Communication and Collaboration Technology Use at the Digital Workplace: Antecedents, Use Processes, and Consequences

DISSERTATION

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Abstract

Our world is becoming more and more digital and interconnected. Particularly new communication and collaboration technologies have changed the way we go about our daily life and work. Several technological and social developments are the driving forces for this change. On the one hand, technological advancements, such as portable devices, fast infrastructure, and constantly available software applications, transform the way employees communicate, collaborate, and transfer knowledge. On the other hand, social developments, such as an increase in knowledge-intense jobs and a workforce that has grown accustomed to increasingly modern and innovative technology from their private lives, contribute to the development. Further, during the COVID-19 pandemic, digital work and the use of communication and collaboration technology has increased unlike anything seen before. It is the organizations' responsibility to care for their employees and leave no one behind in this transformation process of work as we know it. Yet, the management of increasingly complex portfolios of digital technologies, comprised of privately-owned and business-owned components, confronts individuals, IT departments, and management with challenges. To address them, organizations and individuals need to broaden their understanding of how and why employees use digital technologies and learn about the associated outcomes.

Information Systems research has long been concerned with understanding digital technology use, which is among the most researched topics of the discipline. Research results on technology use have been summarized along the three categories antecedents, use process, and outcomes Antecedents describe factors that influence use. Insights into use processes provide us with details of how technology is used in practice. Use outcomes comprise different factors that can be positively or negatively affected by using technology, such as performance or stress. Within the field, a subset of studies has specifically focused on communication and collaboration technology. Yet, in light of the rise in ubiquitous digital work and the challenges that come with it, further investigation into this subject is necessary.

This dissertation aims at providing novel insights into the use of communication and collaboration technology for organizations and individuals across the three categories: antecedents, use processes, and outcomes. For that, this dissertation uses quantitative data (e.g., structured survey data and digital trace data) and qualitative data (e.g., literature and semi-structured interviews). It uses different methods between the six presented papers and within individual papers – an approach called mixed-methods research. This purposeful combination of quantitative and qualitative data allows for deep insights and strong inferences about the investigated phenomena.

In Chapter 2, this dissertation deals with important antecedents of use decisions of communication and collaboration technology. Chapter 2.1 does so by identifying factors that drive the choice of digital technologies in the context of knowledge transfer. Established antecedents are derived from previous literature and their influence and relevance in the light of new emerging technologies are investigated based on expert interviews. Chapter 2.2 analyzes rationales for using privately-owned technology for business purposes based on a risk-benefit perspective. The findings suggest that IT service consumerization is a portfolio decision between the available privately-owned and business-owned technologies and reveal mechanisms as well as reasons for the use decisions.

Chapter 3 analyzes individual use processes of communication and collaboration technology in more detail using digital trace data and user interviews. Different heterogeneous user roles are derived from the data in Chapter 3.1. Eight different types of user behavior and reasons for their emergence are investigated. Second, user behavior over time and the effect of external events on such behavior are examined (Chapter 3.2). The findings imply that users may change their behavior in light of novel situations, which include different work-from-home policies, a change in task, or a change in team.

Chapter 4 presents insights on outcomes of use behavior, particularly adverse outcomes. Insights are provided on the role of individual appraisal in the relationship between communication and collaboration technology use and associated stress (Chapter 4.1). For that, increased technology use due to an external shock and its effect are investigated. It is shown that users react differently to an increase in the use of digital technologies and that individual technological skills are important in this relationship. Second, outcomes of the use of mixed IT portfolios comprised of privately-owned and business-owned components are investigated (Chapter 4.2). Findings imply that such IT consumerization is a source of unreliability when IT portfolio integration is poor and thus has individual-level dark sides.

In summation, this dissertation contributes to the rich body of knowledge on technology use. It broadens our understanding of why communication and collaboration technologies are used, how they are used, and what consequences arise from their use. Thus, insights are provided to practitioners on how to manage technology use in a human-centered way while considering the risks of technology use and reaping its multifaceted benefits. The results of this dissertation may inspire future research on a topic that is potentially more relevant today than ever before.

Zusammenfassung

Unsere Welt wird immer digitaler und vernetzter. Insbesondere neue Kommunikations- und Kollaborationstechnologien haben unser tägliches Leben und unsere Arbeit verändert. Mehrere technologische sowie gesellschaftliche Entwicklungen sind die treibenden Kräfte für diesen Wandel. Einerseits verändern technologische Fortschritte, wie tragbare Endgeräte, schnelle Infrastruktur und ständig verfügbare Softwareanwendungen, die Art und Weise, wie Mitarbeiter kommunizieren, zusammenarbeiten und Wissen übertragen. Andererseits tragen gesellschaftliche Entwicklungen dazu bei, wie die Zunahme wissensintensiver Arbeitsplätze und Arbeitnehmende, die immer modernere und innovativere Technologien aus ihrem Privatleben gewohnt sind. Darüber hinaus ist die digitale Arbeit und der Einsatz von Kommunikations- und Kollaborationstechnologien während der COVID-19-Pandemie gestiegen, wie nie zuvor. Es liegt in der Verantwortung der Organisationen für ihre Mitarbeiter zu sorgen und in diesem Transformationsprozess der Arbeit niemanden zurückzulassen. Das Management von immer komplexer werdenden IT-Portfolios, die aus privaten und unternehmenseigenen Komponenten bestehen, stellt IT-Abteilungen und Geschäftsführungen jedoch vor große Herausforderungen. Um sie anzugehen, müssen Organisationen und Einzelpersonen ihr Verständnis dafür erweitern, wie und warum Mitarbeitende Technologien einsetzen und lernen, welche individuellen Auswirkungen mit der Nutzung einhergehen.

Die Forschung der Wirtschaftsinformatik beschäftigt sich seit langem mit dem Verständnis von Technologienutzung, was zu einem der am meisten erforschten Themen der Disziplin gehört. Forschungsergebnisse zur Technologienutzung wurden entlang der drei Kategorien: Einflussfaktoren auf Nutzung, Nutzungsprozesse und Auswirkungen von Nutzung zusammengefasst. Einflussfaktoren beeinflussen die Nutzung und die Nutzungsweise von Technologien. Erkenntnisse zu Nutzungsprozessen liefern ein tieferes Verständnis zum Einsatz von Technologie. Auswirkungen von Nutzung umfassen dagegen verschiedene Faktoren, die durch den Einsatz von Technologie positiv oder negativ beeinflusst werden, wie Produktivität oder Stress. Eine Teilmenge an Studien beschäftigt sich dabei speziell mit Kommunikations- und Kollaborationstechnologien. Angesichts der rasanten Verbreitung von digitaler Arbeit und den damit verbundenen Herausforderungen sind jedoch weitere Untersuchungen zu diesem Thema erforderlich.

Diese Dissertation zielt darauf ab, Organisationen und Einzelpersonen neue Einblicke in den Einsatz von Kommunikations- und Kollaborationstechnologien zu ermöglichen. Dazu verwendet sie quantitative Daten (z. B. strukturierte Umfragen und digitale Logdaten) und qualitative Daten

(z. B. Literatur und halbstrukturierte Interviews). Nicht nur zwischen den sechs präsentierten Arbeiten kommen unterschiedliche Methoden zum Einsatz, sondern auch innerhalb einzelner Arbeiten. Dieser als Mixed-Methods-Forschung bezeichnete Ansatz ermöglicht die gezielte Kombination quantitativer und qualitativer Daten, die tiefere Einblicke und stärkere Schlussfolgerungen bezüglich der untersuchten Phänomene zulässt als es beim Einsatz von nur einer Art Daten möglich ist.

In Kapitel 2 werden zunächst wichtige Einflussfaktoren der Nutzungsentscheidungen von Kommunikations- und Kollaborationstechnologien diskutiert. Kapitel 2.1 identifiziert dazu Faktoren, die die Wahl digitaler Medien im Kontext des Wissenstransfers bestimmen. Etablierte Einflussfaktoren werden aus bisherigen Arbeiten abgeleitet und deren Wirkung und Relevanz im Lichte neuer Technologien untersucht. Kapitel 2.2 analysiert die Gründe für die Nutzung privater Technologie für geschäftliche Zwecke anhand einer Risiko-Nutzen-Perspektive. Die Ergebnisse zeigen, dass die Nutzung von IT-Diensten aus dem privaten Bereich für geschäftliche Zwecke eine Portfolioentscheidung ist. Die Studie identifiziert außerdem Mechanismen und Gründe für solche Nutzungsentscheidungen.

Kapitel 3 analysiert die individuellen Nutzungsprozesse von Kommunikations- und Kollaborationstechnologien anhand digitaler Logdaten und Nutzerinterviews genauer. Zunächst werden aus den Daten verschiedene heterogene Benutzerrollen abgeleitet (Kapitel 3.1). Acht verschiedene Arten von Nutzungsverhalten und Gründe für deren Entstehung werden untersucht. Außerdem wird das Nutzungsverhalten im Zeitverlauf und die Auswirkung externer Ereignisse auf dieses Verhalten untersucht (Kapitel 3.2). Die Ergebnisse der Studie deuten darauf hin, dass Benutzer ihr Verhalten angesichts neuartiger Situationen ändern können. Dazu zählen z. B. neue Richtlinien für die Arbeit von zu Hause, eine Änderung der Aufgaben oder ein Wechsel des Teams.

Erkenntnisse zu den Folgen des Nutzungsverhaltens werden in Kapitel 4 präsentiert, wobei insbesondere auf negative Folgen eingegangen wird. Zunächst werden Einblicke in die Rolle der individuellen Bewertung der Nutzung von Kommunikations- und Kollaborationstechnologien und dem Zusammenhang mit Stress gegeben (Kapitel 4.1). Dazu wird der erhöhte Technologieeinsatz durch einen externen Schock und dessen Auswirkung untersucht. Es zeigt sich, dass Nutzer unterschiedlich auf eine zunehmende Nutzung digitaler Technologien reagieren und dass in diesem Zusammenhang individuelle technologische Fähigkeiten wichtig sind. Zweitens wird der Einsatz von

IT-Portfolios, die aus privaten und unternehmenseigenen Komponenten bestehen, untersucht (Kapitel 4.2). Die Ergebnisse deuten darauf hin, dass dies eine Quelle von Unzuverlässigkeit ist, wenn die Portfoliointegration gering ist.

Zusammenfassend trägt diese Dissertation zum reichhaltigen Wissen über Technologienutzung bei. Sie erweitert unser Verständnis dafür, warum Kommunikations- und Kollaborationstechnologien verwendet werden, wie sie verwendet werden und welche Konsequenzen sich aus ihrer Nutzung ergeben. Dadurch erhalten Praktiker Einblicke, die für das menschenzentrierte Management von Technologienutzung wichtig sind und deren Risiken sowie vielfältige Vorteile berücksichtigen. Die Ergebnisse dieser Dissertation sollen auch die zukünftige Forschung zum Thema, das heute potenziell relevanter ist als je zuvor, inspirieren.

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1. Introduction[1]

1.1. The Rise of the New Digital Workplace

Our world is becoming more and more digital and interconnected. This phenomenon stretches across our work lives and beyond. Particularly, new communication and collaboration technologies have changed the way we go about our daily lives and work (Brown et al. 2010). Today, it is unthinkable for many to imagine a life and a workplace without emails, smartphones, or shared documents stored in the cloud.

