division heads
Related publications	P2, P5, P8	P5, P8	P2, P5	P5

All case study data were collected using semi-structured[6], open-ended face-to-face interviews with knowledge workers and were conducted and transcribed in German. Later, statements from the interviews were translated to English to be used in the publications. Also, all cases used an embedded design to perform multiple analyzes in one case (Yin, 2009). Thus, we selected interviewees from different hierarchical roles and departments. The analysis of the first cases started before the data of the later cases were collected. Hence, data analysis and collection significantly overlapped, which is fundamental to qualitative research (Eisenhardt, 1989).

For the purpose of qualitative data analysis, we draw on grounded theory methodology, which has proven useful in studying IS phenomena (Urquhart et al., 2010). Following Strauss & Corbin (1998), coding techniques are used to generate and validate codes by constantly comparing the emerging concepts with the data analyzed. The coding was performed independently by multiple researchers at the same time and workshops were used to achieve a shared understanding of the concepts as well as theoretical saturation.

The four case organizations stem from different industry sectors and were selected both to deliver contrasting results, but also to replicate findings across diverse organizations and industries (Orlikowski, 1993). The case organizations are described in the following[7]:

- MANUFACT. The organization from the manufacturing sector had more than 2,000 employees worldwide in 2012. In the company, the IT department noticed an undesired increase in the use of private-owned IT by the employees. As a reaction to this frequent unauthorized IT use, the organization started a pilot project by equipping managers and sales representatives with company-owned smartphones. Interviewees were either participant of the pilot project or members of the IT staff.

- CONSULT. The management consulting organization employed over 900 people in 2013. In the company, almost every employee is provided with laptop and smartphone, since workplace mobility is crucial to serve the customers. Employees are also granted administration rights on the company-provided IT and are allowed to use it for private purposes on business trips and beyond (COPE).

[6] Interviewers had a predefined set of questions for the interviews. Respondents were asked about their experiences with the use of consumer technologies for work. Also, IT staff members and executive were asked to share an overall assessment of the organization about the use of consumer technologies. Please refer to part B for a list of main questions for the semi-structured interviews.

[7] To ensure anonymity of the interviewees, the actual names of the case organizations are hidden.

- CITY. This city administration of a German city with about 250,000 inhabitants employed around 2,500 people in 2012. Similar to the manufacturing company, the IT department noticed the unapproved use of privately-owned IT by employees. It was apparent that employees no longer accepted the rather strict policies in the administration. The managers reacted to this by starting a proof of concept to evaluate the enhanced diffusion of consumer technologies in the administration. As a first step, tablet computers were handed out to executives. Amongst others, interviews were conducted with those executives and with members of the IT staff who governed the proof of concept.

- DISTRICT. The medium-sized district administration has around 100,000 inhabitants in 23 municipalities and is located in a rural area. The administration had around 850 employees in 2012. Though the demand for consumer technologies among the employees had increased, the administration did not yet start to issue new devices, primarily because its financial situation did not allow it. The recruited interviewees varied with respect to IT experience, as the administration featured a wide mixture of tech-savvy and more conservative employees.

3.4 Survey research

Survey research provides quantitative descriptions of a sample population. From the sample result, researchers can draw general inferences about the whole population (Creswell, 2014). This thesis uses three surveys to validate the propositions that were uncovered by the interpretative case studies and to explore new relationships between research concepts.

As regards statistical methods, P3 und P6 use an explorative correlation analysis to identify correlations of item variables to the dependent variables (individual innovation behavior and work-to-life conflict). Also, all three surveys formulate and test hypotheses using structural equation models (SEM). SEM are one of the most frequently applied multivariate statistical methods in IS research (Gefen et al., 2011; Ringle et al., 2012). All hypotheses were tested using partial least squares structural equation modeling (PLS-SEM) using the software tool SmartPLS (Ringle et al., 2005). Table 3.3 gives an overview of the three surveys and the corresponding datasets.

Table 3.3 Overview of quantitative surveys

Publication	P3	P4	P6
Countries	Germany	France, Germany, Italy, Scandinavia, Spain, and United Kingdom	Germany, Romania, and United States
Sample size (collected/used)	73 / 73	>4000 / 486	135 /125
Period of data collection	11/2012	2011/2012	2/2014 – 3/2014 and 8/2014
Sampling method	Convenience sampling	Probability sampling	Convenience sampling
Collection method	Online questionnaire	Online questionnaires and telephone interviews	Online questionnaire
Method(s) of analysis	Correlation analysis; structural equation modeling	Structural equation modeling	Correlation analysis; structural equation modeling

The three surveys used completely different samples and sampling strategies. In the following the survey methodologies are described in more detail. Please refer to part B for details and demographics about the sample population.

The dataset in P3 (Ortbach et al., 2013) comprised of 73 knowledge workers in Germany. Data were collected in 2012 using an online questionnaire. Email and social media were used to invite participants of the survey. The survey was assessed around 260 times, resulting in a response rate of 28 percent. The resulting sample included individuals from a variety of industries. Professional experience ranged from zero to 35 years while the age of respondents reached from 17 to 58 years.

The dataset in P4 (Köffer, Ortbach, et al., 2015) has been collected as part of a global IT consumerization research project of an IT management consultancy with more than 4,000 respondents. An external market research firm collected the data by drawing a probability sample from full-time employees in organizations with more than 100 workers. Data were gathered using online questionnaires and few telephone interviews to reach older age groups. For the purpose of P4, only the data from European companies was considered. Moreover, only employees who had access to all of the technologies under study (i.e., desktop computer, laptop, smartphone, and tablet) were taken into account. Due to these criteria, the initial 1,556 data points from Europe dropped to 486. Age ranged from 18 to 65 and professional experience from less than two years to more than ten years.

The dataset in P6 (Köffer, Junglas, et al., 2014) comprised of 125 participants with a rejection rate of 18 percent. Data were collected using an online questionnaire in three languages: English, German, and Romanian. To be qualified as a participant, respondents had to either use a smartphone or a laptop for work purposes. Respondents covered a variety of industries, different levels of job tenure, and mostly stemmed from Germany, Romania, and the United States. As regards the age of participants, 8.9 percent were below 25, 64.5 percent were between 25 and 34, 16.1 percent between 35 and 44, and 10.4 percent were older than 44.

4 Consequences for individuals and organizations

4.1 Advantages and disadvantages

A starting point of this thesis was the identification of advantages and disadvantages from digital workplace trends. More specifically, qualitative studies in this thesis asked participants for their personal benefits and drawbacks from the use of consumer technologies at the workplace, including those which are privately-owned. In addition to the qualitative studies, a review of practitioner studies and research papers on IT consumerization and BYOD was conducted (Niehaves et al., 2012). Findings from the review were combined with the statements from the interviews and grouped into major concepts. Table 4.1 provides an overview of the aspects as identified in the studies. From the studies, ten distinct aspects were derived and classified into advantages and disadvantages.

Table 4.1 Advantages and disadvantages of consumer technologies

Advantages	Disadvantages
Easier IT use and adoption	Loss of process control
Employee availability and connectivity	Security issues
Employee productivity[8]	Support complexity
User autonomy and flexibility	Stress and work overload
Work satisfaction	Upfront investments[8]

In the following, the aspects are described in detail, starting with the five advantages.

Easier IT use and adoption. Consumer-oriented devices and applications are designed with ease of use as one of the primary objectives. Thus, the tools are perceived as much simpler and intuitive (Golden, 2011; Köffer, Ortbach, et al., 2014) and may help to overcome the existing gap between employees and IT departments concerning the speed of adoption (Gens et al., 2011). If employees work with tools they have selected on their own, they usually bring in pre-existing knowledge about the tools so that learning progresses much faster (Prete et al., 2011). In the context of system interfaces, research has shown that freedom of choice has positive effects on ease of use (Murray & Häubl, 2011). Following the idea of individual IS, tech-savvy workers can create their own solutions by carefully selecting IT tools that are available in the consumer market (Harris et al.,

[8] Literature is inconclusive whether this aspect has more advantages or disadvantages. The categorization for this thesis has been determined with respect to the overall findings.

2012). Most employees are not constrained anymore by IT tools that the company provides but can freely pick IT from the available options in the consumer market (Schwarz & Schwarz, 2014). By deploying devices such as smartphones and tablets, users have easy and fast access to thousands of cloud applications (Gens et al., 2011). To this end, consumer technologies help to increase the speed of adoption for new technologies in an organization and time to market decreases (Prete et al., 2011), and make it easier for organizations to shorten update cycles and introduce new IT solutions.

⊕ **Employee availability and connectivity.** If employees use the same smartphone for both work and private tasks, they are considerably more often available (Dery & MacCormick, 2012; Mazmanian et al., 2013). Moreover, they can deal with simple tasks during idle times (Cousins & Robey, 2015). The increasing overlap between work and private life spaces puts the challenge for workers to find the right state of connectivity (Dery et al., 2014). However, organizations profit from workers that are available for work-related messages and tasks 24x7. In this sense, BYOD or COPE programs can be viewed as converting employees to just-in-time resources (Dell & Intel, 2011b). (Köffer, Anlauf, et al., 2015) showed that people struggle to achieve strict separation of work and life spaces. As a result, organizations benefit from "free" longer work hours of their employees (Niehaves et al., 2012).

⊕ **Employee productivity.** Concerning productivity, many studies draw a positive picture of consumer technologies in the digital workplace. In fact, there are easily observable positive effects. For instance, collaboration technologies like instant messaging, wikis, and social media can act as an enabler of internal collaboration and interaction between employees (Kane, 2015). In this sense, Moore (2011) see the chance for a "next wave of productivity gains to be garnered from investing in a next wave of IT" (p. 3). Mobile work on smart devices allows employee and customer interactions to take place untethered to any location (Köffer, 2015), meaning that employees can squeeze more out of their days (Prete et al., 2011). The positive effects on employee productivity for BYOD initiative has been demonstrated alike. One-half of the workers surveyed by Harris et al. (2012) reported that they could complete more tasks on time if they were allowed to choose IT on their own. In turn, studies presume that personal IT use at work, e.g., in the course of COPE, are likely to boost non-work related activities such as cyberloafing (Schalow et al., 2013). As a result, people are distracted from work or waste their time with leisure activities during work hours (Davenport, 2011; Köffer, Ortbach, et al.,

2014). Also, it is widely acknowledged that increased technology-induced stress might rob parts of previously achieved productivity gains (Tarafdar et al., 2014).

⊕ **User autonomy and flexibility**. Consumer technologies have been associated with greater freedoms for employees (Dell & Intel, 2011a). By using BYOD or CYOD programs, employees have a say which device they use for work. A COPE program that enables dual-use of company-owned IT for private and work purposes increases user autonomy by allowing more flexibility in terms of work-life blurring (Yun et al., 2012), e.g., playing video games on a corporate laptop on a business trip. Many employees enjoy fewer rules, and a certain independence from the IT department (Harris et al., 2012). Thus, along with more autonomy goes a shift of responsibilities from institutions to individuals (Moschella et al., 2004). Even if not all workers can cope with increased autonomy and self-responsibility, particularly tech-savvy workers are likely to be able to increase their productivity (Köffer, Ortbach, et al., 2014). For instance, advanced users will be able to solve IT-related problems on their own without involving IT helpdesks (Ortbach et al., 2014).

⊕ **Work satisfaction.** Several studies found that consumer-oriented working styles relate to an increased work satisfaction. A study of Dell & Intel (2011a) found that six out of ten employees enjoy work more if they can use their own technologies. Half of the IT organizations named employee satisfaction as the primary benefit of IT consumerization in a study by Gens et al. (2011). Similarly, 57 percent of the executives that were asked in a worldwide study by Harris et al. (2012) rated an increased employee satisfaction as an important benefit of IT consumerization. In the same survey, more than a half of workers indeed said that they would be happier if they were allowed to choose their own hardware and software for work. An increased work satisfaction also underpins the role of IT provision to employees as an argument for employer attractiveness (Weeger et al., 2015). For the new workforce generation, modern IT equipment and access to consumer technologies has become an important criterion for job decisions, rather than traditional incentives such as higher salaries or a company car (Cisco, 2011).

⊖ **Loss of process control.** With the emergence of consumer technologies, many organizations struggle to overview which devices and applications are used in the organization. In the absence of norms and guidelines, employees have taken the lead to choose their tools without the involvement of central units, such as the IT department (Harris et al.,

2012). Studies have shown that a significant amount of IT use in organizations remains unnoticed without formal approval (Niehaves et al., 2015). Literature asserts that most employees act with well-meaning. Most common motivations are a desire to be more effective or to help others (Tarafdar et al., 2014). Such behavior also leads to legal violations, for example when using private applications for work without a professional license. Furthermore, it complicates the interoperability between decentral IT solutions as well as the collection of best practices and knowledge resources to be shared among co-workers (Ortbach et al., 2014).

⊖ **Security issues**. Issues regarding data and system security are arguably by far the most often mentioned concern with respect to working with consumer technologies at the digital workplace. Gens et al. (2011) termed security concerns the "largest barrier to more successfully supporting IT consumerization" (p. 13), particularly in the case of employee-owned smartphone and tablets. More general, two aspects cause the huge security concerns. First, technology characteristics pose additional risks to organizational IT systems. Mobile devices, such as laptops and smartphones require secure remote access to company data. Also, the devices may get lost or stolen anywhere and fall into the hands of third parties (Miller et al., 2012). Many of the software applications rely on cloud-based infrastructures, raising the question what happens if corporate data were stored outside the organizational jurisdictions. In any case, risks related to legal and regulatory issues arise (ENISA, 2012). Second, careless employees are said to be a greater security threat than hackers (Dimensional Research, 2012). Besides the enhanced self-responsibility of employees, many do not believe that IS security is part of their job description. Moreover, many employees are unaware of the information security policies in their organization (Bulgurcu et al., 2010). With respect to BYOD, companies struggle to enforce appropriate policies (Crossler et al., 2014; Niehaves et al., 2015). If guidelines are too strict, they might be disregarded and bypassed with IT tools that are not provided by the organization (Harris et al., 2012; Ortbach et al., 2013).