Several technological as well as social developments are driving forces for the increasingly digital workplace. *Technological advancements* drive changes in the digital workplace and transform the way employees communicate, collaborate, and transfer knowledge. Such new and rapidly growing technologies include portable end user devices, like smartphones and laptops, fast infrastructure, such as 5G and cloud storage, and constantly available software applications, such as instant messengers (e.g., Spataro 2020).

Particularly regarding communication and collaboration, new additions to the digital workplace are made continuously. A number of such emerging technologies foster social collaboration, such as, online discussion forums, enterprise social networks, as well as immersive technologies (such as virtual reality) (Charband and Jafari Navimipour 2016; Colbert et al. 2016). A market trend is to combine many of these technologies into comprehensive solutions, with prominent examples such as Microsoft Office 365 (Gotta et al. 2015). These solutions often provide technologies as services and offer a combination of infrastructure and software. Such services are often scalable and innovative (Demirkan et al. 2008).

While technological changes are without a doubt an important driver, there are also manifold *social developments* that are associated with the transformation of how we work and live digitally. For once, knowledge-intense industry sectors have long been on the rise and with it, the number of white-collar jobs. Hence, many jobs in modern organizations require extensive amounts of knowledge work (Kane et al. 2014). Knowledge workers have an increased need to share and access knowledge, collaborate, and communicate to be productive**.** Consequently, the ability to effectively communicate and transfer knowledge within the organization leads to a

[1] It is the nature of a cumulative dissertation that it consists of individual research papers. Thus, the introduction (Section 1) as well as discussion (Section 5) partly include content taken from the research papers of this dissertation. To improve the readability of the text, I omit self-citations for such content.

superior knowledge base and has been recognized as critical to the success, value, and performance of a modern organization (Kogut 2000). Thus, efficient communication and collaboration technology are assets that both companies and employees need to compete in a digitalized world.

Employees grow increasingly accustomed to innovative and easy-to-use technology from their private lives. Baskerville (2011) suggests that the digitalization of the individual has increased to the point where individuals operate, run, and administrate increasingly complex individual information systems by themselves. For example, individuals use their smartphones, such as iPhones, to stay connected with their friends and family, use instant messengers, such as WhatsApp, to chat with peers, store their private files through clouds services, such as Dropbox, and gather much of their news through social media, such as Twitter (Newman et al. 2019). This has an indirect effect on the digitalization of the workplace as it raises employees' expectations towards technology provided by the businesses (Weiß and Leimeister 2012).

State-of-the-art privately-owned technology also has direct effects on businesses: employees increasingly bring their own mobile privately-owned technology to work (Ortbach 2015). For instance, employees use WhatsApp to communicate with their coworkers, use private Zoom accounts to communicate with external partners, or employ private clouds to access work documents from home after hours. Research has indicated that digital natives, who are entering today's workforce in growing numbers, are demanding both modern IT and flexible bring-your-own-device policies from their employers (Weeger et al. 2015).

While these developments have been around for some years, in recent history, the COVID-19 pandemic has been a game changer for digital work. To contain the spread of the virus, many organizations have advised their employees to work from home. Early studies regarding the German workforce indicate that between 25% and 35% worked from home during the height of the first wave of the pandemic in March 2020 (Möhring et al. 2020; Schröder et al. 2020). This number was significantly higher for highly educated workers (up to 60%), which tend to be knowledge workers (Schröder et al. 2020). To maintain communication and collaboration between employees in a physically distanced work environment, organizations and employees reverted to digital communication and collaboration tools, such as Microsoft Teams or Zoom. This fast-tracked the rapid growth of such technology. For example, Microsoft Teams meetings surged from 900 million to 2.7 billion minutes of meetings per day within the month of March 2020 (Spataro 2020).

The increasing digitalization of the workplace brings many opportunities, but it is also associated with challenges for both organizations and individuals. For organizations, modern digital technology has been associated with opportunities, such as increased innovativeness, mobility, flexibility, productivity, and creativity (Behrens 2009; Ortbach 2015; Weeger et al. 2015). To harness them and to cater to the employees' demands, many companies allow them to bring their own privately-owned technology into the workplace. Such policies may have additional advantages for organizations, such as reduced technology expenses and enhanced employer attractiveness (Weeger et al. 2015) and for individuals, such as increased convenience (Lee et al. 2017). However, many of those developments also contribute to increasingly complex IT portfolios which are difficult to manage for organizations. Several risks are associated with this development, such as IT security and data privacy risks (Gewald et al. 2017; e.g., Weeger et al. 2015), and a loss of organizational control (e.g., Behrens 2009). An example for the latter is that organizations lack access and power over privately-owned IT components (Ortbach 2015). Designing rules and regulations in such a complex technological environment while maintaining security standards and catering to the needs and demands of employees is a major challenge for many organizations.

Intensive technology use at the workplace has been associated with a variety of different negative outcomes on an individual level (e.g., Tarafdar et al. 2019). For example, novel circumstances, such as the work-from-home situation during the COVID-19 pandemic, are a potential source of stress for some individuals (Vaziri et al. 2020). Reasons include the increased blurring of boundaries between work live and private live, which creates spill-over effects (Matt et al. 2019). These are particularly relevant when multi-purpose technologies (for both private and business purposes) are used. Another known outcome of using privately-owned IT for work purposes and the increased autonomy that comes with it, is increased workload (Niehaves et al. 2012).

These developments affect individuals asymmetrically. For instance, employees who use many technologies experience adverse outcomes, such as stress, only to a small degree (Gimpel et al. 2019). Another example is that during the COVID-19 pandemic, digital work has increased for highly educated knowledge workers much more than it has for other employees (Schröder et al. 2020). It is the organizations' responsibility to care for their employees and leave no one behind in this transformation process of work as we know it. To address these issues and to manage change in a human-centered way, organizations and individuals need to broaden their

understanding of how and why employees use technology and learn about what individual outcomes can be expected from such use. The topic is thus of great practical significance.

In summation, there are several technological and social trends that have increased technology use at the workplace. Many new types of communication and collaboration technologies have increased the size and complexity of technology landscapes, which usually include both business-owned and privately-owned elements. While this comes with chances for organizations, it also makes the management more difficult and poses challenges. In an increasingly autonomous technology landscape, understanding what drives use and use processes themselves on an individual level is necessary to manage IT. For employees, the increasingly digital workplace may be advantageous, for example through improved personal performance, but it may also impair their health. Whether the advantages or disadvantages outweigh one another is dependent on the individual characteristics and circumstances of the employees. Thus, and for maintaining healthy work in such a digital workplace, a detailed understanding on how people use technology, what drives use, and what consequences emerge from the different ways of using the technologies are required. To broaden the understanding in this regard, this dissertation aims to contribute to our knowledge of individual technology use, particularly regarding digital communication and collaboration.

1.2. Individual Communication and Collaboration Technology Use in a Digital Workplace

The information systems (IS) community has long been concerned with technology use, which is one of the most researched topics of the discipline (e.g., Venkatesh et al. 2003). Technology use is defined as "a user's employment of a [technology] to perform a task" (Burton-Jones and Gallivan 2007). As such, it represents the interaction of a user with a technology. With that, it stands at the center of interest of the IS discipline, which is primarily concerned with socio-technical systems (Sarker et al. 2019). Use is also one of the most important success factors for organizations regarding the implementation of an IS and thus is of great practical significance (Sabherwal et al. 2006; Venkatesh et al. 2008).

While several operationalizations and measurements of use exist, based on its definition, use generally comprises the interplay of three factors: user, technology, and task (Burton-Jones and Straub 2006). Figure 1.2-1 depicts this. Studies of technology use thus involve both social and technological aspects and their interplay (Sarker et al. 2019).

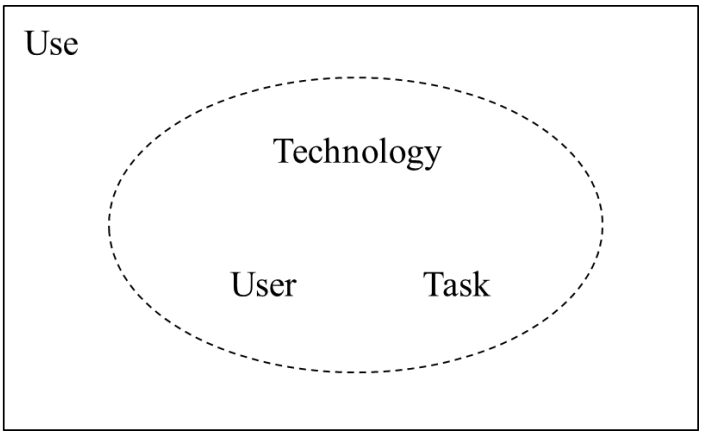

Figure 1.2-1: Conceptualization of Technology Use, Based on Burton-Jones and Straub (2006)

There is a variety of different theories that have sharpened our understanding of various stages of technology use (e.g., Davis 1989; Jasperson et al. 2005; Venkatesh et al. 2003). On a basic level, research on technology use can be divided into two phases. While technology adoption "refers to the stage before and right after a target technology implementation/introduction" (Venkatesh et al. 2016, 345), the post-adoptive use refers to the time "after the application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities" (Jasperson et al. 2005, p. 531).

Research results on technology use have been summarized along the three categories antecedents of use, use processes, and use outcomes (Burton-Jones et al. 2017). Figure 1.2-2 depicts these three categories and their relationships. Antecedents describe factors that influence use, such as social norms or user characteristics. For example, individuals may use a technology to maintain a positive image with individuals they care about (Moore and Benbasat 1991). Insights on use processes provide us with details of how technology is used in practice. This is generally seen to require a post-adoptive point of view. For example, research has shown that there are several ways in which users may adapt their use processes as a result of technology-related events, such as modifications or updates to a technology (Beaudry and Pinsonneault 2005). Lastly, use outcomes include different variables that are affected by using technology, such as performance or stress. For example, extensive use of emails may result in stress, particularly when the individual's preferences are to use less emails (Stich et al. 2019).

It is important to note that technology use, and thus the relationship between antecedents, use processes, and outcomes, is dynamic over time. For example, users can experience stress as a

result of their use of technology (Tarafdar et al. 2015). Yet, one way of coping with such problems may be an adaptation of use processes (Salo et al. 2020). Likewise, use experience may increase technology self-efficacy, which is considered to be an antecedent of use (Venkatesh et al. 2003), and an inhibitor of negative outcomes (Shu et al. 2011). These examples show the recursive nature of antecedents, use processes, and outcomes of technology use.

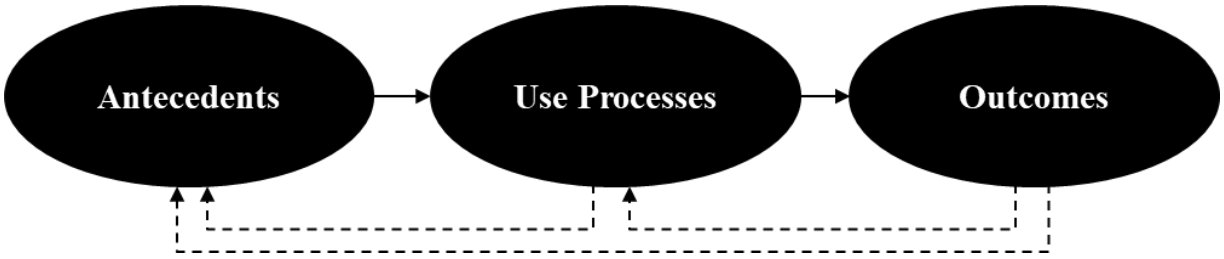

Figure 1.2-2: Key Categories of Theoretical Contributions to Technology Use Research, Based on Burton-Jones et al. (2017)

Within the field of technology use, a subset of studies has focused on the use of communication and collaboration technology. While many general principles of technology use research have been shown to hold true for these types of technologies, there are also some important specificities in this context. A non-exhaustive list of relevant studies regarding communication and collaboration technology shows that these results can again be summarized along the three categories of technology use: For antecedents, factors relevant to the context of communication and collaboration technology have been connected with established models on technology adoption (e.g., Brown et al. 2010). Further, the impact of group dynamics on the adoption of communication technology has been investigated (Bayerl et al. 2016). Research has also indicated that network effects and a critical mass of users play an important role in the adoption of communication and collaboration technology (van Slyke et al. 2007). Regarding use processes, the selection of different technologies and use processes for knowledge transfer between individuals have been studied (Massey and Montoya-Weiss 2006). And regarding outcomes of use, models predict communication performance in relation to different communication technology characteristics and processes (Dennis et al. 2008). Moreover, adverse outcomes, such as technostress, have been connected with the use of communication technologies (Galluch et al. 2015; Stich et al. 2019).

Despite numerous advancements in the area, research regarding the post-adoptive use of such communication and collaboration technology remains rather scattered. This coincides with an increasing interest in in-depth studies of use processes and an increasing emphasis on the post-

adoption phase (Burton-Jones et al. 2017; Jasperson et al. 2005). For example, researchers have long called for insights based on real-world data, longitudinal insights, and detailed post-adoption studies on a fine-grained feature level (e.g., Bagayogo et al. 2014; Jasperson et al. 2005). This is particularly interesting for communication and collaboration technology, where complex and rich network data is available, for example, in the form of message traces. Communication and collaboration technologies can also be used rather autonomously from organizational resources, and thus lend themselves well to IT consumerization – the use of privately-owned technology for business purposes (Niehaves et al. 2012). This trend has introduced additional complexity that warrants additional research. For example, using private devices for business purposes creates spillover effects from the private into the organizational context, which have been at the center of calls for additional research in the area (Matt et al. 2019).

In summation, research on the use of communication and collaboration technology with an emphasis on the post-adoption phase is still scarce. Several opportunities exist to contribute to the existing body of knowledge, such as the use of privately-owned communication and collaboration technology as well as in-depth analyses of use based on trace data. Research contributions on the subject can be made along the three categories antecedents, use processes, and outcomes.

1.3. Aim and Outline of the Dissertation

Even though technology use is a central and well-researched topic in IS research, there are several areas that require further research in the realm of communication and collaboration technology use. Several of these areas are addressed in this dissertation. With that, the dissertation aims at providing novel insights for organizations and individuals into the use of communication and collaboration technology across the three categories antecedents, use processes, and outcomes. Figure 1.3-1 shows the outline of this dissertation and its respective parts. Chapter 1 represents the introduction which provides motivation and aim. In Chapter 2, important antecedents of use decisions of communication and collaboration technology are discussed. Chapter 2.1 does so by identifying factors that drive the choice of digital media in the context of knowledge transfer. Chapter 2.2 analyzes rationales for using privately-owned technology for business purposes. Chapter 3 proceeds by analyzing individual use processes of communication and collaboration technology in more detail using digital trace data. First, different heterogeneous user roles are derived from the data (Chapter 3.1). Second, user behavior over time

and the effect of external events on such behavior are examined (Chapter 3.2). Chapter 4 presents insights on outcomes of use behavior, particularly adverse outcomes. First, insights are provided on the role of individual appraisal in the relationship between communication and collaboration technology use and technostress (Chapter 4.1). Second, outcomes of the use of mixed IT portfolios of privately-owned and business-owned components are investigated (Chapter 4.2). The dissertation ends with the discussion of its results, an outlook on future research, and an overall conclusion in Chapter 5.

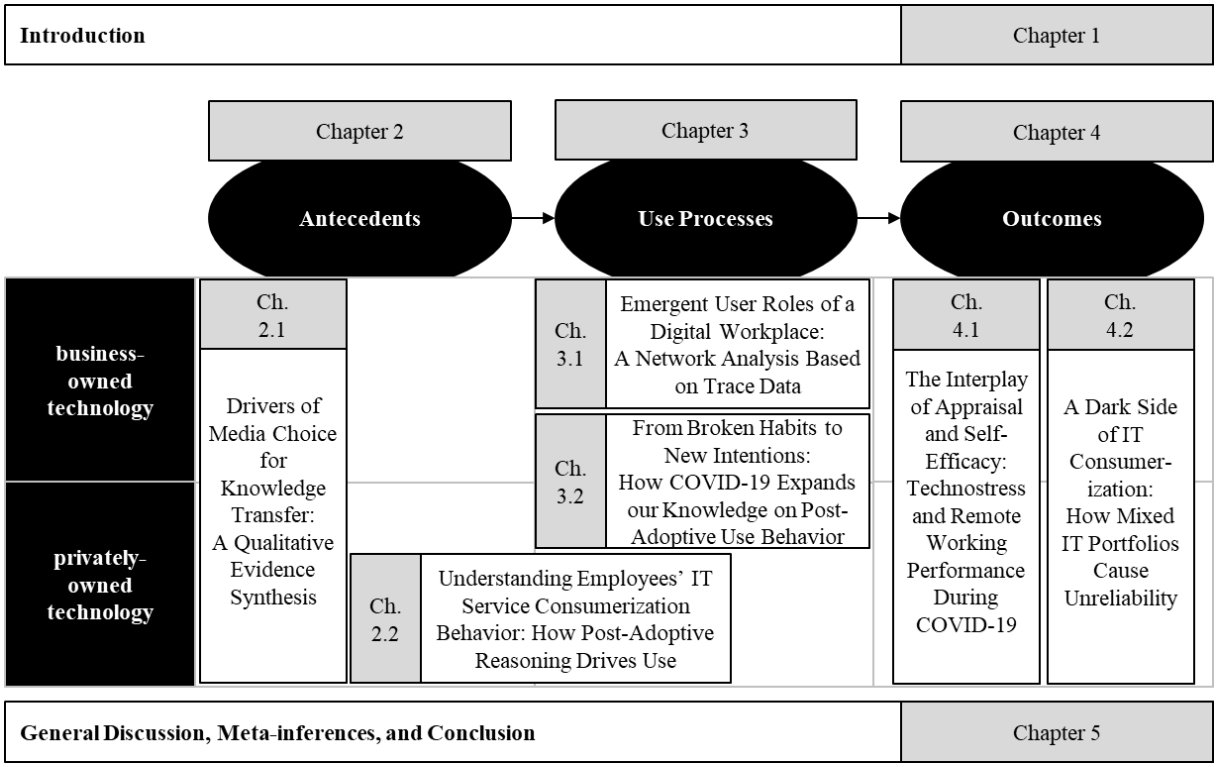

Figure 1.3-1: Structure of the Doctoral Dissertation

Table 1.3-1 shows an overview of the research papers included in this cumulative dissertation. As part of the table, title of the research papers, their objectives, the utilized data sources and research method, and the co-authors are shown.

#	Title of Research Paper	Objectives	Data and Method	Co-Authors
Paper 1 (Ch. 2.1)	Drivers of Media Choice for Knowledge Transfer: A Qualitative Evidence Synthesis and Implications of New ICT-related Developments	Identify drivers of the choice between different media. Investigate whether the advent of new technologies challenges existing theories.	Qualitative multi-method: Literature analysis and expert interviews	Lanzl, Julia; Schöberl, Isabel
Paper 2† (Ch. 2.2)	Understanding Employees' IT Service Consumerization Behavior: How Post-Adoptive Reasoning Drives Use	Analyze drivers to use privately-owned IT for business purposes from a risk-benefit perspective.	Quantitative-dominant mixed-methods: Survey (nested)	Lanzl, Julia; Gimpel, Henner
Paper 3 (Ch. 3.1)	Emergent User Roles of a Digital Workplace: A Network Analysis Based on Trace Data	Segregate different use behaviors in business-owned digital communication and collaboration tools as well as factors that explain them.	Quantitative-dominant mixed-methods: Trace data and user interviews	Frank, Leonhard; Gimpel, Henner, Schmidt, Marco
Paper 4† (Ch. 3.2)	From Broken Habits to New Intentions: How COVID-19 Expands our Knowledge on Post-Adoptive Use Behavior of Digital Communication and Collaboration	Follow different use behavior in business-owned digital communication and collaboration tools over time and identify factors that explain changes.	Quantitative-dominant mixed-methods: Trace data and user interviews	Gimpel, Henner; Maier, Andreas; Neumeier, Kathrin
Paper 5 (Ch. 4.1)	The Interplay of Appraisal and Self-Efficacy: Technostress and Remote Working Performance During COVID-19	Analyze the influence of positive and negative appraisal of IS use situations during COVID-19 and their influence on the perception of work outcomes.	Quantitative: Survey	-
Paper 6 (Ch. 4.2)	A Dark Side of IT Consumerization: How Mixed IT Portfolios with Private and Business IT Components Cause Unreliability	Investigate the negative individual consequences of the use of privately-owned IS for business purposes.	Quantitative-dominant mixed-methods: Survey and user interviews	Lanzl, Julia; Gimpel, Henner

† please note that I am the lead author of this paper

Table 1.3-1: Overview of Papers Included in this Doctoral Dissertation

Antecedents of the Use of Communication and Collaboration Technology

In Chapter 2, this dissertation addresses antecedents of the use of communication and collaboration technology. This chapter includes two research articles. First, Paper 1 (Chapter 2.1) concerns the choice between different available technologies to transfer knowledge between individuals within an organization. The findings of this paper are independent of whether privately-owned or business-owned IT is used. Second, Paper 2 (Chapter 2.2) addresses the increasing use of privately-owned IT for business purposes and employs a net-valence model to explain the user's decision to use.

Paper 1: Because knowledge is a primary resource for many organizations, practitioners have made large investments into digital knowledge management technologies. Yet, in many cases the technologies are not effectively used (Wang and Noe 2010). Thus, several existing studies have investigated antecedents of the choice of technologies for knowledge transfer between individuals. Such empirical studies usually cite motivations, such as a general lack of empirical evidence in light of fragmented theories (e.g., Kalman et al. 2019), and the emergence of new technologies (e.g., Yuan et al. 2013). To investigate this in a structured way, we conduct a mixed-methods study. First, we build a framework that aggregates relevant antecedents of the choice between different technologies for knowledge transfer based on a systematic literature review. Second, we conduct expert interviews to evaluate the framework and extend it through insights on changes associated with emerging ICT-related developments. In doing so, we pursue two research questions:

RQ1: Do influencing factors on media choice for knowledge transfer found in studies investigating new emerging technologies integrate well with long-established literature on media choice theory?

RQ2: Does the emergence of new ICT yield influencing factors that go beyond such established theories?