⊖ **Support complexity**. Under the assumption that the IT function will keep its central role for IT "more devices, times more apps, equals exponentially more complexity for IT to support and manage" (Gens et al., 2011, p. 4). Traditional values of the IT function, such as preferring standardized platforms to simplify management and support costs, are put into question if employees are allowed to choose IT tools on their own (Koch et al., 2014). Hence, every BYOD or CYOD strategy creates a target conflict between freedom

of choice and central IT support (Ortbach et al., 2014). Furthermore, users may adopt consumer technologies faster than it can be supported (Gens et al., 2011). "The notion of an approved device list is laughable," given the variety of tools that is available in the market (Golden, 2011). As a result, there is a controversy whether the IT function should still handle support request for all kind of devices and applications, including privately-owned IT. Surveys have estimated the share of organizations that already provide support for all kind of devices to be around 20 percent (Bradley et al., 2012; Vanson Bourne, 2013). Advocates of consumer-oriented working styles argue that employees are nowadays tech-savvy enough to provide IT support for privately-owned devices on their own or by helping each other (Harris et al., 2012). However, users will need resources for relationship building and knowledge sharing.

⊖ **Stress and work overload**. The influence of new flexible working styles enabled by consumer technologies on stress and work overload is apparent (Köffer, 2015). The ubiquity of the workplace makes it hard for workers to "switch off from work" (Dell & Intel, 2011a). An important antecedent for stress is work overload. By using consumer technologies, people get quickly used to work longer hours. Gens et al. (2011) found that 50 percent of all workers have used consumer technologies while on vacation. Managers know that their employees are basically at work all the time, and do not hesitate to assign tasks to them all around the clock (Niehaves et al., 2012). Also, through the earned flexibility to dual-use IT for both private and work purposes, people may be tempted to check work-related messages more frequently (Yun et al., 2012). Work overload can also be qualitative if work demands exceed an individuals' competence level. For instance, the increasing demand to self-organize IT related work is likely to be challenging for people with low IT proficiency (Kane & Borgatti, 2011). Furthermore, research has often validated stress as an outcome of the conflict between work and life roles (e.g., Ahuja et al., 2007). However, research also pointed out stress-relieving aspects of consumer technologies in particular (Duxbury et al., 2014; Yun et al., 2012), since the tools help to alleviate work complexities and allow a better management of work and life boundaries.

⊖ **Upfront investments.** Early studies on BYOD often argued that organizations may save IT acquisition costs because employees will buy devices at their own expense (e.g., Bradley et al., 2012; Dell & Intel, 2011b). In fact, consumer technologies are mostly cheaper than comparable counterparts from the enterprise space (Gens et al., 2011; Harris et al., 2012). To this end, firms have deployed BYOD programs to cut costs for

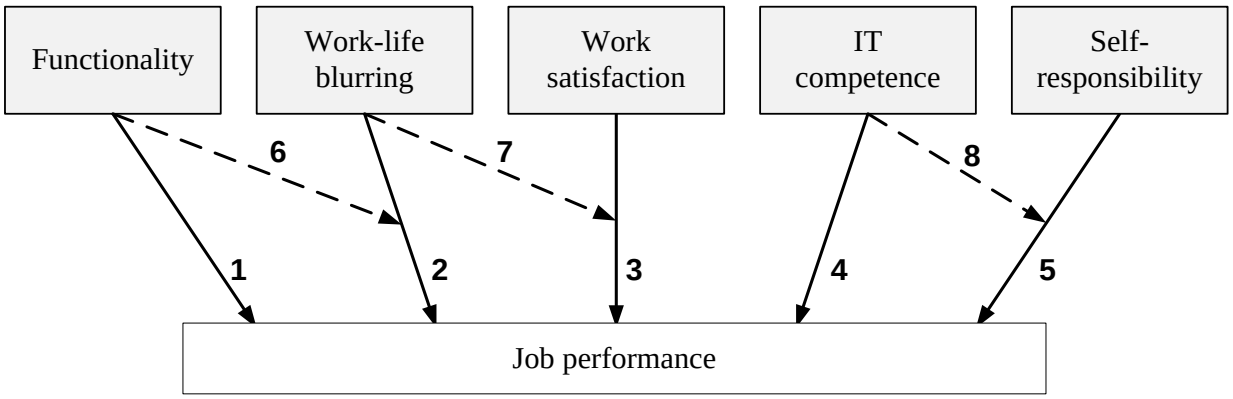
company-provided devices as well as mobile voice and data plans (Forrester, 2012). Most likely, some employees will rather make a capital investment for their company instead of continuing to low-productive work with outdated IT tools. However, this is probably a rather short-sighted strategy. Weeger & Gewald (2014) suggest that many employees carefully value benefits and risks before enrolling in a BYOD program. Cost risks in terms of data security (ENISA, 2012), considerations of employer attractiveness as well as investments in the technical infrastructure (e.g., remote access capabilities) force organizations to make upfront investments. With these prerequisites, organizations can better leverage the advantages of new working styles (Köffer, Fielt, et al., 2015).

4.2 Impacts on employee job performance

The productivity debate related to the use of consumer technologies at the workplace requires a detailed investigation of individual job performance. Job performance in the context of IS use has been viewed as individuals accomplishing tasks with efficiency, (decision) effectiveness, productivity, high awareness, and/or high quality of work (DeLone & McLean, 1992; Goodhue & Thompson, 1995). As part of this thesis and based on a qualitative study, Köffer, Ortbach, et al. (2014) develop a theoretical framework that conceptualizes the relationship between IT consumerization and individuals' job performance. Thereby, the study lays a special focus on effects that are beyond previously studied effects on job performance from task-technology-fit (Goodhue & Thompson, 1995) and mobile technologies (Gebauer & Shaw, 2010; Junglas et al., 2008). Hence, interview questions particularly addressed performance improvements through private ownership and self-selection of IT tools used for work purposes.

Figure 4.1 proposes the theoretical framework that resulted from the data analysis of interview transcripts using grounded theory methodology. Five core categories were discovered to describe the effects of consumer technologies on job performance: 1) Functionality, 2) Work-life blurring[9], 3) Work satisfaction, 4) IT competence, and 5) Self-responsibility. Following the data analysis, the core categories describe direct effects on job performance, both positive and negative. In the process of hierarchical coding, twelve subcategories were assigned below the core categories (Sarker et al., 2001).

[9] For the purpose of this thesis, the term has been changed from work-life overlap to work-life blurring to better fit the overall structure.



– adapted from: Köffer, Ortbach, et al. (2014)

Figure 4.1 Theoretical framework of consumer technologies and job performance

It is not claimed that the core categories are shaped without any overlapping. In particular, for the categories self-responsibility and work-life blurring, case data suggested ambiguous effects, i.e. both aspects can be beneficial or decrementing to job performance depending on other factors. Furthermore, it can be assumed that there are interaction effects between the core categories. Thus, self-responsibility and work-life overlap can be both detrimental and beneficial to job performance depending on individual circumstances.

As regards work-life blurring, employees realize positive effects on job performance if the functionality of consumer technologies allows flexible working, i.e. employees need fast and reliable remote access to conveniently work from anywhere at any time. Thus, work-life blurring and functionality interact with respect to job performance (relationship 6 in Figure 4.1). Furthermore, the framework shows an interaction effect between work-life blurring and work satisfaction. Given that consumer technologies are implicitly blurring work and life spaces, organizational culture, guidelines, and norms are interfering with work satisfaction. If people are unhappy with too many or too few overlaps between work and life space, work satisfaction is likely to be inhibited (Köffer, Junglas, et al., 2014) (relationship 7 in Figure 4.1). Another interaction effect was found between self-responsibility and IT competence. As statements from the interviews suggest, positive effects on job performance from enhanced self-responsibility will particularly unfold if employees bring in the required IT competence to exercise their responsibilities in a right manner (relationship 8 in Figure 4.1).

In the following, observations from the case study by Köffer, Ortbach, et al. (2014) are used to describe the core categories in more detail. The description is complemented by exemplary interview statements from the interviewees.

Functionality

Consumer technologies contributed to individual job performance through their technological features. First, employees can overcome corporate communication barriers when communicating with people, especially with those from external organizations (Köffer, Ortbach, et al., 2014). The reason is that people are often easiest to reach via social media applications, such as Facebook, Twitter or LinkedIn. Second, employees also appreciated the ease of use of consumer technologies. While the speed differences between consumer and enterprise technologies continue to disappear, first smartphones and tablet computers on the market were significantly faster and easier to use than comparable enterprise IT, e.g., classical cell phones and desktop computer (Harris et al., 2012). Third, employees evaluate their privately-owned IT against enterprise IT. In case that enterprise IT is not available or not suitable for a work task, privately-owned technology serves as a substitute. As a result, employees create workarounds which include sending data back and forth between privately-owned and enterprise systems. One interviewed executive from city administration gave the following example:

> *"I take photos with my private cell phone. Then, I use my private personal computer to download them and send them back to my business account via email. The only other alternative would be to ask the IT department to download the photos from my camera. Then, it would take much time until I finally get the pictures."*

Work-life blurring

By using consumer technologies, people are better able to take care of professional tasks on private trips or in daily private life. As technologies facilitate work from home since many years, it is not a completely new phenomenon. However, if people dual-use IT single devices and applications for private and work purposes – which was almost impossible without consumer technologies – there is no physical barrier between the two spaces anymore (Köffer, Junglas, et al., 2014). Obviously, this can make people more efficient in terms of job performance (Köffer, Ortbach, et al., 2014). More specifically, people save time because tasks like calendar synchronization between privately-owned and business devices are not required any more. Also, people will be reachable on their dual-use smartphone all around the clock unless they take technical actions against this, such as "containerized" phones that clearly separate private and business contents and activities (Harris et al., 2012). An IT staff member from the city administration was afraid that work practices with privately-owned IT get exploited:

> *"If the employee uses personal IT for business purpose, then the management could have the desire 'as a matter of principle, the employee carries everything needed to perform job tasks all the time,' so we should make use of it."*

Yun et al. (2012) compare this to an "open door policy" in the real world, where every co-worker can always step into one's office with a request and without prior notice. In this sense, lowering the boundaries between work and life spaces may also inhibit job performance (Cousins & Robey, 2005), for example if employees get overwhelmed with private tasks.

Work satisfaction

Work satisfaction is an important factor with respect to consumer technologies (cf. Section 4.1). Existing enterprise IT infrastructure often leads to frustrations among employees towards corporate IT (Moschella et al., 2004). Employees complain about blocked Internet access, locked functions on mobile phones, and restrictions on software provision. In turn, IT from the consumer space, such as smartphones and tablets complemented by public app stores, is demonstrating how enjoying and efficiently IT can be designed (Niehaves et al., 2012). In their interview study, Köffer, Ortbach, et al. (2014) found several other aspects of consumer technologies that might inhibit work satisfaction. First, employees worried about their privately-owned devices getting damaged during work use without any compensation. Thus, the costs will just be passed on to the employees. Second, privately-owned devices that are overloaded with corporate software to make them secure are likely to lose their consumer originality, and with that all other positive effects from consumer technologies. Third, employees fear that personal data are invaded by the organization. A staff member from the industry organization shared the following:

> *"[Company control of my private device] raises the question about access to my photos, videos, and movies or whatever I have on my personal device. I will be a 'glass human being' for my company because they will know all my preferences. I can understand people who say 'I don't want that.' They will probably call it a backup feature but in the background, they save private emails from my girlfriend, my wife, my concubine."*

IT competence

The influence of IT competence on job performance is not surprising since it resembles the IS literature on computer self-efficacy and end user proficiency, which both have been showed as strong predictors of performance (Marakas et al., 2007; Marcolin et al., 2000). However, it remains, of course, an important factor. Through consumer technologies, additional effects occur. For instance, people may first learn about technologies in the private realm and then

transfer this knowledge to the business realm to solve problems (Davis, 2013; Harris et al., 2012). When thinking about solutions for IT-related business problems, users often do not even distinguish between privately-owned and enterprise IT anymore. Instead, they focus on problem-solving. Furthermore, the proliferation of consumer technologies in the daily life has encouraged many people to follow the market closely. In doing so, they keep in line with the technical progress and are able to recommend technologies for organizational use (Köffer, Ortbach, et al., 2014). One employee of the industry organization stated:

> *"I really think that employees who use mobile devices or smartphones can better keep pace with technology advances. They face technological challenges and think about solutions, which then can be transferred to the organization. That's why I see an advantage if employees use their private IT."*

Self-responsibility

The findings of Köffer, Ortbach, et al. (2014) suggest that the self-assessment to make one's own IT choices can positively influence job performance. While privately-owned IT is naturally self-purchased, company-provided consumer technologies may be self-chosen or not. Thus, it is crucial whether employees freely decide which IT tool is used for certain work tasks. However, employees can also be reluctant to take over responsibilities because they doubt that they are able to solve IT-related problems as efficient as enterprise IT support. Consequently, Köffer, Ortbach, et al. (2014) found that the relationship between self-responsibility and job performance is influenced by IT competence; that is, "employees with high IT affinity were happy to use modern and more efficient IT solutions and, thus, were able to create a higher job performance benefits for themselves than their colleagues" (p. 270). One sales representative of the industry organization explained:

> *"The use of private consumer technologies brings no advantages for people with no IT affinity. But for people with high affinity towards IT, it does. They will get a strong motivational boost because they can use their self-purchased devices at work. They will dive deeper into work and will be better motivated."*

4.3 Non-malicious shadow systems

Organizations have put in place extensive guidelines and governance procedures concerning consumer technologies, but these are not always followed by employees (Crossler et al., 2014; Niehaves et al., 2015). Studies on information security compliance assert that the employees are the weakest link in the IT security defense (e.g., Boss et al., 2009). People rely heavily on

practices they experienced with their private IT. Hence, they transfer them to the professional world without caring whether there is organizational approval or not (Harris et al., 2012). Literature asserts that, for the most part, people engage in non-compliant behaviors without a malicious intention (D'Arcy et al., 2014; Guo et al., 2011). In turn, security is seen "as a nontask and thus not a goal that [users] will try to pursue" (Guo et al., 2011, p. 222). Ironically, the desire to be more effective might be the most common motivation to violate rules (Tarafdar et al., 2014).