Paper 2: Using privately-owned technology for business purposes (IT consumerization) has many advantages for individuals and organizations (e.g., Ortbach 2015). With widely available mobile data plans and portable technologies, employees not only bring their devices but their entire infrastructure, which allows them to operate these technologies with little to no dependencies to the existing organizational infrastructure (Baskerville 2011). This increases the complexity of governing technology use by organizations and makes it increasingly difficult to control the disadvantages of IT consumerization (Behrens 2009). Therefore, an understanding of the antecedents of IT consumerization is necessary. A particular area of interest are situations

where both business-owned and privately-owned communication and collaboration technology alternatives are available. Thus, this paper aims to detail our understanding of IT consumerization on a service layer to provide IT departments with insights on how to manage IT service consumerization. To do that, this mixed-methods study build on post-adoptive technology use literature to investigate how users evaluate risks and benefits in this context. In a quantitative part, a structural equation model based on survey data investigates relationships between different antecedents and IT consumerization use. In a qualitative part, we provide qualitative evidence for why these relationships exist. With this study, we answer the following research question:

RQ: What rationales drive post-adoptive IT service consumerization use behavior?

Use Processes of Communication and Collaboration Technology for Work Purposes

In Chapter 3, this dissertation focuses on use processes of communication and collaboration technology within organizations in the post-adoption phase. This chapter includes two research articles. On the one hand, Paper 3 (Chapter 3.1) deals with heterogeneous user behavior through a network analysis based on digital trace data of a communication channel and a collaboration platform. On the other hand, Paper 4 (Chapter 3.2) provides insights on changing user behavior based on a longitudinal analysis of digital trace data.

Paper 3: Communication and collaboration technologies have been introduced with high expectations, especially in knowledge-intense industries. Yet, use of such tools differs widely between individuals. For a lack of real-world data, such differing use processes have not been well-understood (e.g., Pawlowski et al. 2014). To fill this void, this mixed-methods study aims to explore different types of use behavior with digital trace data of a communication channel and a collaboration platform from a German service organization. It does so by using means of social network analysis (e.g., Kane et al. 2014). The quantitative strand uses a cluster analysis to derive a typology of use behavior. In subsequent qualitative interviews, the quantitative findings are enriched with reasons for the existence of the heterogeneous use behaviors. In doing so, the paper investigates two research questions:

RQ: What heterogeneous user behaviors can be derived from the social structure of a digital communication and collaboration technology and why do users show these different behaviors?

Paper 4: The COVID-19 pandemic has caused an unprecedented surge in digital communication and collaboration (e.g., Möhring et al. 2020). Existing knowledge regarding post-adoptive

use behavior of communication and collaboration technology is limited in capturing such spikes. This paper uses a mixed-methods approach combining quantitative data analysis and qualitative interviews to provide a comprehensive understanding of the post-adoptive use behaviors and the changes caused by COVID-19. The quantitative strand uses real-world data consisting of feature use counts of a communication and collaboration tool over a period of 9 months. Distinct use patterns are identified and traced over time. Variation of use behavior between individuals and within individuals over time are analyzed. In the qualitative strand, user interviews investigate the impact of novel situations, such as mandatory work-from-home policies and a change in tasks or teams, as potential causes for altered use behavior. With this study, we pursue the following research question:

RQ: How and why do changes in post-adoptive digital communication and collaboration use behavior occur, and what can we learn from the times of COVID-19 about it?

Outcomes of the Use of Communication and Collaboration Technology

In Chapter 4, individual-level outcomes of the use of communication and collaboration technology are investigated. In this chapter, the emphasis lies on negative outcomes in the form of technostress – stress that users experience as a result of the use of digital technology (Tarafdar et al. 2015). The dissertation contains two papers regarding outcomes. Paper 5 (Chapter 4.1) primarily concerns different individual appraisals (perceptions) of new use situations because of increased work-from-home situations during COVID-19. Paper 6 (Chapter 4.2) focuses on mixed IT portfolios consisting of business-owned and privately-owned components and how they may cause technostress.

Paper 5: As a result of the COVID-19 pandemic, many employees had to work from home, which has led to an increased use of digital technologies. This has created a novel situation in which individuals use communication and collaboration technology differently and more intensely to stay in touch with their co-workers than they previously have. Early indications suggest that increased use of technologies may be a potential source of stress (Vaziri et al. 2020). However, work-from-home has affected individuals unequally (Schröder et al. 2020). The transactional model of stress suggests that individuals perceive situations differently which depends on the individual's resources (Lazarus and Folkman 1984). Based on this, Paper 5 investigates the relationship between individual appraisal, remote working self-efficacy, as well as positive and negative outcomes in light of increased use due to COVID-19. It does so through

cross-sectional survey data analyzed through a structural equation model. The study investigates the research question:

RQ: What relationship do individual appraisal and self-efficacy have with techno-distress and performance in times of remote work?

Paper 6: The adverse individual consequences of the use of privately-owned technology for business purposes has been an understudied area. Yet, early studies indicate that this relationship exists (e.g., Niehaves et al. 2012). Paper 6 builds on technostress literature to identify factors that contribute to such stress when using mixed portfolios consisting of both privately-owned and business-owned technology. Through user interviews, relationships between IT consumerization use behavior and technostress are identified and mapped to several other outcomes, such as dissatisfaction with IT and work-home-conflict. In the quantitative strand, factors that drive the identified relationships are provided, to get a complete picture of the phenomenon. With this, the study aims to answer the following research question:

RQ: How does IT consumerization behavior affect the negative side of technostress and what factors drive the relationship?

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2. Antecedents of the Use of Communication and Collaboration Technology

2.1. Drivers of Media Choice for Knowledge Transfer: A Qualitative Evidence Synthesis and Implications of New ICT-related Developments

Abstract

Knowledge is a critical factor for an organization's success and considered the primary resource for long run superior performance. The transfer of knowledge plays an important role in maintaining this competitive advantage and can occur via various types of media. In the past years, there has been a rapid rise in technological opportunities and investments in new types of media for knowledge management. Following this development, there is a substantial amount of renewed research in that field. Numerous of the studies have specifically focused on the antecedents of media choice for knowledge transfer. This is mostly motivated by a fragmentation of empirical evidence as well as the continuous emergence of ICT-related developments. However, the question of whether the factors influencing knowledge transfer decisions are indeed fundamentally different from traditional research on media choice and whether new ICT-related developments change them, has not been comprehensively answered in the existing literature. To fill this gap, a framework of the relevant influencing factors of media choice for knowledge transfer is built based on a systematic literature review. By means of semi-structured interviews, the framework is evaluated and extended by insights on changes that come with emerging ICT-related developments. Results show that characteristics of knowledge itself, individuals in the knowledge transfer process, their relationship, as well as the environmental and situational factors influence media choice for knowledge transfer. However, the influence of many of the factors may change with new ICT-related developments.

Keywords: knowledge transfer, media choice, literature review, evidence synthesis

Authors: Julia Lanzl, Dr..; Isabel Schöberl, M.Sc.; Manfred Schoch, M.Sc.

Status: Working paper

2.1.1. Introduction

Knowledge is the primary resource of an organization (Grant 1996) and a superior knowledge base increases both its value and its performance (Kogut 2000). The ability of organizations to effectively transfer knowledge within the organization has been recognized as critical to an organization's success (Grover and Davenport 2001). Knowledge transfer enables organizational learning and involves both the sharing of knowledge from a source and the application of it by a receiver. Knowledge transfer can occur either directly between a sender and a receiver or indirectly through an intermediary (Massey and Montoya-Weiss 2006). To be able to manage this task efficiently and effectively, organizations have to understand what factors drive behavior (Grant 1996; Murray and Peyrefitte 2007). In an age where digitalization becomes increasingly prevalent, knowledge management has become particularly important (Sousa and Rocha 2019).

In light of this, a recent representative survey has proposed that knowledge management will become the most important hard skill for managers by 2027 (Bitkom Research and LinkedIn 2017). At the same time, advancements in information and communication technologies (ICT) drive changes in the workplace and transform the way employees transfer knowledge through a wide range of newly available ICT. This may involve online discussion forums, wikis, or social media (Charband and Jafari Navimipour 2016; Sousa and Rocha 2019) as well as immersive technologies which enable virtual teams to increase their presence (Colbert et al. 2016) and artificial intelligence (AI). With digital natives entering the workforce, whose communication and collaboration preferences are likely to be different, such technology will become increasingly important (Colbert et al. 2016).

Although practice has made large investments into digital knowledge management systems, practitioners notice that in many cases the systems are not yet effectively used for sharing and transferring knowledge (Wang and Noe 2010). Thus, several studies investigate and aim to understand reasons for the choice of knowledge transfer mechanisms and do so mainly for three reasons: a general lack of empirical evidence in light of fragmented theories (e.g., Kalman et al. 2019; Murray and Peyrefitte 2007; Snyder and Eng Lee-Partridge 2013), the need to understand temporal effects in switching between different mechanisms (e.g., Massey and Montoya-Weiss 2006; Yuan et al. 2013) and because of the emergence of new technologies (e.g., Chai and Liu 2010; Magwenzi et al. 2016; Snyder and Eng Lee-Partridge 2013; Yuan et al. 2013).

While several literature reviews exist that have previously dealt with knowledge management (Alavi and Leidner 2001; Charband and Jafari Navimipour 2016; Wang and Noe 2010), to the best of our knowledge no endeavor has yet to investigate new ICT-related developments and their impact on the intersection of knowledge transfer and media choice. Therefore, two questions remain unanswered: (1) whether the influencing factors on media choice found in these fragmented studies integrate well with long-established literature on media choice theory (e.g., Carlson and Zmud 1994; Daft and Lengel 1984; Dennis et al. 2008; Trevino et al. 2000; Webster and Watson 2002), and (2) if the emergence of new ICT yield influencing factors that go beyond such established theories.

Thus, and to broaden the understanding of media choice for knowledge transfer between individuals, we first systematically review the literature from several disciplines to identify factors influencing media choice for knowledge transfer from the existing body of knowledge. Second, we conduct expert interviews to evaluate and possibly extend the framework as well as to identify changes in the relevance of the factors through the emergence of new ICT developments. Thereby, we (1) provide an organizing framework on previous research structuring the existing fragmented influencing factors on media choice for knowledge transfer and related empirical findings. Furthermore, we (2) differentiate between theorized effects and those for which qualitative or quantitative evidence exists. Through our expert interviews, we (3) seek additional insights into the influence of new ICT developments, such as AI, on the relevance of the factors. We further (4) analyze whether the influencing factors from both literature and expert interviews are in line with media choice theories to examine their robustness. We find that several factors can indeed be mapped to a variety of theories that exist within the greater realm of media choice research and conclude that while some specificities exist for knowledge transfer and some technological changes may warrant researchers' attention, the theoretical underpinning remains largely robust.

2.1.2. Theoretical Background

2.1.2.1. Knowledge Transfer

Researchers from different areas have used different definitions of knowledge (Alavi and Leidner 2001). Alavi and Leidner (2001) give an overview of different knowledge perspectives (e.g., knowledge as an object, capability, or process) discussed in information systems research, strategic management, and organizational theory literature and of their implications for

knowledge management and the role of information technology. Because our focus lies on media choice, we refer to their definition of knowledge as "information possessed in the mind of individuals" (Alavi and Leidner 2001, p. 109).

The knowledge-based-view of the firm argues that knowledge is the primary resource for long-run superior performance (Grant 1996). Consequently, as knowledge leads to competitive advantage, management of knowledge is crucial. Yet, on a continuum from data to information to knowledge, knowledge is the most difficult to manage (Grover and Davenport 2001). The concept of knowledge management consists of four basic processes: creating, storing/retrieving, transferring, and applying knowledge (Alavi and Leidner 2001). Knowledge creation represents the individual or organizational learning and results in new knowledge, for example, created through the combination of existing knowledge (Alavi and Leidner 2001; Nonaka 1994). To be preserved and able to be retrieved, knowledge needs to be stored, for example in documents (Alavi and Leidner 2001). The source of competitive advantage is the application of knowledge which may result, for example, in product innovations (Alavi and Leidner 2001). The crucial challenge and seen as one of the most important aspects of knowledge management, the transfer of knowledge is defined as "the communication of knowledge from a source so that it is learned and applied by a recipient" (Ko et al. 2005, p. 62). In that way, it enables organizational learning and secures competitive advantages (Argote and Ingram 2000; Grant 1996, p. 111). Because of its crucial position in knowledge management, this literature review focuses on the process of knowledge transfer.

Knowledge transfer involves both the sharing by a sender and the application by a receiver and therefore goes beyond merely sharing knowledge, yet it is often mistakenly used interchangeably in the literature (Wang and Noe 2010). Knowledge conversion, on the other hand, involves activities that lead to the transference and transformation of knowledge; thus, it involves the exchange and potential creation of new knowledge (Massey and Montoya-Weiss 2006). Furthermore, knowledge transfer is different from decision making and collaboration, yet it may be part of it. Collaboration is seen as "a process of joint decision making" (Gray 1989, p. 11) and "occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process […] to act or decide on issues related to that domain" (Wood and Gray 1991, p. 146). Knowledge transfer can be seen as a function of the value of the sender's knowledge, the motivation to transfer and acquire, the transmission channels, and the absorptive capacity of the recipient (Gupta and Govindarajan 2000). The transfer can either be through direct chan-

nels between sender and receiver, indirectly through a knowledge artifact (e.g., written document), or both (Massey and Montoya-Weiss 2006). Primarily communication and discourse systems (e.g., face-to-face interaction, email, telephone), as well as knowledge repository systems (e.g., physical documents, intranets, blogs), enable such transfer of knowledge between participants (see Figure 2.1-1) (Massey and Montoya-Weiss 2006). This indicates that while communication plays an important role in knowledge transfer, transfer via codified documents extends knowledge transfer beyond direct communication.

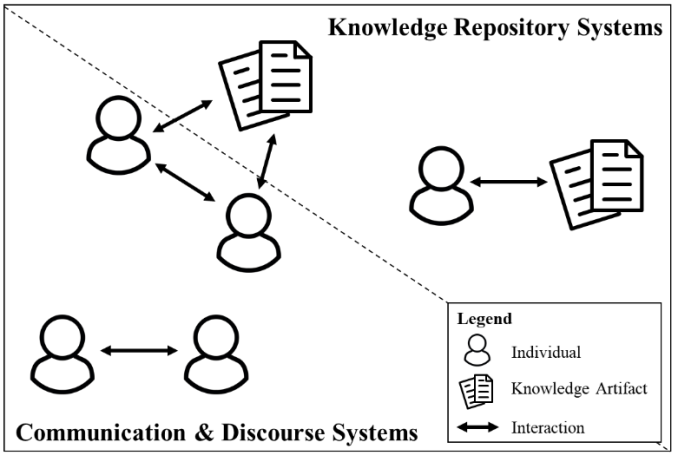

Figure 2.1-1: Forms of Knowledge Transfer Systems, Based on Massey and Montoya-Weiss (2006, p. 101)

2.1.2.2. Media Choice Theories

The *concept of media richness*, developed by Daft and Lengel (1984), was one of the first to explain media choice. They argue that communication media vary in their degree of richness of information processed. This is because each medium differs in multiple aspects: its ability to provide rapid feedback, the channels of communication utilized (i.e., visual or audio), the source, and the use of natural language (Daft and Lengel 1984). A rich medium, such as face-to-face, allows immediate feedback, uses multiple cues of language, and is personal, which allows people to clarify the message (Daft and Lengel 1984; Jung and Lyytinen 2014; Rice and Shook 1990). Media richness is a promising concept for understanding media choice, but empirical evidence has provided only mixed support (Dennis and Valacich 1999). *Channel expansion theory* was primarily developed to reconcile these inconsistent findings in research that focuses on media richness theory (Carlson and Zmud 1994). In addition to the constructs of media richness theory, stated as nominal media richness, Carlson and Zmud (1994) argue that participants over time gain experience with the channel, their co-participants, and the messaging topic, which influences perceived media richness (Carlson and Zmud 1994). Furthermore,

they argue that situational constraints, message characteristics, individual differences, communication norms, and social influence affect the need for information richness and, thus, affect media choice (Carlson and Zmud 1994).

To further detail the understanding of media choice, *media synchronicity theory* provides five factors of media characteristics that subsume and extend the dimensions of media richness theory (Dennis et al. 2008; Dennis and Valacich 1999): Immediacy of feedback (ability to provide rapid feedback), symbol variety (ability to use different types of symbols), parallelism (ability of several simultaneous transmissions), rehearsability (allowing sender to rehearse and encode a message), and reprocessability (the ability to be re-read and reviewed). The theory of media synchronicity suggests that factors influencing media choice are the communication process (conveying, i.e., communicating information or converging, i.e., reaching a consensus (Keats et al. 2005), media synchronicity, and appropriation factors (familiarity, training, past experiences, and social norms). In general, low media synchronicity is preferred for conveyance and high synchronicity for convergence (Dennis et al. 2008; Dennis and Valacich 1999).

A large body of work regarding media choice, such as media richness theory, channel expansion theory, and theory of media synchronicity focuses primarily on rational theories. However, others argue that both *social and rational factors* complementarily influence the choice, since an individual's perception of a medium is socially constructed (Büchel and Raub 2001; Trevino et al. 2000; Webster and Trevino 1995). Hence, Trevino et al. (2000) study these complementary factors that influence media choice, attitude, and use. In their study, they find support for several influencing variables: objective factors (equivocality), contextual constraints (recipients' distance, number of recipients), social factors (perceived social influence, medium symbolism), person factors (individual skills), and technology factors (perceived medium richness). Therefore, not only rational factors for media choice should be considered, but additional factors like social influence and individual characteristics.

2.1.2.3. Related Literature Reviews

The focus of this paper lies in analyzing the intersection of knowledge transfer and media choice. Several reviews of the literature in both domains have been conducted to understand and integrate the current state of the art on media choice in communication, the domain of knowledge management, and the specifics of knowledge transfer. We proceed to briefly summarize theses papers.

According to Kalman et al. (2019) reviewing media choice literature is primarily necessary because researchers still have difficulties testing the different theories on media choice in communication empirically. In addition, their review brings together disparate streams of work on media choice theory. Kalman et al. (2019) review literature of information systems and communication research regarding media choice and provide a unified framework for using a goals perspective. In their work, they provide a valuable overview of the different existing perspectives. However, most media choice theories do not directly associate their concepts developed for communication of information with the characteristics of knowledge. However, most media choice theories do not directly associate their concepts developed for communication of information with the characteristics of knowledge. Yet, some authors argue that the characteristics of knowledge go beyond information and, therefore, the existing con-structs do not fully explain the choice of media for knowledge transfer (Roberts 2000; Windsperger and Gorovaia 2011). Indeed, we find several knowledge characteristics to influence media choice for knowledge transfer (see Section 4) letting us conclude that specificities for knowledge transfer exist. This is also congruent with Kalman et al. (2019) who argue that differences often exist between goals of individual media choice theories.

Regarding knowledge management and knowledge transfer, several reviews and meta-analyses synthesizing existing research help to understand the domain. Alavi and Leidner (2001) provide a review of knowledge management literature in different areas. They present a systematic framework for the processes of organizational knowledge management (creation, storage/retrieval, transfer, and application) and the potential role of information technology in these processes. Knowledge transfer has also gained attention with van Wijk et al. (2008) providing a meta-analysis on the antecedents and consequences of knowledge transfer. They find that the characteristics of knowledge, organizational characteristics, and network characteristics influence the intensity of knowledge transfer and that knowledge transfer influences performance and innovativeness. Furthermore, a narrative review of the literature on antecedents of knowledge sharing by Wang and Noe (2010) provides a framework based on areas of emphasis that include organizational context, interpersonal and team characteristics, cultural characteristics, individual characteristics, and motivational factors. Additionally, Charband and Jafari Navimipour (2016) have systematically reviewed the literature on online knowledge sharing mechanisms, finding that online knowledge sharing is easier and faster, but people still rely on face-to-face knowledge sharing.

For combining literature on knowledge transfer and media choice in general as well as for comprehensively understanding media choice for knowledge transfer in particular, we conduct a systematic review of the existing research that examines influencing factors. Through our synthesis of past research, we also highlight existing gaps and provide directions for future research. Furthermore, we extend our findings through semi-structured interviews.

2.1.3. Method

2.1.3.1. Multi-Method Design

We conduct a two-stage study in order to combine different sources and increase validity and reliability. The research design is a multi-method approach, consisting of two qualitative strands (Mingers 2001). First, we conduct a systematic literature review in order to synthesize the existing work and to develop a model of factors influencing media choice for knowledge transfer. Afterwards, we use the findings of the literature review to conduct semi-structured interviews in order to further extent insights on what and how factors influence media choice for knowledge transfer. Additionally, we extend the model by investigating how emerging technologies might change the factors and their influence. Figure 2.1-2 gives an overview of the two research strands.