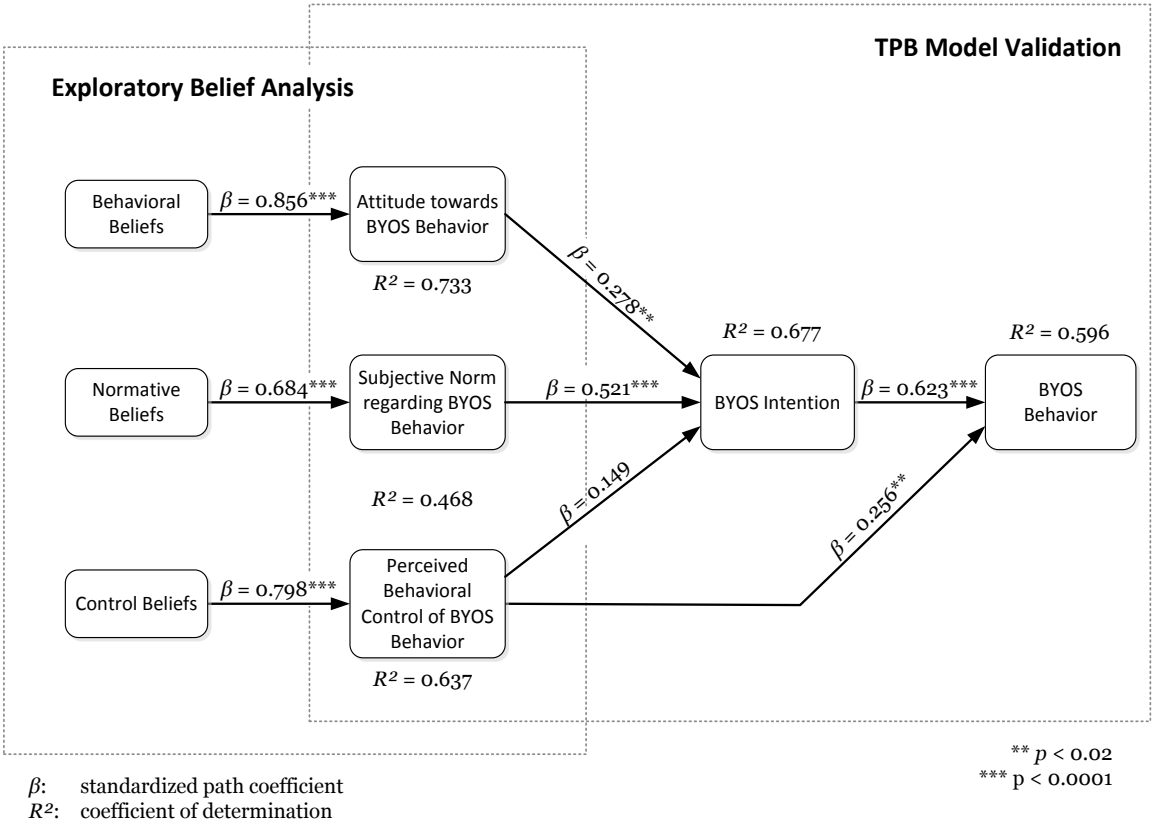
D'Arcy (2011) notices that organizations are in a "consumerization catch-22," forcing IT departments to provide up-to-date IT tools and applications through programs, such as BYOD or CYOD. Otherwise, the users will just bypass organizational guidelines and do not hesitate to bring in what they need for their work (Köffer, Fielt, et al., 2015). Outdated norms and standards of the organizations that makes them less productive than in the private realms might cause employees to violate policies with the ultimate goal to maintain their job performance (Köffer, Ortbach, et al., 2014). For instance, individuals develop small workarounds to solve problems of interoperability between the personal activity system and the professional activity system (Köffer, Ortbach, et al., 2014). While those actions usually violate corporate IT guidelines, they certainly help employees to be more productive workers, which is why the non-compliant behaviors are often implicitly tolerated by their direct supervisors (Köffer, Fielt, et al., 2015).

To understand the motivations of employees to turn towards hardware and software tools that are not provided by the organization, Ortbach et al. (2013), as part of this thesis, developed a comprehensive model that was tested with a quantitative survey. The study analyzed the process of how individuals idiosyncratically compose their individual IS. BYOS behavior[10] is thereby defined "as the use of technologies from the private or dual-use space for business purposes, i.e. the individualization of the professional activity system by means of consumer technologies" (Ortbach et al., 2013, p. 3). Since the quantitative data collection took place in organizations without formal approval of BYOS, the study focuses implicitly on unapproved consumer technologies adoption. The conceptualization deliberately excludes the adoption of approved consumer technologies and enterprise IT, since such procedures are rather comparable to standard top-down IT adoption processes (Ortbach et al., 2013). Instead, the study focuses on bottom-up IT adoption that resembles the process with respect to consumer technologies adoption trends (Leclercq-Vandelannoitte, 2015).

[10] In the study, the term „IT consumerization behavior" is used. For a better fit to the overall context of the thesis, the term has been changed to "BYOS behavior".

The comprehensive model of BYOS adoption draws upon the theory of planned behavior (Ajzen, 1991). The theory proposes that the behavioral intention to carry out the behavior is influenced by three constructs: 1) Attitude towards the behavior, 2) Subjective norm, and 3) Perceived behavioral control. *Attitude towards the behavior* refers to the individual beliefs that the behavior will yield the desired results. *Subjective norm* refers to the perceived social pressure by significant others (referents) to engage in the behavior. *Perceived behavioral control* is defined as "people's perceptions of the degree to which they are capable of, or have control over, performing a given behavior" (Fishbein & Ajzen, 2010, p. 64).

For using the theory to explain BYOS behavior, two steps were performed. First, the notion of "using other technologies than those provided by the individuals' company to perform work tasks within the next two months" was incorporated in all constructs. Second, based on a review of the literature on IT consumerization, salient beliefs were identified that can explain the behavior of using consumer technologies from the private or dual-use space instead of the technology that is provided by the organization.



- adapted from: Ortbach et al. (2013) as in Ortbach (2015)

Figure 4.2 Analysis of BYOS behavior using the theory of planned behavior

As the first part of the analysis, the theory of planned behavior was applied to the concept of BYOS intention to validate the appropriateness of the theory for the context. The results, depicted in Figure 4.2, showed that subjective norm had the highest effect ($\beta = 0.521$; $p < 0.0001$) on BYOS behavior, suggesting the opinions of referents play an important role. As the effect is much higher than the effect originating from attitude ($\beta = 0.278$; $p < 0.02$), the study suggests that "it is more important to behave in line with the social context than it is to follow individual requirements concerning IT selection" (Ortbach, 2015, p. 36). Thus, individuals frequently follow the path of direct referents when selecting IT that is not provided by their organization. In turn, the influence of perceived behavioral control on BYOS behavior turned out to be rather low and partly insignificant. Thus, the role of organizational constraints cannot be seen a limiting factor of BYOS intention (Ortbach et al., 2013). To this end, the results raise the question whether to the formulation of policies and guidelines is effective to avoid the use of consumer technologies that is not company-provided.

The second part of the analysis was an explanatory belief analysis, addressing behavioral, normative, and control beliefs. The results of the exploratory belief analysis are shown in Table 4.2. A range of potential beliefs was extracted from both academic literature and practitioner literature with respect to the IT consumerization trend (Ortbach et al., 2013). As for normative beliefs, colleagues, direct supervisors, chief executive, friends, and family were considered as normative referents (Giles & Larmour, 2000; Guo et al., 2011; Taylor & Todd, 1995). In line with the theory of planned behavior, normative beliefs were measured as injunctive and descriptive. The former refer to what the referent thinks the individual should do while the latter captures what the referent does himself (Ortbach et al., 2013).

The highest correlations between beliefs and BYOS intention were found for *easier to use*, followed by *performance improvements*, and *suitability for the task*. All three beliefs relate to the functionality of consumer technologies confirming their important role for job performance (Köffer, Ortbach, et al., 2014). In addition, *feels familiar* and *more fun* showed significant correlations, which underscores the relevance of hedonistic factors. As regards behavioral beliefs that are associated with negative outcomes, highest correlations were found for *fear for disciplinary actions* of the organization and *put important data at risk*. These results show that employees are mostly aware of the risks associated with the use of consumer technologies and are willing to comply with rules and guidelines.

Table 4.2 Explorative belief analysis of BYOS behavior

	Correl[a]			Correl[a]
Behavioral Belief		**Normative Referent**		
Performance improvements	0.534**	Colleagues	(injunctive)	0.309**
Easier to use	0.536**	Direct Superior	(injunctive)	0.354**
More fun	0.415**	Chief Executive	(injunctive)	0.190
Suitability for the task	0.515**	Friends	(injunctive)	0.245*
Prestige gain	0.019	Family	(injunctive)	0.158
Aesthetically pleasing	0.285*	Colleagues	(descriptive)	0.433**
Be yourself	0.285*	Direct Superior	(descriptive)	0.430**
Feel in control	0.388**	Chief Executive	(descriptive)	0.278*
Feel competent	0.220	Friends	(descriptive)	0.481**
Feels familiar	0.456**	Family	(descriptive)	0.192
Disciplinary actions	0.403**			
Less reliable	0.162	**Control Belief**		
Distraction	-0.099	Recognize potentials	(Installation)	0.273*
Put important data at risk	0.375**	Necessary knowledge	(Installation)	0.367**
Technology wears out	-0.043	No technical support	(Installation)	0.215
		Technical restrictions	(Installation)	0.122
		Compatibility problems	(Installation)	-0.033
		Monetary costs	(Installation)	0.404**
		Access	(Installation)	-.302**
		Necessary knowledge	(Use)	0.272*
		No technical support	(Use)	0.328**

* $p < 0.05$; ** $p < 0.01$;

[a] Correlation between control belief composite (belief strength × perceived power of control factor) and BYOS intention.

- adapted from: Ortbach et al. (2013) as in Ortbach (2015)

As for normative beliefs, the results show that colleagues, the direct superior, and friends influence BYOS intention rather than the chief executive and family. Thus, both the private and the work-related social contexts are important drivers of BYOS behavior (Ortbach, 2015). Moreover, the behavior of the referents (descriptive beliefs) plays a larger role than their opinion on what the individual should do (injunctive beliefs). Regarding the minor role of the chief executive, individuals seem to be primarily influenced by their direct work-referents. One explanation for this is that both benefits and risks of new consumer technologies diffuse quickly by means of word-of-mouth within an organization. Thus, this finding underscores the important role of organizational culture and norms in relation to the formulation of policies and formal sanctions (Tarafdar et al., 2014).

As regards control beliefs, especially *monetary costs* that have to be covered by employees were found as an inhibiting factor. A significant correlation with BYOS behavior was also found for *necessary knowledge*, *recognize potentials*, and *no technical support*. The latter three beliefs resemble an individuals' expertise with consumer-oriented technology. The inhibiting role of these factors demonstrates that it cannot be taken for granted that tech-savvy knowledge workers inherently know to apply any technology in any context. Instead, self-efficacy with technology is likely to remain an important factor of BYOS adoption.

On a more general note, the study shows that "IT individualization behavior is not determined by a few single factors, but rather by a complex set of factors" (Ortbach et al., 2013, p. 14). Traditional factors of technology acceptance, such as perceived ease of use, perceived usefulness, and self-efficacy remain important for BYOS behavior. It is important to note that the study implicitly investigated IT tools at work that have not been formally approved by the organization, what "may be seen as either a threat or an opportunity" (Harris et al., 2012, p. 101). Thus, the study dealt with shadow IS that were created unauthorized, and thus may be viewed as deviant behaviors.

Research has pointed to positive outcomes of deviant behaviors that can become desirable for organizations, especially when considering dynamic environments (Spreitzer & Sonenshein, 2004). As regards IT, this notion refers to avoid missing important technologies at the consumer market, sometimes called "the next big thing." In this sense, using IT that is not provided by the organization can resemble a powerful source of innovation inside company walls (Behrens, 2009). In particular, tech-savvy employees can recreate work procedures by means of productive workarounds, ultimate leading to higher productivity and employee-driven innovation (Zimmermann & Rentrop, 2014).

4.4 Employee-driven IT innovation

With the emerging use of consumer technologies, the notion of employee-driven IT innovation is increasingly becoming real (Köffer, Ortbach, et al., 2015). Researchers have observed a fundamental shift how IT innovation processes flow. In the 20th century, the innovation process was merely top-down, i.e. new technologies were first deployed in organizations. With consumer technologies in the game, the opposite can be observed (Leclercq-Vandelannoitte, 2015; Moschella et al., 2004). Increasingly, IT tools that originate in the consumer space move in a bottom-up way into corporate IT infrastructures (Moore, 2011). For instance, smartphones and tablets are carried to the workplace by employees and are used in addition to, and sometimes in lieu of, existing enterprise IT (Köffer, Ortbach, et al., 2015).

In the survey of Harris et al. (2012), 61 percent of executives considered increased organizational innovation as an important benefit of IT consumerization. Through increased self-responsibility of consumer-oriented working styles, companies are "able to instill a culture of innovation" (Junglas et al., 2014, p. 15). Following the slogan "innovation is everyone's job" (Andriole, 2012b), organizations leverage organizational innovation at the bottom level, i.e. at the workplace of individuals, by means of consumer technologies. In other words, employees may "use digital technology to innovate on their own behalf" (Gates, 2012). The developments are reminiscent of the early 1980s when technically skilled graduates initiated the era of end-user computing with considerable productivity gains for organizations (Benson, 1983). Harris et al. (2012) call this the first iteration of an employee-driven IT innovation – IT consumerization, on the other hand, is destined to be the second.

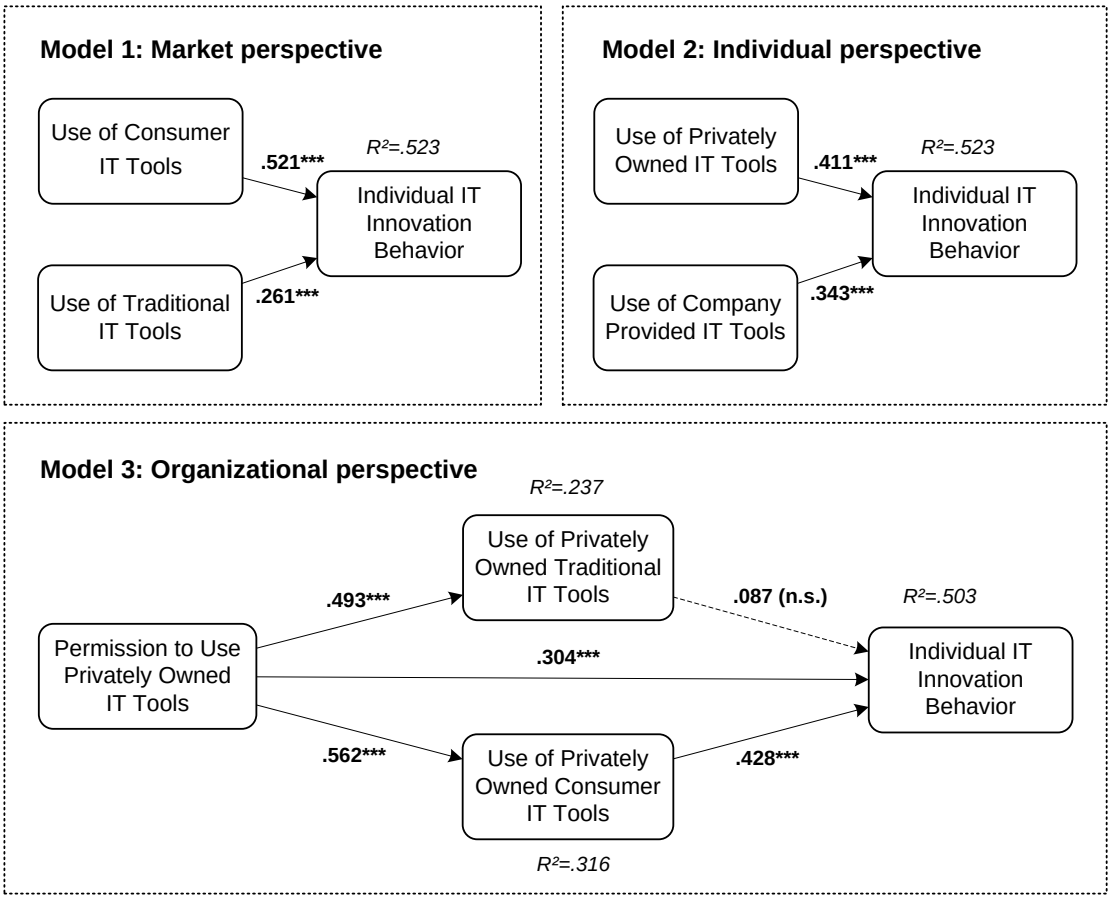
Three characteristics make clear why this comparison of end user computing and IT consumerization is appropriate. First, both trends originate in the consumer space. For end user computer, Hackathorn & Keen (1981) stated that "a significant percentage of sales of small-scale computers are to individuals rather than corporations" (p. 22). Likewise Moschella et al. (2004) coined the term IT consumerization by drawing on the dual-use of IT both by business and consumers. Second, both "phenomena" are user-liberating technologies, i.e. they are both rather driven bottom-up than top-down (Benson, 1983; Moschella et al., 2004). While the personal computer precipitated acceptance by the IT departments in the 1980s, IT departments today are overrun by employees with powerful consumer technologies (Harris et al., 2012). Third, end user computing was initially rather characterized by a distributed than centralized technological architecture (Brown & Bostrom, 1989). Likewise, IT consumerization is associated with a variety of ways how employees use IT, leading to the decentral and individual use of many devices and applications rather than consistent use through IT standardization (Junglas & Harris, 2013; Koch et al., 2014).

Two reasons further explain why consumer technologies contribute to employee-driven innovation. First, the changed nature of the digital workplace underscores innovative behavior. Employees have a say in what tool is applied to their job-related problems (Köffer, Ortbach, et al., 2015). They do not have to wait until the whole organization agrees on using a new software application, but can start micro innovating at the single workplace. Second, the new generation of tech-savvy knowledge workers possesses required task-specific expertise for innovative actions. In the context of IS, task-specific expertise has been conceptualized as the "user's knowledge about capabilities of technology, its features, potential use, as well as costs and benefits" (Nambisan et al., 1999, p. 372).

The relation between consumer technologies and innovation has not yet been proven empirically. To address this research gap, Köffer, Ortbach, et al. (2015) conducted a quantitative study that juxtaposes the distinct perspectives of IT consumerization to quantify the relationship between IT consumerization and individual IT innovation behavior in detail. The core dependent variable of the research model is individual IT innovation behavior. For the conceptualization of the variable, the study adopts the definition of individual workplace innovation by West & Farr (1990) and defines employee-driven IT innovation behavior as "the intentional introduction and application of information technology (both hard- and software), new to the organization, designed to significantly benefit the individual, the organization, or the wider society" (p. 365).

The definition for employee-driven IT innovation behavior thereby resembles user behavior in the context of IT individualization, where people experiment with different devices and software applications (Baskerville & Lee, 2013), and so create entirely new processes that open up new ways to perform work tasks (Baskerville, 2011a). It is in line with the definition of individual innovation in the management literature (Anderson et al., 2004), and thus comprises more than the creative process of idea generation but also evaluation, selection of alternatives, and implementation.

Following Harris et al. (2012), the three research models in Köffer, Ortbach, et al. (2015) relate to the three distinct perspectives of IT consumerization as described in Section 2.4. Use of consumer technology was measured by the self-reported extent of laptop and desktop use for traditional IT, as well as smartphone, tablet, and netbook use for consumer technologies. Please refer to part B for details about the measurement items. Figure 4.3 depicts the three research models and the results of the structural model testing.



Source: Köffer, Ortbach, et al. (2015)

Figure 4.3 Effects of IT consumerization on individual IT innovation behavior

The model regarding the *market perspective* juxtaposes consumer technologies and traditional IT tools. It is hypothesized that consumer technologies tools lead to higher levels of individual IT innovation than the use of traditional IT tools. While IT use alone is likely to positively influence innovative behavior (Li et al., 2013), consumer technologies further increase this effect due to their functionality (Köffer, Ortbach, et al., 2014) and form factors that allow easier use and adoption than traditional enterprise IT (see Section 4.1). The survey results show that the impact of use of consumer technologies ($\beta = 0.521$; $p < 0.001$) on individual IT innovation behavior is much higher than that of traditional IT tools ($\beta = 0.261$; $p < 0.001$). Path comparison analysis showed that the difference is statistically significant, confirming the hypotheses.

The model with respect to the *individual perspective* juxtaposes privately-owned IT tools and company-provided IT tools. Thus, it focuses on the ownership of the tools. As hypotheses, the use of privately-owned IT should have a positive effect on individual IT innovation since employees have self-purchased the tools for a reason, i.e. they know the tools better and have a

steeper learning curve in applying them. It was found that both the use of privately-owned IT ($\beta = 0.411$; $p < 0.001$) and company-provided IT ($\beta = 0.343$; $p < 0.001$) positively influences individual IT innovation behavior. However, the small difference between the path coefficients is insignificant, i.e. there is no statistical evidence, that ownership exerts an effect on individual IT innovation behavior.

The model regarding the *organizational perspective* uses privately-owned IT and the permission to use privately-owned IT as independent variables. Here, it is hypothesized that the permission to use privately-owned IT tools for work leads to increased individual IT innovation behavior. This hypothesis was confirmed as the data showed a significant effect ($\beta = 0.304$; $p < 0.001$) beyond what is mediated by the actual use of privately-owned IT. Also, the permission to use privately-owned IT tools at work had also a strong effect on their actual use. Here, only the use of private consumer technologies significantly impacted individual IT innovation behavior while the use of privately-owned traditional tools turned out to have no influence.

In summary, the results of Köffer, Ortbach, et al. (2015) suggest that the introduction of consumer technologies to the organization is beneficial with respect to the question of the impact of IT consumerization on innovation. To this end, it is less important whether IT tools are company-provided or privately-owned. An explanation for this difference can be found in the notion of knowledge transfer from the private realm to practice (Köffer, Ortbach, et al., 2014). An individual's knowledge about consumer technologies is related to its functionality rather than ownership of the tools. Thus, the effect of knowledge transfer is similar irrespective of who owns the used IT tools. In other words, CYOD and BYOD programs are unlikely to yield different effects on employee-driven innovation.

The fact that allowing privately-owned devices – regardless whether employees use this option or not – had positive effects on individual IT innovation behavior suggests that the mere perception of choice and freedom alone may contribute to innovation (Köffer, Ortbach, et al., 2015). This finding underscores related research on the influence of user autonomy and increased empowerment on innovation (Ahuja & Thatcher, 2005; Junglas et al., 2014). In other words, an organizational culture that welcomes the experiential use of privately-owned IT is likely to enhance employee-driven innovation.

4.5 Intensification of work-life blurring

"It would've been better for me to use two separate phones and two email accounts. I thought using one device would be simpler." Using these words, Hillary Clinton justified her use of a personal email account for work-related emails during her time as secretary of state (Schmidt, 2015). The news conference was preceded and followed by an intensive political debate about the legitimacy of her email use (Köffer, 2015). Although it can be assumed that such dual-use of email accounts is likely to be common practice for many politicians, Clinton decided to admit a personal failure. The email controversy resembles individual and organizational challenges that result from dual-use of technologies. Managing technologies has become a cornerstone in managing work and private life spaces (Groysberg & Abrahams, 2014).

Several authors noticed an intensification of work-life blurring through the proliferation of consumer technologies. Yun et al. (2012) suggested that "office home smartphones" used for both personal and professional tasks intensify the effect of blurring boundaries "by affecting more people and more work functions, and doing so more ubiquitously" (p. 143). Schalow et al. (2013) termed emerging social media and mobile tools "as a catalyst in the ongoing blurring of work-life boundaries" (p. 10). Sarker et al. (2012) observed "an increasing need for ubiquitous access to systems and information" in many sectors that lead to intrusion of these technologies into the private lives of employees (p. 143).

The intensified blurring of work and life spaces poses the question whether people are still able to manage the two spaces with positive outcomes for their well-being. In other words, work-life balance is "an elusive ideal and at worst a complete myth" for senior executives (Groysberg & Abrahams, 2014 p. 60). At the same time, organizations face pressure to preserve their work culture. The notion of work-life balance has emerged as desirable state and is accepted as an important antecedent for people's well-being (OECD, 2013) as well as a predictor of psychological health factors, such as stress and work exhaustion (Ahuja et al., 2007; Ayyagari & Grover, 2011).

It is often argued that work and life spaces should be segmented to achieve work-life balance (Perlow & Porter, 2009). In turn, the notion of work-life balance is also getting criticized. For instance, entrepreneurs and managers often promote a culture of work-life integration, manifested through dual-use of technologies and open office spaces (Sarker et al., 2012). The thoughts behind this are a strong identification with the employer, i.e. working is not seen as a

burden and inhibitor of work-life balance. In fact, studies also showed that work and life roles do not necessarily conflict and that positive experiences from one role can enrich the other (Greenhaus & Powell, 2006). Also, mobile technologies allow frequent "micro-role transitions" between work and life domains, so that each role can quickly receive attention if requested (Ashforth et al., 2000; Cousins & Robey, 2015).

Literature has emphasized that preferences of work-life integration and segmentation lie on a continuum, i.e. classifying workers into groups of integrators and segmentors is invalid (Ashforth et al., 2000; Nippert-Eng, 1996). Instead, the very same people follow diverse integration and segmentation preferences within each relevant domain depending on tasks and circumstances with regard to temporal, spatial and psychological dimensions (Cousins & Robey, 2015; Sayah, 2013) – "and even for different technologies in the same situations" (Köffer, Junglas, et al., 2014, p. 14). For example, employees might prefer not to log on to corporate systems after hours, but feel quite at ease for checking work email before going to bed from the privately-owned smartphone.

Moreover, preferences are subject to change in the course of life, depending on individual's career ambition or family situation (Sarker et al., 2012). For example, people usually demand more work-life segmentation if they are parents. Enabled by consumer technologies in the home office, flexible private time slots between working hours throughout the day have become common practice to care for the children. As a consequence, this thesis uses the terms *integrators* and *segmentors* only by referring to specific situations at one point in time.

Since individuals may vary in their need to keep work and life separated, boundary theory suggest that a misfit between the organizational culture and individual preferences may result in a work-life conflict (Ashforth et al., 2000; Kreiner, 2006; Rothbard et al., 2005). An employee whose company favors dual-use of technologies might find it hard to follow this integrative culture if he or she prefers a clear delineation between work and private spaces. Likewise, an employee who prefers to integrate work and personal life might find it difficult to obey a separating culture within the organization (Köffer, Junglas, et al., 2014).

Extant literature has extensively studied the notion of work-family conflict[11] – a synonym of work-life conflict – defined as a "form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect" (Greenhaus & Beutell, 1985, p. 77). For instance, a high work-life integration enabled by dual-use of consum-

[11] An overview of related studies on work-life conflict and its synonyms can be found in Yun et al. (2012) and – within IS context – in Köffer, Junglas, et al. (2014)

er technologies for both work and life purposes might be a reason for heightened work-life conflict. At the same token, however, the "very same integration might also be a source of lowered work-life conflict, since it eases transitioning between roles from one domain into the other" (Köffer, Junglas, et al., 2014, p. 4).