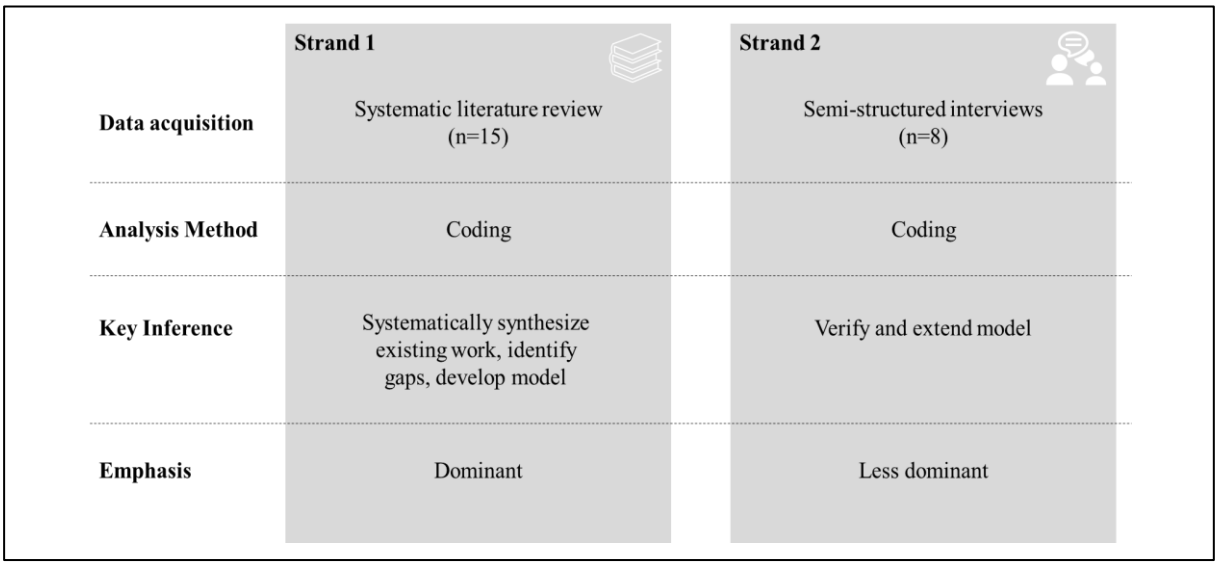

Figure 2.1-2: Overview of the Research Strands

2.1.3.2. Systematic Literature Review

To study the existing literature comprehensively and systematically, we conduct a systematic literature review. A systematic literature review – a review based on a structured approach – identifies, evaluates, and synthesizes research to address a specific issue (vom Brocke et al. 2015). Literature reviews synthesize the existing work on a domain and identify gaps future research needs to address (vom Brocke et al. 2015). Systematic reviews assume objectivity, transparency, and reproducibility, but are also criticized for being mechanistic (Boell and Cecez-Kecmanovic 2015). We argue that our topic "media choice for knowledge transfer" is specific and closely formulated, thus a clearly delimited topic, and therefore according to Boell and Cecez-Kecmanovic (2015), a systematic approach is appropriate. The primary goal of this systematic literature review is a qualitative evidence synthesis on the existing constructs and empirical findings regarding their influence on media choice in knowledge transfer (Grant and Booth 2009). We outline the process we followed in Figure 2.1-3.

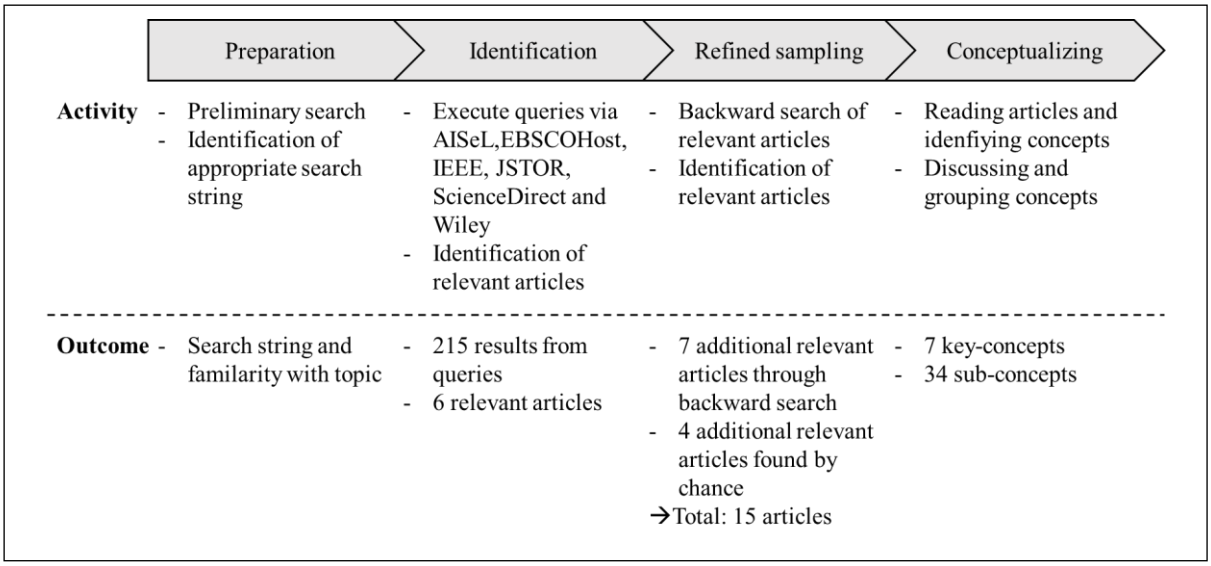

Figure 2.1-3: Process of the Conducted Literature Review

As recommended by vom Brocke et al. (2015) for literature reviews that are concept-centric (i.e., organized around concepts), we started our review with an intensive preliminary search and narrative review of the literature in September 2018 in the areas of both media choice and knowledge transfer, because it is problematic to identify good search terms in advance (Boell and Cecez-Kecmanovic 2015; Webster and Watson 2002). By reading and analyzing articles from our initial search, we were able to learn about the topic and the terms used and refined and expanded our search with terms that were used to investigate similar phenomena (Boell and Cecez-Kecmanovic 2015; vom Brocke et al. 2015). Relevant articles we found in this step were

used to check if our search string is adequate. Since our research topic refers to different research areas, we conducted our search in several databases, namely AISeL, EBSCOHost, IEEE, JSTOR, ScienceDirect and Wiley. Congruent with Webster and Watson (2002), we searched across many journals and did not limit our search to a small range, for example regarding disciplines or journals. We further included all study designs in order to combine findings of quantitative and qualitative studies. Furthermore, we included literature published in journals, conferences and books and did not limit to certain publication dates. Beside articles focusing on knowledge transfer, we also searched for articles investigating knowledge sharing, as it is part of the transfer of knowledge and the term often has been used interchangeably when investigating the same phenomena. Furthermore, we included articles investigating knowledge conversion because its result is transferred knowledge (Massey and Montoya-Weiss 2006). Thus, using the search string "*Knowledge AND (Transfer* OR Shar* OR Convers*) AND (Media Choice OR Media Selection)*" in title or abstract, we found 215 articles (for the number of articles by database see Appendix 2.1/A). The search was conducted in January 2019. In total, we identified 41 articles as potentially relevant, based on whether the title roughly refers to our topic/answers our research question. After reading the abstract and in case of uncertainty scanning the article and discussing its relevance and inclusion in our sample with all authors we conducted a backward search to identify seminal work and articles the keyword search did not retrieve (vom Brocke et al. 2015). According to the suggestions of vom Brocke et al. (2015), we did not exclude relevant articles, even if we found them by chance. In total, we included 15 articles in our review. All assessments were first made by a single researcher and the prioritization of the last 41 articles was discussed amongst all three researchers. The final list of articles was reached in consensus and is presented in Appendix 2.1/B. Before the conceptualization, we have read all articles and further familiarized with the literature as recommended by Bandara et al. (2015). Following the suggestions of Wolfswinkel et al. (2013) to analyze the literature we then identified 132 non-unique constructs from the 15 articles through open coding. For every article, we first coded findings that contained factors which influence the choice of media for knowledge transfer. Those excerpts then were re-read and analyzed several times in order to identify constructs. Afterwards, we grouped them to sub-categories and key concepts. This was done amongst the three researchers and upon extensive discussions while continuously comparing and relating the identified constructs. An example of the coding and conceptualiza-

tion process is illustrated in Appendix 2.1/C. As we did not find any new concepts in the identified studies, we argue that our framework is complete (Webster and Watson 2002). We found that the articles covered six key concepts that will be presented in the following section.

2.1.3.3. Semi-Structured Interviews

We built upon the findings of the literature review by conducting semi-structured interviews to generate further insights on the topic. The purpose of this step is threefold: First, we want to check whether the factors influencing knowledge transfer for media choice we identified in the literature are complete or whether there might be new factors. Second, we aim to gain an understanding on how (i.e., positively or negatively) the identified factors influence the decision of choosing digital media for knowledge transfer. Third and last, we want to extend the existing knowledge and investigate how emerging technologies and other developments in the working world might change media choice for knowledge transfer. Therefore, we conducted eight semi-structured interviews with experts for knowledge management and/or emerging technologies (see Appendix 2.1/D). The interviews have been conducted from October to December 2020, transcribed, and initially coded by each researcher conducting the interview. Based on our guiding questions all researchers analyzed and discussed the outcomes of the interviews. An exemplary coding is illustrated in Appendix 2.1/E.

2.1.4. Literature Review

Through examination of the studies on knowledge transfer and media choice, we identified knowledge, individual, interpersonal, environmental, and situational characteristics as areas of emphasis. Table 2.1-1 offers an overview of our review. We provide insights on whether the constructs were merely proposed to have an influence, or empirically tested with data gathered either qualitatively (e.g., through interviews or observation in a case study) or quantitatively (e.g., through a survey). In the next sections, we will present the concepts and articles in detail.

	Influence not specified	Digital Media	Richness	Synchronicity & Interactivity
Knowledge Characteristics				
Ambiguity		Majchrzak et al. (2000) ↓ [3 ns]	Büchel & Raub (2001) ↑ [1] Klitmoller & Lauring (2013) ↑ [2]	Keats et al. (2005) ↑ [1]
Tacitness	Massey and Montoya-Weiss (2006) [1]	Alavi & Leidner (2001) ↓ [1] Goodman & Darr (1998)↓ [2] Jasimuddin et al. (2014) ↓ [2] Chai & Liu (2010) ↓ [3]	Murray & Peyrefitte (2007) ↑ [3] Windsperger & Gorovaia (2011) ↑ [3]	Yuan et al. (2013) ↑ [2]
Specificity		Alavi & Leidner (2001) ↓ [1]		Yuan et al. (2013) ↑ [2]
Complexity		Goodman & Darr (1998)↓ [2]		
Interpersonal Characteristics				
Experience with Relationship	Massey and Montoya-Weiss (2006) [1] Büchel & Raub (2001) [1] Alavi & Leidner (2001) [1] Jasimuddin et al. (2014) [2]	Majchrzak et al. (2000) ↑ [3] Chai & Liu (2010) ↑ [3 ns] Goodman & Darr (1998) ↓ [2]	Windsperger & Gorovaia (2011) ↑ [3 ns]	
Hierarchical Distance	Jasimuddin et al. (2014) [2]	Chai & Liu (2010) ↑ [3 ns]		
Environmental Characteristics				
Diversity in Language and Culture	Magwenzi et al. (2016) [3]		Klitmoller & Lauring (2013) ↑ [2]	Klitmoller & Lauring (2013) ↓ [2]
Organizational Culture and Norms fostering Digital Media	Alavi & Leidner (2001) [1] Büchel & Raub (2001) [1] Snyder & Lee-Partridge (2013) [1] Goodman & Darr (1998) [2]			
Situational Characteristics				
Number of Receivers		Chai & Liu (2010) ↑ [3 ns]		
Geographic Distance	Büchel & Raub (2001) [1] Massey and Montoya-Weiss (2006) [1] Magwenzi et al. (2016) [3]	Jasimuddin et al. (2014) ↑ [2]		
Non-Availability of Receiver				Massey and Montoya-Weiss (2006) ↓ [1]
Urgency	Büchel & Raub (2001) [1]			Jasimuddin et al. (2014) ↑ [2] Yuan et al. (2013) ↑ [2] Magwenzi et al. (2016) [3]

Individual Characteristics of the Sender	
Level of Hierarchy	Büchel & Raub (2001) [1] Magwenzi et al. (2016) [3] Murray & Peyrefitte (2007) [3 ns]
Personal Preference	Büchel & Raub (2001) [1] Hasty et al. (2006) [1] Massey and Montoya-Weiss (2006) [1] Snyder & Lee-Partridge (2013) [1] Murray & Peyrefitte (2007) [1] Chai & Liu (2010) [3 ns]
Experience with Media	Büchel & Raub (2001) [1] Murray & Peyrefitte (2007) [1] Massey and Montoya-Weiss (2006) [1] Snyder & Lee-Partridge (2013) [1] Goodman & Darr (1998) [2] Magwenzi et al. (2016) [3] Majchrzak et al. (2000) [3 ns]
Experience with Topic	Massey and Montoya-Weiss (2006) [1]
Social Capital Gains	Yuan et al. (2013) [2]
Individual Characteristics of the Receiver	
Level of Hierarchy	Büchel & Raub (2001) [1]
Personal Preference	Büchel & Raub (2001) [1] Hasty et al. (2006) [1] Snyder & Lee-Partridge (2013) [1] Jasimuddin et al. (2014) [2]
Experience with Media	Majchrzak et al. (2000) [3 ns]

Note: 1: proposed; 2: qualitatively investigated; 3: quantitatively investigated (ns: not significant); ↑: positive influence; ↓: negative influence

Table 2.1-1: Results of Literature Review

2.1.4.1. Media Characteristics as Dependent Variables

Many studies examine the effect of different media characteristics on the choice of media for knowledge transfer, because "media vary in their capacity to reduce uncertainty and ambiguity" (Büchel and Raub 2001, p. 520). In the reviewed studies, the following media characteristics have been considered as dependent variables: *richness, interactivity, and synchronicity*. Further, some studies only differentiate between computer-aided and non-computer-aided systems, rather than describing the underlying media characteristics in detail.