As part of this thesis, two studies analyzed the blurring of work and life spaces and its resulting conflicts in more detail. The first study by Köffer, Anlauf, et al. (2015) took a qualitative approach by interviewing people from four different organizations about their habits of managing work and life spaces with consumer technologies. The second study by Köffer, Junglas, et al. (2014) carried out a quantitative survey that focused on dual-use of the same technologies for both work and life spaces.

By means of a multiple case study, Köffer, Anlauf, et al. (2015) aimed to investigate how employees manage work and life boundaries using mobile consumer technologies. In situations where people strive for integrating work and private life spaces, the authors identified three aspects related to IT consumerization: 1) Dual-use of company IT for private tasks, 2) Dual-use of private IT for work tasks, and 3) Remote access to work data. Table 4.3 displays the three aspects and shows – drawing on the case data – under which circumstances the aspects will likely lead to work-life balance or conflict.

Table 4.3 Balance and conflict of work-life integration preferences

Balance	Consumer technologies aspect	Conflict
Allowed and convenient	Dual-use of company IT for private purposes	Not allowed or inconvenient
Allowed and convenient	Dual-use of private IT for work purposes	Not allowed or inconvenient
Possible and convenient	Remote access to work data	Impossible or inconvenient

Source: Köffer, Anlauf, et al. (2015)

In earlier stages of mobile work, people typically possessed separated devices for work and play (Dery et al., 2014). Later, the chance to dual-use the same technologies for work and private tasks has become convenient to fulfill work-life integration preferences. From the ownership perspective, there are two ways to enable dual-use of technologies: 1) Private use of company-provided IT and 2) Work use of privately-owned IT (BYOS). As regards COPE, consequently, an organization that does not tolerate if people use company-provided IT for

private matters (COPE) will most likely cause people to bring their own system to work and on business trips (Köffer, Anlauf, et al., 2015). In turn, BYOS implies the full electronic unification of private and work contents. To enable dual-use via BYOS, remote access from privately-owned devices is essential. While the proliferation of consumer technologies has considerably increased the connectivity of IT tools, the remote access capabilities must be fast and reliable to support workers following their work-life integration.

Regarding situations where people strive for segmenting work and private life spaces, Köffer, Anlauf, et al. (2015) identified three aspects: 1) Distinct devices for private and work purposes, 2) Separate private and business accounts, and 3) Quality of company-provided IT. Table 4.4 shows under which circumstances the aspects will lead to work-life balance or conflict.

Table 4.4 Balance and conflict of work-life segmentation preferences

Balance	**Consumer technologies aspect**	**Conflict**
Convenient (4)	Distinct devices for private and work purposes	Inconvenient (2)
Convenient (4)	Separate private and business accounts	Inconvenient (7)
Satisfying (7)	Quality of company-provided IT	Not satisfying (34)

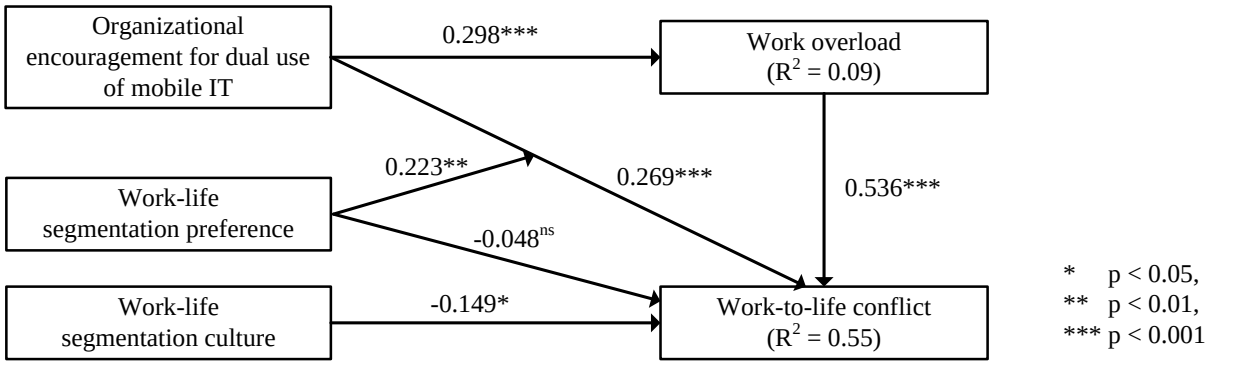
Source: Köffer, Anlauf, et al. (2015)

For situations where people want to segment work and life spaces, dual-use of technologies is not favorable. That is why some workers retain two distinct devices to have an absolute separation between work and life spaces. The findings suggest, however, that people have to make an additional effort to realize their preference. For instance, they face additional work for data integration between the two devices, they must carry around additional chargers, and they must increasingly justify their decision towards their social context, for example, their direct supervisors.

Managing multiple accounts in social media applications requires additional effort. Most social media providers do not support integration between private and business accounts, i.e. users are either urged to dual-use one single profile or manually integrate separate profiles. One example for a convenient separation of private and business accounts can be found among cloud storage providers. Here, users are allowed to have two separated profiles, one for private files and another for business files. As the profiles can be integrated, bonus space acquired in the professional account is transferable to the private account.

The notion of convenience seems to be crucial when realizing work-life preferences. The data suggested that people may give up individual preferences if their realization is perceived as inconvenient or cumbersome (Köffer, Anlauf, et al., 2015). This finding relates to the concept of usefulness for technology acceptance, which is more important for voluntary technology adoption (Wu & Lederer, 2009). Thus, employees will carefully decide, based on factors like usefulness and convenience, when to dual-use technologies for private and work matters. This behavior is likely to increase the use of other technologies than those provided by their organization (Ortbach et al., 2013), either because company-provided IT is perceived as inconvenient or just not available for dual-use.

In their quantitative study, Köffer, Junglas, et al. (2014) proposed a research model that investigated the relation between organizational encouragement for dual-use of IT and work-to-life conflict[12]. The model also measured the influence of work-life segmentation culture and preferences on this relation. For the purpose of the study, organizational encouragement for dual-use was defined as "organizational promotions, rules and strategies that encourage the dual-use of a single IT device or application for both private and work activities" (p. 6). Figure 4.4 illustrates the study's research model and hypotheses and shows the results from structural model testing.



Source: (Köffer, Junglas, et al., 2014)

Figure 4.4 Analysis of dual-use of mobile technologies and work-to-life conflict

A significant relationship was measured between organizational encouragement for dual-use of mobile technologies and work-to-life conflict ($\beta = 0.269$; $p < 0.001$). The moderation analysis also showed that the effect is stronger for people that strive for work-life segmentation ($\beta = 0.223$; $p < 0.01$). The relations remain significant besides the strong impact of work overload on work-to-life conflict ($\beta = 0.536$; $p < 0.001$). The research model included work overload

[12] The term work-to-life conflict instead of just work-life conflict is used in the study since the word "to" clarifies the direction of spillover effects from work to life. See Köffer, Junglas, et al. (2014) for a disambiguation.

because the concept is an important antecedent of work-to-life conflict in the literature (e.g., Yun et al., 2012). Organizational encouragement for dual-use of mobile technologies also exerts a positive effect on work overload ($\beta = 0.298$; $p < 0.001$). For a full overview of the results of hypothesis testing, please refer to part B.

The influence of organizational encouragement for dual-use on work overload and work-to-life conflict underscores that policies regulating the use of mobile technologies are an essential factor for influencing the well-being of employees (Köffer, Junglas, et al., 2014). In detailing the influence of organizational strategies on work-to-life conflict, an indicator analysis was conducted that compared the influence of the particular items used in the survey.

Table 4.5 documents the results of the indicator analysis. The analysis revealed that correlations for encouragement for dual-use of company-provided IT (COPE) were considerably lower than for dual-use of privately-owned IT (BYOS). The highest correlations were measured at the items "My workplace encourages the use of privately-owned mobile devices for work purposes", followed by "My workplace encourages the use of private software accounts for work purposes", and "My company offers support for my privately-owned IT if I use it for work purposes" (Köffer, Junglas, et al., 2014).

Table 4.5 Correlation of dual-use strategies with work-to-life conflict

Strategy	**Mean**	**SD**	**Correl**[(b)]	**t-value**
Encourage use of one single device	3.137	1.987	0.278	2.828
Encourage use of private devices	2.966	1.974	0.400	4.448
Encourage use of private software	2.605	2.022	0.332	3.557
Easy access to company data from private IT	3.950	2.361	0.243	2.430
Offer support for private IT	3.000	2.168	0.332	3.558
Provide a budget for IT purchases	2.736	2.186	0.284	2.979
Allow private use of company IT	3.876	2.174	0.221	2.165
Carry costs for private calls, made with company IT	4.045	2.295	0.202	1.848
Allow private software on company IT	3.317	2.263	0.285	3.002

[(b)] Correlation between the single indicator and latent variable of work-to-life conflict

Source: Köffer, Junglas, et al. (2014)

In summary, both studies clearly confirm that consumer technologies strongly intensify work-life blurring with considerable consequences for peoples' well-being. Interestingly, it is often a mix of certain technology aspects that constitute the intensifying effect on work-life blurring. Working during holidays is a perfect example in this regard: While many employees still refuse to take along a company-provided device on vacation, BYOS programs as well as convenient remote access will create the implicit chance to work during the holiday, since the privately-owned device is likely to be at hand.

Workers have established a variety of personal boundary management strategies to match particular situations in which work and life spaces are blurring (Cousins & Robey, 2015). If "technological boundaries dissolve, people must build up mental boundaries to maintain work-life separation" (Köffer, Anlauf, et al., 2015, p. 10). It seems that many individuals are unfit to deal with this mental task – or their job duties somehow outperform the desire of work-life segmentation. More specifically, the indicator analysis showed that particularly BYOS makes it hard for individuals to maintain boundaries between work and life spaces.

Dery et al. (2014) found that mobile workers tend "not to disconnect totally from either work- or non-work communication" (p. 569). As a result, individuals are likely to be reachable for work via consumer technologies more than necessary. In other words, the group of "always at work" employees does likely contain not only people with a preference for work-life integration, but also those who have given up to realize their work-life segmentation preference anymore (Köffer, Anlauf, et al., 2015).

5 Managerial implications for digital knowledge workplace design

5.1 Enhancing user autonomy

Enabled by the increased IT competence beyond the IS department (Davis, 2013), digital knowledge work of the future will be characterized by enhanced user autonomy. Such autonomy presumes that knowledge workers will determine their technological needs to be productive at work (Davenport, 2011). Consumer technologies, such as smartphones are easy to use and allow employees to be empowered about which applications to use for work and how to use them for work (Junglas et al., 2014). Thus, the IT consumerization trend has accelerated the debate about the responsibilities of end users of technology – knowing that they experience limitless freedom with consumer technologies in the private lives (Koch et al., 2014).

It is evident that a more self-organized workforce requires changes in the leadership culture of an organization. Thus, managers should promote an organizational climate that supports decentralized and self-responsible use of information assets (Köffer, 2015). To achieve this, many leaders are likely required to develop new skills, resulting in training recommendations for supervisors, who have a prominent position in digital workflows. For instance, supervisors need to acquire social media skills and help to build communities (Huy & Shipilov, 2012).

The increased complexity of central functions to provide IT support for problems with specific devices or application has increased the need to improve relationship building between users of technology (Köffer, 2015). Interpersonal networks in the form of knowledge repositories may help mobile workers to find answers to open issues on their own (Ahuja et al., 2007). Enterprise 2.0 tools and help communities are perfectly suited to support this relationship building between employees and enable user-to-user support (Ortbach et al., 2014).

The quality of work can also be improved by enhanced exchange of mobile work practices between departments and individuals so that people in the organization work more closely together (Elie-Dit-Cosaque et al., 2011; Sarker et al., 2012). For instance, organizations can provide chances to share and create useful applications for work (Jung, 2014). However, it cannot be assumed that the pure existence of Enterprise 2.0 tools will lead to better collaboration within the company. Instead, managers must actively promote their use to reach the goals of such initiatives (Kügler et al., 2015).

Maximizing positive effects from employee autonomy does not necessarily mean that users have to privately-own the IT they use for work. Köffer, Ortbach, et al. (2015) found that

regarding innovative behaviors, it is irrelevant who owns the tool. Most likely, an individual's knowledge about the functionality of consumer technologies is not related to ownership. In contrast, the perception of freedom regarding IT choice can affect an individual's IT innovation behavior. Also, several studies proposed positive effects on job performance, if employees have a say in selecting the IT for work, e.g., regarding BYOD or CYOD programs (Harris et al., 2012; Köffer, Ortbach, et al., 2014).

Given increased user autonomy, employees will not make use of it as long as they are afraid of making mistakes. To counter this, managers should actively pursue a culture that welcomes experimental IT use (Junglas et al., 2014), ensuring at the same time that data and system security is not endangered. Recall that experiential IT use is a constituting characteristic of individual IS (Baskerville & Lee, 2013) and evident to embrace new IT trends with productivity potential at the consumer market. Strategies, where the monitoring of market developments is an exclusive task for the management will most likely fail (Köffer, Ortbach, et al., 2014). Instead, there is a need that employees can play around new IT solutions to evaluate whether the tools have the potential to improve business processes (Köffer, 2015). For instance, individuals routinely uninstall and reinstall software applications (Baskerville, 2011a). If employees that try out new IT practices decentralized, organizations can create "a resource of creativity and innovation" (Behrens, 2009, p. 128).

In considering the heterogeneity of user requirements, managers must become used to the idea that decentralized technological responsibility and enabling choice is required to optimize employees' job performance (Köffer, Ortbach, et al., 2014). Hence, organizations should be aware that, besides concerns about data security, increasing employees' self-responsibility with technology is ultimately good for the organizations (PricewaterhouseCoopers, 2011). Solution and work practices that individuals applied in their individual IS can become an important source of work innovation and "guide changes in the organizational IS" (Baskerville, 2011a, p. 8). With the support of the organization, such practices may become even more valuable because individuals' price and resource limitations will no longer apply.

At the same time, managers must ensure not to overwhelm their staff with responsibilities. Mazmanian et al. (2013) observed that knowledge workers sometimes deliberately restrict their autonomy by being connected to work through their mobile devices all around the clock. For example, managers can think about when exactly to send out messages and tasks to their employees to avoid detrimental effects (Li et al., 2011). People need help to handle better their daily work demands (Hemp, 2009).

Table 5.1 summarizes the managerial implications to maintain process control at the digital knowledge workplace, including concrete examples for their implementation.

Table 5.1 Summary of managerial implications to enhance user autonomy

Recommendation	Description	Example
Enhance collaboration	Improve relationship building and exchange about IT work practices	Use Enterprise 2.0 tools to enable virtual user-to-user support
Freedom of choice	Let people choose the devices and applications they work with	Choose Your Own Device or Bring Your Own Device programs
Open organizational culture	Promote an organizational climate that supports decentralized and self-responsible IT use	Organize face-to-face meeting or brown bag session where people share stories about professional IT use
Allow experimentation	Let people experiment with new IT solutions from the consumer market to evaluate their business purpose	Make it possible and easy for knowledge workers to install and uninstall software from the web and app stores

5.2 Maintain control over IT processes

Most apparent in studies about non-malicious security violations, organizations ought to maintain control over behaviors with user-liberating technologies in the digital workplace (Köffer, 2015). This intention is of particular importance – and sometimes prescribed by law – for safety-critical business sectors (Harris et al., 2012). Furthermore, it is dangerous to assume end users care enough about security without controls (Vile, 2011). Not surprisingly, many articles emphasize the role of clear and well-communicated policies, combined with formal sanctions in case of noncompliance (Köffer, 2015).

Ortbach et al. (2013) showed that policies have the potential to guide IT individualization behavior. Risks and punishments associated with IT individualization negatively influence the intention to perform such behaviors. The findings also indicated that "employees are highly motivated to conform to the opinions and expectations of the top management and, especially, to those of their superiors" (Ortbach et al., 2013, p. 15). As a result, if the organization clearly points out their expectations through appropriate guidelines, employees are likely to act upon these expectations. Those guidelines should not only address security aspects, such as questions like "where can I store my work data?", alternatively, "can I use my private laptop?" but

also underscore digital work norms, such as "when do I have to be reachable by smartphone?" or "what messages have high priority and how do I label an urgent message?" (Köffer, 2015)[13].

As regards non-malicious security violations, studies have raised the question whether organizations should follow a "carrot or stick" approach, i.e. whether it is more effective to reward conform behavior rather than punishing non-compliance. Thereby, the findings show that soft measures can be more effective than policies and sanctions (Köffer, 2015). For instance, a better involvement of users during the design of security policies (e.g., Tarafdar et al., 2014), or an organizational culture that supports adherence to policies (Hsu et al., 2015) is likely to inhibit non-complaint behaviors. Even incentivizing employees to adhere to security guidelines can increase compliance (e.g., Chen et al., 2012). In any case, employees must feel the consequences of non-complaint behaviors. In other words, knowledge workers "will likely ignore security policies if they are solely evaluated based on their job or business outcomes" (Guo et al., 2011, p. 226).

However, maintaining control has more facets than security. It also comprised to check whether knowledge workers perform work tasks with maximum productivity and without overstraining themselves (Köffer, 2015). Effective collection of IS controls may help to increase IS process efficiency (Cram et al., 2016). Control can be enhanced by structured business processes. For instance, Davenport (2011) recommends the use of structured-provision technologies, such as workflow or case management systems, whenever some degree of structure in the process can be imposed. Also, the fact that improvisations of technology use could also enable innovation makes it crucial to monitor such workarounds to make employees accountable and facilitate such initiatives (Yeo & Marquardt, 2015)

Literature argues that an assessment of the problem size is required before thinking about countermeasures (Köffer, 2015). Thus, the inevitable consequence of control is the necessity of monitoring user behavior. The term problem size can relate to stress level, collaboration overload, or any other measure of ineffectiveness and inefficiency. Many studies have developed measurement constructs that can be used as diagnostic tools for employee surveys on the problem size (Ayyagari & Grover, 2011; Tarafdar et al., 2007). However, by analyzing personal data, organizations enter a sensitive area regarding surveillance and privacy invasion (Leclercq-Vandelannoitte et al., 2014). Also, excessive monitoring may undermine practices that are intended to empower workers (Tafti et al., 2007).

[13] D'Arcy et al. (2014) list statements that information security policies should contain. Hemp (2009) as well as Cross & Gray (2013) give exemplary guidelines to reduce collaboration and communication overload.

Table 5.2 summarizes the recommendations to maintain process control.

Table 5.2 Summary of managerial implications to maintain process control

Recommendation	Description	Example
Involve users	Involve user in the process of policy creation or other control behaviors	Discuss impacts on personal productivity with users during policy formulation
Regulation of IT use	Establish and communicate policies and sanctions for the IT use for work tasks.	Define disciplinary actions and use cases for non-compliant IS use
Structure technologies	Define process structure and monitor process execution with technologies	Use of case or workflow management systems for IT provision and use
Monitor IT use behaviors	Create awareness of the IT tools that are used for organizational work	Trace the use of devices, applications over the corporate network
Reward compliance	Reward employees that behave in line with norms and policies	Make compliant behaviors a significant part of employee's annual evaluation

5.3 Individual workplace designs

The results of this thesis clearly support the proposition that there are considerable differences between individuals when it comes to consumer technologies use and its effect on job performance and well-being. Since the "typical IT user" no longer exists, personal IT identities and desired functionalities are becoming more and more heterogeneous (D'Arcy, 2011). In other words, "one-size-fits-all"-approaches that treat all employees equally are inadequate to address current challenges of digital knowledge work (Maruping & Magni, 2015; Mayer et al., 2012; Srivastava et al., 2015; Tarafdar et al., 2014). For example, Cross & Gray (2013) found that "only some individuals improve their productivity when using social media while others experience significant negative effects" (p. 54 f.).

The request to better target individual knowledge worker preferences and job role requirements is reminiscent of the long-standing discussions in IS research on individual differences in end user computing (Agarwal & Prasad, 1999; Harrison & Kelly Rainer, 1992) and task-technology fit (Goodhue & Thompson, 1995). Rockart & Flannery (1983) early pointed out that "there is no single, stereotyped end user with a defined set of characteristics" (p. 778).

However, mobile technologies that have changed the nature of work tasks considerably complicate the reusability of existing theories on individual differences (Gebauer & Shaw, 2010). Moreover, organizations are now required to consider developments beyond the company

walls, i.e. constantly be aware of consumer market developments. In many cases, consumer-oriented working styles in the digital workplace that better target people's preferences, characteristics, and job roles will be rather a necessity than "nice to have" (Köffer, 2015).

By individual workplace designs, managers can target individual differences, which can be summarized under the following three aspects:

- **Individual characteristic traits:** Work behaviors in relation to IT use may depend on personality. For instance, literature notes that people with particular personality types are more susceptible to policy violations (e.g., D'Arcy et al., 2014). As a result, the effect of formal sanctions is likely to have different effects depending on personal moral values (Li et al., 2014). Also, people's willingness to contribute to collaboration platforms like Enterprise 2.0 depends on the level of openness and extraversion.

- **Individual job roles:** "The application of technology across the organization must vary considerably, according to the tasks different knowledge workers perform" (Davenport, 2011, p. 1). For instance, communication and collaboration requirements of employees vary depending the hierarchical position or the amount of direct customer interaction (Cameron & Webster, 2013). Thus, engaging in collaboration tools or social media will be highly relevant to certain roles, but unimportant for other roles.

- **Idiosyncratic preferences:** People have different preferences for IT hardware and software tools. The classical discrepancy between iOS and Android users is just the beginning and comparatively easy manageable. Individuals may have distinct preferences for communication styles (Li et al., 2011). For instance, people may have valid reasons not to be an active social media user (Niehaves et al., 2015). Moreover, the preferences how to balance work and life roles are different and change over time (Dery & MacCormick, 2012; Sarker et al., 2012). Hence, organizations are requested to apply interventions accordingly.

The notion of individual workplace designs resembles the idea of separating the workforce into appropriate groups of knowledge workers (Andriole, 2012a; Davenport et al., 2002; Harris et al., 2012). Given the variety of factors that are relevant when people build their individual IS (Ortbach et al., 2013), building such segments is not trivial and highly dependent on the work characteristics and individuals' digital work style[14]. In some cases, defining norms

[14] As an example of worker segmentation, van Heck et al. (2012) have developed seven personas with a specific digital work style. Davenport (2011) segments knowledge work along two perspectives: level of interdependence among workers and the work's degree of complexity.

when to be available for work-related calls and when not might be sufficient to bring employees back together. However, certain user preferences will not fit certain job roles, i.e. assignments must be taken with care – or even considered when hiring new staff (Köffer, 2015). Also, a better fit between the type of mobile technology and job demands is likely to increase productivity (Harris et al., 2012).

Determining individual workplace designs or worker segments can help to achieve a right balance between enhancing user autonomy and maintaining process control (Köffer & Urbach, 2016). However, the determination of the right level of autonomy and control must be based on various factors as well as considering individual preferences of the knowledge workers. Following the segmentation by Davenport (2011), enabling end user autonomy regarding tool access is favored for knowledge workers that work collaboratively on tasks that require interpretation and judgment. In turn, controlled approaches are well suited for individual knowledge work that contains routine elements. Mobile workers that spend major parts of everyday activities on the road will likely require different IT tools (van Heck et al., 2012), enabling them to be more autonomous. As individual characteristics, enhancing technological autonomy will be more appropriate for knowledge workers with a higher level of IT competence (Köffer, Ortbach, et al., 2014).

Implementing individual design includes focusing on extreme behaviors of knowledge workers. For instance, many of value-added collaborations in organizations come from only 3 to 5 percent of employees (Cross et al., 2016). In turn, workers with "too much independence may produce poor collective results" (Dery et al., 2014, p. 559). Managers can pay particular attention to assisting employees that have only a few collaborative ties (Cross & Gray, 2013; Zhang & Venkatesh, 2013). Similarly, employees and managers with too many ties can be reminded to combat against their obvious communication overload, for example, by reducing the number of attended meetings or received emails (Köffer, 2015). Otherwise, the number of interactions creates human bottlenecks in the organization, i.e. employees that become so overtaxed that they are no longer personally effective (Cross et al., 2016). To counter this, the organization must identify extreme behaviors in the workforce by appropriate monitoring of users.

As regards the management of blurring boundaries between work and life spaces, managers should put employees into the driver's seat by realizing their preference (Köffer, Junglas, et al., 2014). In general, practitioner literature is inconclusive whether a work-life integration or work-life balance should be viewed as desirable objective (Friedman, 2014; Sarker et al., 2012). Smaller companies, particularly start-ups, as well as work-intensive industries like strategy consulting can address these challenges by hiring only people that fit their organizational cul-

ture that romanticizes work-life integration cultures (Dery et al., 2014). In other organizations with a diverse workforce regarding work-life blurring, policies and an organizational climate that encourages dual-use of IT for both private and professional purposes are likely to be appropriate only for people that pursue work-life integration (Köffer, Junglas, et al., 2014).

Organizations have recognized a need for action and started to deploy countermeasures to combat the implicit integration of work and life spaces. In accordance with worker unions, Volkswagen decided to cut mobile email after hours (BBC News, 2011) and Daimler invented an auto-delete policy for emails that employees receive during holiday time (Mohn, 2012). However, such centrally applied technology restrictions push employees toward work-life segmentation. In doing so, the restrictions are likely to deprive employees of their previously gained flexibility and will be only effective for a subset of the total workforce (Köffer, Junglas, et al., 2014; Sarker et al., 2012).

Table 5.3 summarizes the recommendations to create individual workplace designs.

Table 5.3 Summary of managerial implications for individual workplace design

Recommendation	Description	Example
Focus on extreme behaviors	Identify employees that have a very low or high level of interactions and check the influence on their productivity	Perform a network analysis to visualize the network structure of the organization
Support individual working styles	Eliminate tensions that arise between workers that have different preferences and characteristics	Create individual communication profiles of about when to be available by mobile phones, email, etc.
Segment the workforce	Build meaningful groups of the workforce to apply technology in the same way to similar individuals	Create worker segments based on workplace mobility, job complexity or level of interdependence
Fit between job and individual	Create a fit between the job characteristics and individual characteristics	Hire only people that fit the particular digital work style of the job role
Consider individual preferences	Consider the desires of knowledge workers when determining their level of autonomy and control	BYOD or COPE programs, in which employees can self-enroll

5.4 User training and support

Although it is evident that the IT competence level of the workforce has considerably increased recently, many studies on the digital workplace call for enhanced user training to support digital work of knowledge workers. In other words, it seems that the new workforce generation, although claimed to be inherently tech-savvy, has not reduced the demand for vocational training yet (Köffer, 2015). Only a few studies argue for lower training necessity. For instance, Tarafdar et al. (2014) suggest that continuous ongoing support is more effective than one-time training for employees to avoid negative outcomes of technology use.

Besides rather traditional tool-based training approaches to explain technological features, there is a demand for broader topics to enable users to exert technological autonomy. If employees make their choices about which IT to use and how to use it, they will need a deeper understanding why certain technologies can be used in specific contexts (Köffer, 2015). Also, employees must be able to estimate how the use of technologies affects their individual job performance (Guo et al., 2011) and whether outcomes of their behaviors are bad for the organization (Siponen & Vance, 2010).