Massey and Montoya-Weiss (2006) as well as Hasty et al. (2006) propose that *media richness* as well as *interactivity of media* (which is highly interrelated with social presence) determine the perception of media utility and thus affect media choice. Additionally, Büchel and Raub (2001) and Snyder and Eng Lee-Partridge (2013) argue that *media synchronicity* is an important factor when choosing media. Media synchronicity is defined as "the extent to which the capabilities of a medium enable individuals to achieve synchronicity" (Dennis et al. 2008, p. 581). Synchronicity in turn provides a better performance in the communication interactions that require convergence (a shared understanding) between individuals. In our results, we combine synchronicity and interactivity as they are mostly mentioned together, as synchronicity offers the possibility of direct interactions which can provide immediate feedback (Dennis et al. 2008).

Concrete media types, such as email, knowledge databases, or face-to-face meetings can be viewed as instantiations of those possible media characteristics. For example, in a case study of a Chinese branch of a multinational company on different media for knowledge sharing, interviewees argue that instant messaging is often used because it provides more interactivity than other media, such as knowledge data bases (Yuan et al. 2013). Similarly, Chai and Liu (2010) find that if senders want to have immediate feedback (which relates to media richness and media synchronicity) they rely more on face-to-face interaction than on written media. This is in line with the findings of Magwenzi et al. (2016). Yuan et al. (2013) also argue that ICTs, such as social media, can facilitate the sharing of knowledge with more people. In a qualitative study, interviewees mention ICT's ability to document information as an influencing factor (Snyder and Eng Lee-Partridge 2013). These findings describe the individual media's characteristics. We proceed to analyze why they are relevant and chosen for knowledge transfer.

The operationalization of the dependent variable, which generally are characteristics of media or concrete media for which a choice is made, varies in the different papers. For example,

Windsperger and Gorovaia (2011) differentiate eight knowledge transfer mechanisms according to their degree of information richness. They argue that knowledge transfer mechanisms differ from those of communication media as they enable the transfer of both explicit and tacit knowledge. Jasimuddin et al. (2014) propose a decision tree for media choice, which include the following media: face-to-face interaction, telephone, instant messaging, TeamRoom, and email. Massey and Montoya-Weiss (2006) include the following (more or less concrete) media types into their analysis: face-to-face interaction, telephone, written memos, documents, and computer-based alternatives. The authors argue that media utility derives from media characteristics, such as richness. Hasty et al. (2006) examine the dependent variable of the perception of media richness for knowledge transfer. The authors do so for the media types shared whiteboard, instant messaging, and voice mail.

As these examples show, there are many different concrete media types that might be included in studying media choice for knowledge transfer. With advancements in ICTs, the list of possible media will continue to increase. Overall, the papers indicate that different but highly interrelated characteristics of media have an influence on the choice of media, but a recent review of theories for media choice concludes that researchers "still struggle with knowing how to test these various theories" (Kalman et al. 2019, p. 6240). Hence, we need to understand what factors influence the selection of different media to understand the use of newly developed ICTs for knowledge transfer.

2.1.4.2. Knowledge Characteristics

We found that the factors most often studied are the characteristics of the knowledge. We identified the following characteristics of knowledge: Ambiguity, tacitness, specificity, and complexity as influencing factors.

Knowledge ambiguity refers to the extent to which conflicting interpretations of the underlying knowledge exist (van Wijk et al. 2008). It is seen as the most important antecedent of knowledge transfer and derives from the characteristics (1) complexity, (2) specificity, and (3) tacitness of knowledge (Büchel and Raub 2001; Reed and Defillippi 1990; van Wijk et al. 2008). Complex knowledge (1) results from the interrelationship within knowledge, while specific knowledge (2) is knowledge that cannot be easily generalized to other contexts (Alavi and Leidner 2001; Reed and Defillippi 1990). The degree of tacitness (3) is the degree to which knowledge can be codified and articulated (Grant 1996; Haas and Hansen 2007). Tacit knowledge is revealed through its application and can only be acquired through practice (Grant 1996). None of the studies identified in this literature review investigate the construct of complexity on its own.

Generally, it is proposed that the characteristics of knowledge are the primary determinant for media choice for knowledge transfer (e.g., Massey and Montoya-Weiss 2006). Various authors argue that knowledge *ambiguity* requires media with a high degree of information richness (Büchel and Raub 2001; Klitmøller and Lauring 2013), high synchronicity (Keats et al. 2005). Digital media generally have a lower richness than face-to-face interactions (Büchel and Raub 2001). In their longitudinal study of knowledge sharing within an engineering design team, Majchrzak et al. (2000) propose that team members tend to use face-to-face or phone for more ambiguous situations and ICTs for less ambiguous situations. Yet, they do not find empirical evidence for their proposition.

Several researchers focus on the characteristics of knowledge separately: *Complexity*, *specificity*, and *tacitness*. Alavi and Leidner (2001) propose that face-to-face interaction may be more effective to transfer tacit or specific knowledge. They argue that this is because resources can be saved when knowledge does not need to be made explicit (i.e., codified). Furthermore, Chai and Liu (2010) find that for sharing tacit knowledge, face-to-face is used more than the digital media email. Additionally, Jasimuddin et al. (2014) argue that for transferring tacit knowledge, face-to-face interactions are chosen. In a case study, it is found that knowledge repositories (like digital databases) are used for less complex and explicit knowledge and that ambiguous knowledge is shared face-to-face (Goodman and Darr 1998).

Two studies generalize the rationale behind the choice to the construct of media richness. Murray and Peyrefitte (2007) find that media with a high degree of information richness (e.g., face-to-face meetings) are chosen for tacit knowledge sharing. For sharing explicit knowledge, however, digital media like email or videotape are used (Murray and Peyrefitte 2007). This is also in line with Windsperger and Gorovaia (2011) who find that if knowledge is highly tacit, media with a high degree of information richness, like workshops, are used. Contrarily, digital media like email or the intranet are used for knowledge with lower degrees of tacitness. Yuan et al. (2013) find that tacit or specific knowledge requires high media synchronicity. A rationale behind this finding could be that highly tacit knowledge requires intense social interactions and thus immediate feedback to be transferred (Hislop 2002; Murray and Peyrefitte 2007).

There seems to be broad consensus in the presented studies that individuals choose media that is high in richness and synchronicity to reduce high degrees of ambiguity (e.g., Büchel and Raub 2001; Keats et al. 2005). In qualitative and quantitative studies this proposition is largely confirmed. Further, studies show that virtual communication is less effective for the transfer of highly ambiguous knowledge (e.g., Klitmøller and Lauring 2013). This is likely because face-

to-face interactions generally provide more richness than digital media (Büchel and Raub 2001). Yet, the degree of ambiguity results from the following sub-dimensions of the construct: tacitness, specificity, and complexity (van Wijk et al. 2008). Of the sub-dimensions, the identified studies mainly investigate tacitness. Empirical evidence regarding the other sub-dimensions, however, is rare. The same is true for studies addressing ambiguity as a whole. However, the theoretical hypothesis is strong, and the available evidence points in that direction. Though, to comprehensively investigate the characteristics of knowledge, all three sub-dimensions of ambiguity should be investigated. A promising methodological approach may be to model cases of knowledge transfer situations with varying degrees of tacitness, specificity, and complexity and ask participants about the media that participants would use in those specific instances. This would isolate the effect of each sub-dimension of ambiguity and may contribute to a better understanding of its role in media choice for knowledge transfer.

2.1.4.3. Interpersonal Characteristics

We find that experience with relationship, hierarchical relationship, and the type of relationship are all factors that influence media choice for knowledge transfer. First, *experience with a relationship* (the experience sender and receiver have with each other) leads to an expansion of the perceived media richness and thus influences media utility (Carlson and Zmud 1994; Massey and Montoya-Weiss 2006). When sender and receiver gain experience with each other, the individuals involved have a greater share of common knowledge which contributes to a better shared understanding (Hislop 2002). Moreover, the strength of relationship between sender and receiver (the degree to which they are close) is proposed to have an impact on media choice for knowledge transfer (Alavi and Leidner 2001; Büchel and Raub 2001). These two factors are closely related as an intense and close relationship relates to a high experience with the relationship. Thus, both result in common knowledge and a shared understanding due to experience with the relationship. The empirical results on how the experience with a relationship impacts the choice are contradictory at first sight: In the study of Jasimuddin et al. (2014) some employees prefer face-to-face interaction when they have strong ties and prefer email when the ties are weak. However, other employees seem to be indifferent because the utility of ICTs increases when sender and receiver are familiar with each other and share a common language. This in turn leads to a state where ICTs can be used interchangeably with face-to-face. In a field study of a virtual team, Majchrzak et al. (2000) found that over time, participants did indeed increase their use of collaboration technology and decreased face-to-face interactions. The authors of the study relate that back to a shared language that was formed through the increased experience

amongst the team. Contrarily, in a different case study, employees state that they use face-to-face mostly for the exchange of best practices because there is "a common bond" between the participants (Goodman and Darr 1998, p. 436). Chai and Liu (2010) find that if sender and receiver have a strong relationship, they tend to prefer face-to-face over digital media (email). Other authors hypothesize that a trustful relationship decreases barriers of knowledge transfer and that the use of all media increases in turn. However, no significant influence of trust on the choice of rich or lean media is found in this study (Windsperger and Gorovaia 2011). These results are not necessarily in contradiction. Experience with a relationship decreases the barrier to approach someone face-to-face, however, it also increases the utility of less rich media due to a common language and thus creates alternatives if face-to-face interactions are not feasible. Yet, we follow up on this relationship in the second part of our study.