Through the increased importance of IT in people's lifestyles, many users acquire technological skills in the private realm and offer to volunteer their competence to the organization (Davis, 2013; Köffer, Ortbach, et al., 2014). User training should acknowledge the overlaps between the private and the business space and may actively address the dual-use space, in which the same IT is used for private and professional purposes. For example, training can reach into the personal activity system of employees to identify synergies with the professional activity system. Also, training that may assist employees with managing IT lifestyles within the dual-use space (Ahuja et al., 2007).

Organizations should support training with appropriate organizational norms and guidelines, for example, by defining work ethics about the relevant and effective use of mobile technologies (Leclercq-Vandelannoitte et al., 2014). However, many studies have shown that users are often unaware of existing guidelines or do not fully understand them. This missing awareness is a necessary antecedent for security violations (Bulgurcu et al., 2010). Consequently, studies recommend enhanced so called SETA training („Security, Education, Training, and Awareness") to increase information security awareness and peoples' self-efficacy on compliant be-

havior[15]. With respect to BYOD, Crossler et al. (2014) recommend focusing on the response efficacy of IT security actions, i.e. organizations should explain how IT security measures respond to security threats.

As a consequence of the individual workplace design, "one-size-fits-all" is also inappropriate for providing end user training on norms and guidelines. Instead, training contents should be more personalized towards the specific characteristics, needs, and job roles of knowledge workers (Dery & MacCormick, 2012). For instance, training can consider previous knowledge and job experience of participants (Puhakainen & Siponen, 2010). Also, training is of particular importance for susceptible employees, i.e. those who work in critical business functions or those who are more likely to violate guidelines because of their individual characteristic traits. Ideally, the training is also targeted with relevance to the individual workplace.

As regards user support it is important to align the ability of the IT function with user expectations (Koch et al., 2014). For example, end users cannot require the IT function to support everything since this is not manageable anymore due to the heterogeneity of consumer hard- and software (Gens et al., 2011). Moreover, technical staff need a deeper understanding of what services are required that exceed their traditional core competencies (Raj et al., 2013). At the same time, enterprise support should be knowledgeable to prevent security violations. The social context plays a significant role in the adoption of consumer technologies. Thus, to avoid wrong advice from colleagues, "end users should be able to turn to IS personnel rather than their supervisors and coworkers for advice on these issues, particularly those related to IS security" (Guo et al., 2011, p. 226f.). In fact, senior managers might be the ones that are most interested in having the freedom to use the tools they want to use (Vile, 2011).

Table 5.4 summarizes the recommendations for user training and support.

[15] Literature provides suggestions for the design of SETA training programs to ensure compliant technology use. Please refer to Guo et al. (2011), Siponen & Vance (2010), as well as Puhakainen & Siponen (2010).

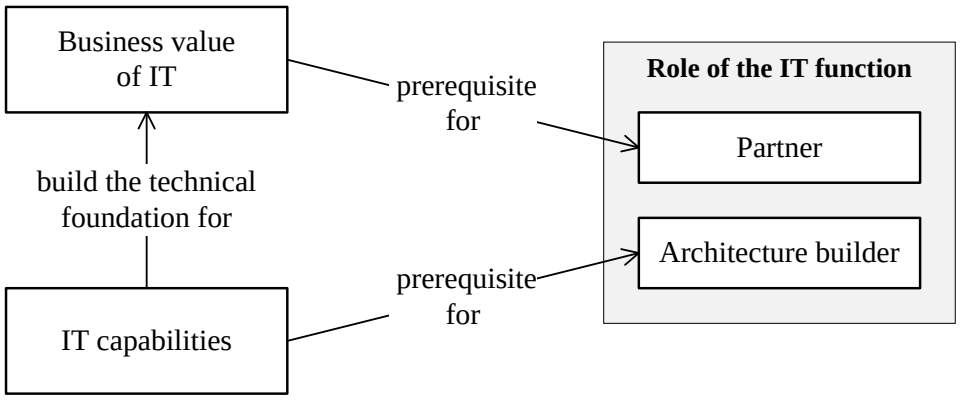
Table 5.4 Summary of managerial implications for user training and support

Recommendation	Description	Example
Foster understanding of IT use	Make sure that employees understand the outcomes (positive and negative) of their IT use behavior	Explain how IT security measures respond to actual security and privacy threats
Extend training to private aspects	Actively address the dual-use space, i.e. consider the private needs of employees when designing training programs	Share stories about dual-use applications that help employees to organize their daily private and professional time
Provide training about norms and guidelines	Increase the awareness of knowledge workers about guidelines and norms of the organization	Security, Education, Training, and Awareness (SETA) programs for critical business functions
Personalize training contents	Target training towards the specific characteristics, needs, and job roles of knowledge workers	Conduct pre-tests to assess actual competence level and make training relevant to the specific job role
Align user expectations with IT capabilities	Instead of providing no support, make clear what users can expect from enterprise support and what not	Provide a list of devices, applications, and incidents with them for which the IS function offers support

5.5 Role of the IT function

The IT function refers to the total set of structures, processes and accommodations for managing and organizing IT in organizations (Earl, 1989). Consumer technologies are supposed to be the major driver that redefines the relationship between employees – literally of consumers of enterprise IT (Moschella et al., 2004) – and the IT function. The developments have put much pressure on IT functions to enhance the modernity of the IT landscape using quicker update cycles, matching the habits people have in the private realm. In doing so, the IT function has likely to give up some of its traditional values that conflict with consumer-oriented working styles (Koch et al., 2014).

To position the role of the IT function, Köffer, Fielt, et al. (2015) propose a relationship with important management issues, namely the *business value of IT* and *IT capabilities*. The business value of IT is often associated with the relationship between IT and firm performance. IT capabilities have received much attention within the business value of IT literature. They stress the need for organizations to leverage IT assets to deliver a sustained competitive advantage instead of the IT assets themselves (Bharadwaj, 2000; Henderson & Venkatraman, 1993). Figure 5.1 illustrates the relationship between the three concepts above about the proliferation of consumer technologies and styles at the digital knowledge workplace.



adapted from: (Köffer, Fielt, et al., 2015)

Figure 5.1 Role of the IS function related to business value of IT and IT capabilities

Guillemette & Paré (2012) suggested that the IT function should take the role of a partner or architecture builder. As a *partner*, the IT function adds value by facilitating change and improving business processes. As for consumer technologies, this would be the case if the IT function could actively support the self-selection of IT tools by employees in the course of BYOD or CYOD programs. By assisting users in the process, additional benefits regarding productivity and innovation might be revealed.

Köffer, Fielt, et al. (2015) argue that it depends on the business value of consumer technologies whether the IT function can be a partner in this context. Thereby, the IT tools become IT-enabled resources, defined as "systems that are formed through relationships between IT assets and organizational resources" (Nevo & Wade, 2010, p. 166). Companies might see clear potentials for real business opportunities through the use of cutting-edge consumer technologies (Leclercq-Vandelannoitte, 2015). As an advantage of consumer technologies, users are directly embedded in the process of value creation from IT assets. Their self-responsible and voluntary decision to use certain technologies as part of their professional activity systems is part of the value creation (Köffer, Fielt, et al., 2015). In other words, the individualization of IT helps to solve the often specific IT-related problems in organizations. Thereby, tech-savvy employees are the best judge to decide on technologies and how to turn them into business value (Harris et al., 2012).

The IT function as *architecture builder* "adds value by implementing a single, integrated and flexible architecture, which enables the firm to benefit from new opportunities" (Köffer, Fielt, et al., 2015, p. 12). This approach resembles a platform model where the IT function provides a scalable and flexible infrastructure for the diffusion of consumer technologies across the enterprise (Agarwal & Sambamurthy, 2002). In doing so, it is implied that the organization does

not perceive any clear benefit from consumer technologies. Thus, strategies that proactively promote the diffusion of consumer technologies "do not appear to offer any business opportunity; rather, it represents normal practice" (Leclercq-Vandelannoitte, 2015, p. 20).

In any case, for advancing the IT architecture, the IT function will require a set of IT capabilities to set the technical foundation to mitigate disadvantages from consumer technologies, such as security concerns and support complexity (Köffer, Fielt, et al., 2015). Organizations should take measures to ensure that lost or stolen mobile devices are no threat to corporate systems (ENISA, 2012). For securing enterprise users and content, many companies put their faith in mobility management systems that support encrypted remote access, remote wiping, and many other security-related functions. Also, desktop virtualization and cloud services may be part of the technical foundation (D'Arcy, 2011).

Without the technical capabilities of the IT function, it is unlikely that IT organizations can yield the full extent of business value. Koch et al. (2014) found that directly after the introduction of consumer technologies, the tools may be viewed rather as a luxury instead of recognizing their business value. Organizations with lower IT capabilities tend to be skeptical about the possibility to open guidelines and transfer decision-making authority on IT matters to the users (Köffer, Fielt, et al., 2015). Instead, security concerns are overestimated and used to block initiatives towards this direction (Gens et al., 2011).

Table 5.5 summarizes the recommendations about the role of the IT function.

Table 5.5 Summary of managerial implications about the role of the IT function

Recommendation	Description	Example
Position the IT function according to business value opportunities	Position the IT function as a partner to encourage employees to yield business value from consumer technologies use	Proactively support the introduction of consumer technologies and encourage experiential behaviors with IT
	Position IT function as architecture builder to support employees with consumer technologies	Assist employees to reduce problems with consumer technologies use without actively promoting their experiential use
Support flexible working with IT	Ensure that workers can work at any time, from any place, with any device	Enable remote access to organizational resources via mobile devices
Apply technical security measures	Ensure that the IT function has the necessary capabilities to ensure system and data security	Invest in mobile device management, desktop virtualization, and other services

6 Conclusion and outlook

6.1 Contributions to theory and practice

Ad RO.1: To investigate the consequences of digital knowledge workplace trends for individuals and organizations.

The results of this thesis strongly suggest that digital knowledge workplace trends are ultimately beneficial for organizations. For instance, mobile technologies that come with thousands of useful applications contribute to an employee's job performance. Positive effects are also related to the enhanced knowledge that individuals have gathered about consumer technologies in the private realm (Köffer, Ortbach, et al., 2014). The thesis has also suggested that consumer technologies have positive effects on employee-driven innovation (Köffer, Ortbach, et al., 2015). Thereby, an organizational climate that supports experiential use with technologies positively influences the innovative behavior of knowledge workers.

In turn, the thesis deals with negative consequences of the trends that can diminish the previously achieved productivity gains. To this end, employees' use of privately-owned IT that has not been formally approved by the organization was investigated. Since such use often represents a threat to corporate security, the results can inform policy and guideline formulation in organizations. Moreover, there is empirical evidence that guidelines can considerably influence the decision of employees to use certain hardware and software tools for work (Niehaves et al., 2015; Ortbach et al., 2013). However, in line with the literature on information security awareness, the findings of this thesis confirm that most employees act in good faith when not asking for permissions to use IT, i.e. they act with result orientation in their mind and pursue the goal of maximizing their personal productivity.

Also, this thesis deals with consequences for individuals' well-being in relation to work-life-blurring, both positively and negatively. In general, the results suggest that the common culture of work and private life blurring has been shifted further towards integration than segmentation (Köffer, Anlauf, et al., 2015). As organizations become more complex and global, and demands on workers increase, integration of work and life roles has "become more expected and practiced" (Reyt & Wiesenfeld, 2015, p. 757). As a result, there is less understanding if employees want to switch off from work at certain hours. Instead, employees may be viewed as "low in motivation or, in the worst of cases, as low performers" (Köffer, Junglas, et al., 2014, p. 14). According to boundary theory, this would imply that people with a preference for work-life segmentation are subliminally undermined and forced to adapt themselves at the

cost of their well-being. This finding represents not only a challenge for individuals and organizations, but also for the society as a whole.

As regards research methodology, Köffer, Ortbach, et al. (2015) provide a quantification of the three perspectives of consumerization (market, individual, and organization). Also, the study created a new measurement construct for individual IT innovation behavior, which is anchored in the literature on individual innovation. Furthermore, this thesis adds empirical findings of beliefs held by individuals. In Ortbach et al. (2013), the quantitative evaluation details attitudinal, normative and control beliefs to identify factors of preferring IT tools that are not provided by the organization. Similarly, the indicator analysis conducted in Köffer, Junglas, et al. (2014) investigates organizational encouragements for work-life integration in relation to IT. Other researchers may draw on these detailed results to empirically check consequences of workplace trends that are still to come.

With respect to theory, the perspective on technology adoption changes because individuals adopt and own IS in their private lives and dual-use them at work at the same time. Established theories of technology acceptance often assume that users tend to resist new technologies (Bagozzi, 2007; Vodanovich et al., 2010). However, the adoption of consumer technologies is characterized by voluntary and educated decisions. Such decisions resemble the idea of human agency where "humans are relatively free to enact technologies in different ways" (Boudreau & Robey, 2005, p. 3). The notion of agency is particularly applicable to mobile consumer technologies because they allow the user to make choices regarding its use (Dery et al., 2014). For instance, smartphones can be individualized by selecting the applications and functions that users want (Jung, 2014).

Many employees are nowadays able to consider past IT use practices to project future situations, i.e. they can estimate fairly whether the use of certain IT tools has positive consequences for their individual productivity (Köffer, Ortbach, et al., 2014). The results of this thesis also support the idea that the selection of IT tools at the digital knowledge workplace is part of an ongoing IS individualization (Baskerville, 2011b). In other words, the concept of individual IS represents a useful theoretical lens to study the ongoing developments. Several studies in this thesis have shown that user behaviors show conformity with the theory (e.g., Köffer, Anlauf, et al., 2015; Köffer, Ortbach, et al., 2014).

Ad RO.2: To formulate implications to managing knowledge work in the digital workplace of the future.

This thesis points out several recommendations for practitioners to address current challenges to design the digital knowledge workplace. Organizations are forced to take action and embrace the opportunities. In total, the recommendations can be summarized under the following seven aspects:

- **Understand the impact**. Recent advances in the digital workplace are not just another fashion hyperbole of some overhyped "hot gadgets", but here to stay (Vile, 2011). Using privately-owned IT for work or, more general, using consumer technologies to achieve flexibility between work and life spaces is not confined to a group of "tech nerds" or digital natives but triggered ubiquitous technology use at all hierarchical levels (Yun et al. 2012). It has become the norm for the majority of employees (Gens et al., 2011; Niehaves et al., 2015). The proliferation of consumer technologies in organizations is an observable indicator of the fact that IT individualization will be a prevailing practice that cannot be stopped (Ortbach et al., 2013). As a result, managers must rethink their norms, controls, and governance about IT use and IT provision to employees at the digital knowledge workplace.

- **Freedom for employees.** Employees are no longer just passive users of technology (Junglas et al., 2014; Vodanovich et al., 2010). In the literal sense of the word "consumerization", they have become consumers within the organization (Baskerville, 2011a; Moschella et al., 2004). Thus, to avoid shadow systems, enterprise IT has to match not only corporate requirements but also external solution available at the consumer market (Schwarz & Schwarz, 2014). For the most part, the practice of IT individualization makes it infeasible to address employees centrally with one-size-fits-all strategies (Köffer, 2015). Instead, managers must give up several long-preferred standardization values and provide employees with more freedom to decide self-determined about IT selection and use (Koch et al., 2014). The chances are that the new workforce generation is better able to establish a fit between the IT requirements of their job role and personal preferences on IT use.

- **Manage autonomy with enhanced control**. At first glance, the recommendations given in this thesis about enabling autonomy and maintaining control may look like competing choices because they make different assumptions about how knowledge

work should be performed (Davenport, 2011). However, the various requests for autonomy and control at the same time suggest that the two concepts should be approached from a 'both/and' perspective rather than doing 'either/or' judgments (Köffer & Urbach, 2016). In other words, organizations should strive for synergies in the paradoxical relationship of user autonomy and control, integrating the tensions between interests of the employees and the organization (Zhang et al., 2015). For instance, if employees can select the IT they want to use, and also how they want to use it, organizations should nevertheless track the users' IT use – not only because of compliance checking but also to provide additional value to the employee by proposing adjustments that help employees solving business tasks.

- **Look for individual productivity potential**. Increased heterogeneity among workers and job demands is an important aspect of the digital knowledge workplace. As a consequence, "one-size-fits-all"-approaches that treat all knowledge workers equally "will increasingly alienate employees and result in lost business opportunities" (Moschella et al., 2004, p. 1). Thus, such strategies have become infeasible to target the requirements of specific job roles (Köffer, 2015). Instead, organizations ought to leverage individual productivity gains. Since tasks of knowledge workers and their information requirements vary, one step to better productivity is applying technology more precisely (Davenport, 2011). IT individualization resembles this idea by better addressing the strengths and needs of demographic groups and worker segments.

- **Support employee-driven innovation**. Given the increasingly diverse IT landscape in combination with the massive amount of innovations in the consumer market, organizations have no choice but to exploit individual IT innovation more than in the past (Köffer, Junglas, et al., 2014). This task includes innovation of the technical infrastructure at the digital workplace. As long as innovation happens only in the course of shadow workarounds that are created by tech-savvy workers, organizations miss the opportunity to actively support useful bottom-up innovation (Niehaves et al., 2015).

- **Set the technical foundation**. Organizations must overcome several technical hurdles to implement BYOD, COPE, or CYOD strategies. The realization requires upfront investments in the technical infrastructure that ensure complaint procedures and an effective way of working. For instance, employees need remote access capabilities to enterprise systems from (privately-owned) mobile devices. More general, bind points should be developed to integrate consumer applications and devices into the corporate systems (Baskerville & Lee, 2013) – perhaps even with the goal to ultimately integrate

everything from everyone (Golden, 2011). Mobility management software may be operated to enhance data security by enabling remote wiping and preventing that private and company data get intermingled. The results of this thesis suggest that only organizations that have built such technical foundations can fully leverage the benefits of digital workplace trends (Köffer, Fielt, et al., 2015). Also, it will be easier for employees to manage work and life roles if convenient and secure access to private and business resources is available from the work devices, whether they are privately-owned or company-provided (Köffer, Anlauf, et al., 2015).

- **Consider the social dimension**. Flexible working is a major advantage of the digital knowledge workplace for organizations and individuals alike. However, being available to perform professional tasks from anywhere anytime comes with a dark side (Tarafdar et al., 2014). Many people are unfit to manage self-responsibly their work and life spaces. Also, the heterogeneity of the workforce naturally produces differences regarding individual productivity. Organizations should acknowledge that people may have sound reasons against the use of particular hardware and software. Likewise, the decision not to be available around the clock for the organization should be accepted, encouraged, and not be misinterpreted as a lack of organizational commitment (Köffer, Anlauf, et al., 2015; Köffer, Junglas, et al., 2014).

6.2 Limitations

The research presented in this thesis is beset with limitations that need to be pointed out. As the individual papers in part B address the limitations of each study, this section will focus on the limitations of the overall research endeavor.

While this thesis formulates some managerial implications, it must be noted that most of the empirical studies in this thesis focus on the individual level. Organizational issues are addressed directly by literature reviews. In qualitative studies, interviewees were asked about organizational impacts if their position promised to give valuable answers about the IT use in the organization as a whole, e.g., chief information officer or members of the IT department. Other implications were derived based on the interpretations of the individual-level analysis. Thus, a consideration of hard facts, such as financial figures about the impact of digital workplace trends, is missing.

This thesis includes empirical studies that use qualitative and quantitative data collection. None of these studies is without restrictions regarding its theoretical sampling, i.e. the studies

have limited generalizability. More specifically, two out of three studies that use a quantitative evaluation use non-probability sampling, so that sample bias exists. Particularly, studies have used participants with lower age so that the sample is invalid to represent the actual diversity of the workforce. Similarly, the selection of interviewees for qualitative studies was limited to four organizations from only one country – Germany. Besides the effort to select interviewees with a maximum of variation within the selected organizations, this sampling reduces the meaningfulness of the results, especially regarding validity for other cultural and national contexts. Furthermore, all empirical data pools have been collected in a single period of time, i.e. this thesis does not include any longitudinal approach to increase the reliability of the findings. For instance, it can be assumed that negative perceptions of stress and work-to-life conflict in the long-term offset positive short-term effects on job performance.

Furthermore, it must be noted that qualitative data analysis is naturally subject to interpretations of the participating researchers. Thus, other researchers may have come to different results regarding consequences and implications for the organization. The mixed method approach was used to minimize this effect of subjectivity. For instance, literature reviews on managerial implications helped to position the empirical findings of this thesis into the body of literature on digital workplace design. The same subjectivity issues hold for research models and theoretical frameworks, which are most likely not fully complete because research models did not capture particular effects or required concepts were missing at all. Instead, the used concepts represent only what emerged in the analysis of theoretical literature and empirical data collected.

On a more general note, the managerial implications of this thesis raise the question how organizations can find the resources to achieve the desired goals. Organizations are requested to be an active promoter of the digital knowledge workplace. Thus, "managers are required to create more awareness, more support, more training and know-how, more control structures, and more opportunities for empowerment" and so forth (Köffer, 2015, p. 13). It remains open, what this "more" means in terms of resources such as time, money, facilities, and technology (Kietzmann et al., 2013). Although this critique is most likely applicable to much ongoing research on the digital workplace, longitudinal research endeavors that study the developments more deeply and in retrospect may be able to give a closer look at resource input.

6.3 Outlook for future research

Research on the digital workplace has much progressed during the preparation of this thesis. However, the topic is still far from being completely investigated. The results of this thesis

and related literature open up many opportunities for future research on the design of the digital knowledge workplace. Thus, it is impossible to compile an exhaustive list of research opportunities. In the following, two overarching examples will be outlined that are – in the view of the author – most promising and important for IS research on the digital workplace:

From use to effective/enhanced use

As regards the recommendations in this thesis to foster autonomy of IS users in organizations, the question arises whether there are limits of autonomy for certain individuals. Knowledge workers' non-routine tasks are often difficult regarding scheduling and managing work (Davis, 2002). Thus, workers will likely differ in job performance depending on their self-organization skills (Köffer, Ortbach, et al., 2014). In other words, it is unlikely that all employees will ultimately enjoy more freedom and use this freedom to be more productive (Köffer, Ortbach, et al., 2014). Instead, it is still "an important corollary … that individuals maybe uneducated in IS" to design their individual IS (Baskerville, 2011a, p. 7). People also may not be skilled at searching and sharing knowledge, so that they spend too much time on information use (Davenport, 2011). As a result, people might choose the wrong technologies for work tasks, or work inefficiently with the right tools due to a lack of skills and an overestimation of their skills.

IS research has intensified the efforts to investigate the technology post-adoption phase by using the notions of effective or enhanced IS use. "Effective use is defined as using a system in a way that helps attain the goals for using the system" (Burton-Jones & Grange, 2013, p. 633). Enhanced IS use refers to novel ways of employing technology features, e.g., using IT for additional tasks or use features that have not been used before for a particular task (Bagayogo et al., 2014). Both concepts require that users have sufficient understanding of the purpose of the system. Thus, they resemble demands of this thesis to foster users' understanding of consequences from the use of consumer technology at work (Köffer, 2015). Future investigations on effective and enhanced use can inform organizations how to pay closer attention to the quality of IS use, rather than time and frequency of IS use (Li et al., 2013). Thus, the notions of effective and enhanced use are particularly important if employees are encouraged to experiment with new technologies, and receive more freedom to select technologies on their own.

Most studies investigate outcomes of consumer technologies use in a rather unilateral fashion. Future research may juxtapose the positive (productivity, satisfaction) with negative effects (stress, overload) by drawing on person-environment-fit approaches (Köffer, 2015). In this

sense, Cameron & Webster (2013) call for "extended IS theories of fit that consider the overlapping and complex use of technologies in today's organizations" (p. 366).

As an example, future research may investigate the increasing demands towards self-determined and self-organized IT use drawing on the concept of demands-ability fit (Edwards et al., 2006). Research has shown that users will grasp IS differently depending on their proficiency with technologies. While high proficiency users can understand IS conceptually, low-proficiency users understand IS procedurally and "lack understanding of how functions contribute to overall system logic" (Kane & Borgatti, 2011, p. 1065). Most likely, users with low-proficiency will be unfit to administrate the considerable complexity of individual IS (Baskerville, 2011a). They will be overwhelmed by the plethora of IT applications on offer at the market and unable to select the best technologies for their job roles (Elie-Dit-Cosaque et al., 2011). Thus, such users should probably not participate in BYOD or CYOD programs without control or assistance. However, research yet lacks studies that investigate negative outcomes of such a misfit between personal preferences and actual behaviors and the requirements of the job role (Köffer, Anlauf, et al., 2015).

Designing individual IS

Most of the implications for practice in this thesis are of rather managerial nature. The question remains in how far better-designed systems can address current challenges and disadvantages at the digital knowledge workplace (Köffer, 2015). With employees transforming to consumers of enterprise IT, the notion of "building systems that users want to use", should receive renewed attention (Malhotra & Galletta, 2004; Markus & Keil, 1994). Hence, the use and individual composition of consumer technologies that is available in the market may in many respects serve as a blueprint for designing organizational IS (Baskerville, 2011a). For instance, designing technologies that consider individuality may reduce current tensions that arise from the use of consumer technologies. However, current research offers relatively little insight about how systems should address individual designs (Köffer, 2015).

Is important to note that IT individualization goes beyond customization of devices and applications, i.e. it encompasses more than just choosing the background color or the text layout. One example of individual design is an expert mode in software that skilled users can access to use more complex functions (Vodanovich et al., 2010). Furthermore, individual IS are idiosyncratic in nature, i.e. the values underlying these systems may stem from technology use habits that are highly individual. As a result, it is hard to formulate design theories (Baskerville, 2011a). Enhanced design-oriented research is required to validate further the assumptions

about the formation of individual IS and the potential positive outcomes of IT individualization for employees and organizations (Köffer, Anlauf, et al., 2015).

Existing design flaws in the dual-use space between the personal and professional activity systems complicate IT individualization, particularly the management of work and life spaces for individuals (Köffer, Anlauf, et al., 2015). These flaws are not only related to inadequacies in the organizational system but also to the very nature of consumer technologies. For instance, smartphone applications often have a persuasive design that hooks consumers, keeping them coming back and stay longer with the application. As a result, constant notifications and reminders cannot be shut down by the user or other applications (Singer, 2015). Here, the economic interest of software providers conflicts with user preferences (Köffer, 2014). Platform providers of social media and message services have no interest to reduce online communication that is transmitted through their platforms since more traffic is part of their business model of leveraging user-generated content.

Wearable consumer technologies, such as wristbands and data glasses, or other sensor-based technologies will soon proliferate at the workplace and influence technical designs. The tools will enable enhanced monitoring of employee behaviors. Future research may develop the tools for assessing employees' problem level from role-integration between work and life spaces to give managers the chance to buffer their employees from pressure (Reyt & Wiesenfeld, 2015). At the same time, researchers are requested to guarantee the (ethical) acceptability and societal desirability of the technological innovation (Von Schomberg, 2013). In particular at the digital knowledge workplace, technical innovations include the risk of exploitation and overload of workers.

Upcoming innovation waves in the consumer market will raise more fundamental social and personal questions on knowledge work (Newell, 2015). The IS field has an important role concerning responsible innovation to address societal challenges (Stahl et al., 2014). Hence, research endeavors can hopefully be somehow independent of economic compulsions that often restrict the user-centricity of technologies. Instead, IS researchers should move beyond the organizational perspective of enhancing productivity and strive for building technologies that ultimately increase peoples' well-being at the digital knowledge workplace.

May this thesis help researchers and designers to achieve this pretentious goal.

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