Secondly, the *hierarchical distance* between the sender and receiver (i.e., if they are from the same hierarchical level or from different levels) is hypothesized to influence media choice, because the organizational structure often determines the use of communication channels (Hinds and Kiesler 1995). Chai and Liu (2010) hypothesized an increased usage of digital media when sender and receiver are from different hierarchical levels. However, they find no significant difference in their empirical analysis. Interviewees in a case study, however, argue that if senders are from a high hierarchical level, they prefer a more formal media, like email (Jasimuddin et al. 2014) and that receivers cater to those preferences. The authors acknowledge that this construct has not been extensively recognized in the existing literature.

In conclusion, there is little and in parts conflicting empirical evidence regarding the influence of interpersonal characteristics on media choice for knowledge transfer. While Goodman and Darr (1998) find face-to-face interactions to be preferred with high experience with the relationship, most other authors argue in line with media expansion theory that experience with the relationship extends the perceived richness of media and, thus, less rich media is needed. A difference in hierarchical levels of sender and receiver is said to influence choice, but empirical results seem inconclusive. To clarify the results and understand the influence in detail, we follow up on the relationship of interpersonal characteristics and the media choice in our interviews.

2.1.4.4. Environmental Characteristics

Research has investigated how characteristics of the environment in which the knowledge transfer takes place relate to media choice. Factors that we identified in our studies are: Diversity in language and culture, organizational characteristics, norms of media use, organizational culture,

and team norms. First, a shared understanding developed through experience with the relationship leads to an extension of perceived media utility and thus affects media choice. This is hypothesized to be true when employees share a common understanding of a *language* (e.g., English as a common language of global teams) *and culture* (Klitmøller and Lauring 2013). In a study of a multi-national corporation located in Denmark and India, Klitmøller and Lauring (2013) find that teams characterized by high language diversity and cultural differences prefer rich media for sharing ambiguous knowledge and lean media for sharing simpler, explicit knowledge. That is because rich media allows to clarify misunderstanding, but media with low interactivity allows to for the sender to review and revise the content before disseminating it und thus ensuring that it is of high clarity and quality, compared to a simultaneous face-to-face interaction (Klitmøller and Lauring 2013; Walther 1992). Another study, however, where employees were asked to rank influencing factors of media choice for knowledge transfer, found that language difference and cultural differences are amongst the least important factors (17 & 19 out of 21) (Magwenzi et al. 2016). However, the study did not specifically investigate global teams, which might explain why the factor was not important on average.

Several authors suggest that *organizational culture and norms fostering digital media* affect media choice (Alavi and Leidner 2001; Büchel and Raub 2001; Snyder and Eng Lee-Partridge 2013). For example, within a competitive corporate culture, people might prefer to choose media with a small scope because they want to avoid that their knowledge is available to everyone (Snyder and Eng Lee-Partridge 2013). Further, Büchel and Raub (2001) and Goodman and Darr (1998) propose that team norms act as a counterculture to the organizational norms, because the communication norms within the team may differ from those of the organization. However, there is only little empirical evidence for the influence of organizational culture and norms on media choice for knowledge transfer. One exception are the research results of Goodman and Darr (1998) which indicate based on interviews, that team norms do influence media choice for knowledge transfer and that they differ from the organizational norms. For example, they state that if a team mostly uses email to communicate it may also steer the individual team members towards email usage.

To sum up, we find that only few studies empirically investigated environmental characteristics. Thus, open questions remain regarding the influence of language diversity and cultural differences and the direction in which they act. Likewise, the impact of organizational culture is understudied, particularly regarding organizational culture characteristics, which are said to

have a strong influence on the knowledge transfer process (Fulk et al. 1987; Murray and Peyrefitte 2007). Snyder and Eng Lee-Partridge (2013) already proposed the influence of a competitive culture on media choice for knowledge transfer.

2.1.4.5. Situational Characteristics

The context within which the knowledge transfer takes place further influences media choice. Relevant situational characteristics proposed by the literature are: Number of receivers, geographic proximity, non-availability of receiver, and urgency.

Only one study addresses the impact of the *number of receivers* a sender wants to reach. Chai and Liu (2010) hypothesize that individuals chose media which is high in scope when they want to transfer knowledge with many people. Yet, they find that employees use both non-digital (face-to-face, which is generally low in scope) and digital media (email, which is generally high in scope) when they want to transfer the knowledge to a large number of people.

One factor proposed by several authors is *geographic distance*, which states that the source and recipient are located geographically far from each other (Büchel and Raub 2001; Massey and Montoya-Weiss 2006). ICTs are expected to reduce space and time barriers for knowledge transfer, while face-to-face interactions can only be used when participants are close (Jasimuddin et al. 2014). In interviews, employees argue that they sometimes would prefer to use face-to-face, but have to rely on ICTs instead because of a geographical distance between the sender and receiver (Jasimuddin et al. 2014). Congruently, Magwenzi et al. (2016) find that geographical distance generally does affect media choice. Closely related is the *non-availability of the receiver*. It is proposed that because participants are not immediately available asynchronous media may be preferred (Massey and Montoya-Weiss 2006).

Furthermore, the degree to which the knowledge transfer is *urgent* is proposed to have an impact on media choice (Büchel and Raub 2001). Individuals argue that if knowledge transfer is time critical, they prefer synchronous media that promises quick results, such as face-to-face interactions (as long as the recipient is close and available) (Jasimuddin et al. 2014; Yuan et al. 2013). Magwenzi et al. (2016) also finds it to be an influential factor.

The situation in which knowledge transfer takes place constrains the media which are perceived to be useful and thus affects media choice. Although it has been argued that if the intended "number of receivers" is high, people might tend to use media high in scope, to reach many people simultaneously, empirical evidence is missing. Chai and Liu (2010) find that media high in scope as well as low in scope is used when the number of receivers is high. Yet, whether

there are circumstances under which there are significant statistical differences have not been investigated. Empirical evidence, however, is found for the situational characteristics geographic distance and urgency which constrain and influence media choice.

2.1.4.6. Individual Characteristics

As knowledge transfer occurs between a sender and a receiver, their individual characteristics have a substantial influence on media choice. We identified several characteristics of sender and receiver as influencing factors for media choice for knowledge transfer, namely: level of hierarchy, personal preference, experience with media and topic, and social capital gains.

The *level of hierarchy* of sender and receiver may influence media choice (Büchel and Raub 2001). In a quantitative study, employees from different hierarchical positions ranked this factor as the least important organizational factor for their media choice (Magwenzi et al. 2016). Results of a study from Murray and Peyrefitte (2007) show no difference between the media choice of individuals from different hierarchical levels on aggregate. However, empirical evidence still remains unclear.

Furthermore, *personal preference* of the sender and the receiver is addressed in several studies. Several authors propose that media for knowledge transfer is chosen because it is simply subjectively preferred, regardless of other circumstances (Büchel and Raub 2001; Hasty et al. 2006; Massey and Montoya-Weiss 2006; Murray and Peyrefitte 2007; Snyder and Eng Lee-Partridge 2013). For example, monochronic individuals (i.e., individuals who prefer to engage in one activity at a time and hence, have a greater desire for immediate closure) might prefer media that allows for immediate feedback, such as in face-to-face communication (Massey and Montoya-Weiss 2006). However, a quantitative study that takes monochronic behavior into account does not find empirical evidence for it to affect media choice in the knowledge transfer stage significantly (Chai and Liu 2010). It is also proposed that preferences of receivers may lead senders to disregard their own preference (Büchel and Raub 2001; Hasty et al. 2006; Snyder and Eng Lee-Partridge 2013). Jasimuddin et al. (2014) study this in the situation when sender and receiver are of different hierarchical levels: If the receiver is on a higher organizational level (e.g., boss of the boss) and has a personal preference, the sender follows this preference. If they are on the same level or the receiver is ‘only’ the immediate boss, personal preference of the receiver does not play a role.

Experience with the media is relevant because when sender and receiver gain experience with different media for knowledge transfer, it leads to an extension of media utility and thus affects

media choice (Büchel and Raub 2001; Massey and Montoya-Weiss 2006). Additionally, individuals tend to communicate in familiar ways i.e., they tend to select media they have experience with (Murray and Peyrefitte 2007; Snyder and Eng Lee-Partridge 2013). Studies identified in our literature review provide empirical evidence for such an effect in multiple ways: For example, through two case studies, Goodman and Darr (1998) find that employees still rely more on familiar media when a new media is introduced. Furthermore, Magwenzi et al. (2016) report that having experience with the media is ranked as an important influencing factor. Majchrzak et al. (2000) do not observe a trend of increasing ICT usage when employees gain experience with the respective media – this applies for both senders and receivers.

The effect of *experience with the topic* on media choice also is hypothesized to have an impact because it affects perceived media richness (Massey and Montoya-Weiss 2006). Yet, this proposition was not empirically investigated in any of the studies within our sample.

The factor *social capital gains* of the sender is also not well investigated but still might have a strong impact – especially with the increased use of social media in organizational context. Interviewees, for example, argue that they were more motivated to share knowledge on social media than through other media because it "could increase [their] visibility in the organization" (Yuan et al. 2013, p. 1665). The rationale behind this finding could be that usage of social media is said to increase the social capital by gaining reputation through knowledge transfer (Gil de Zúñiga et al. 2012; Kankanhalli et al. 2005).

Overall, it appears that individual characteristics of both sender and receiver influence the decision which medium to choose for knowledge transfer. Studies often propose this, but there are only a few studies that have investigated it empirically. Level of hierarchy has been proposed to have an effect on media choice for knowledge transfer but has not been found empirically. This may be because it is not the hierarchy that is the decisive factor, but situational factors like recipient non-availability that follow indirectly from the hierarchy, thus creating a correlation but no causality (Frank et al. 2017). Further research should investigate and consider such correlations. We find studies that propose personal preference to have an effect on media choice for knowledge transfer. There are multiple aspects that have been proposed with regard to personal preferences. Seminal works in media choice literature like "task-technology-fit" or "channel expansion theory" contain the construct "individual characteristics" referred to personality traits like introversion or extroversion (Carlson and Zmud 1994; Goodhue and Thompson 1995). Yet, personality factors have not received attention so far, especially as determinants on personal media preferences (Hemmer and Heinzl 2012; Hertel et al. 2008). Yet, Wang and

Noe (2010) for example propose that extraverts may prefer to transfer knowledge face-to-face rather than via ICTs because of their need for social interaction and highlight the need for future research. Additional factors of the "Big Five" may also warrant consideration: Neurotic individuals might feel aversion to direct reaction of the other participants and thus prefer asynchronous written media like email (Hertel et al. 2008).In contrast, open people might be curious to use new ICTs to transfer knowledge (Hemmer and Heinzl 2012).

The influence of experience with media and topic has been proposed several times, based on channel expansion theory. Nevertheless, the influence it has on media choice for knowledge transfer was seldom tested empirically and could not be verified yet.

2.1.5. Semi-Structured Interviews

After the literature review, we conducted semi-structured expert interviews to verify and extend our findings to reflect new ICT-related developments. The corresponding goals were 1) testing the completeness of our identified factors, 2) verifying the direction of their influence on media choice for knowledge transfer, and 3) assessing whether emerging technologies and other major developments in the working world change the factors and their influence. Figure 2.1-4 displays our findings for the first two goals. We find that two further factors have to be added to the ones already found in existing literature. That are knowledge sensitivity and the availability of infrastructure for knowledge transfer. Also, we find insights on whether the factors positively or negatively influence the choice of digital media for knowledge transfer. However, for some factors, our interviewees stated differing results depending on the presence of moderating factors.

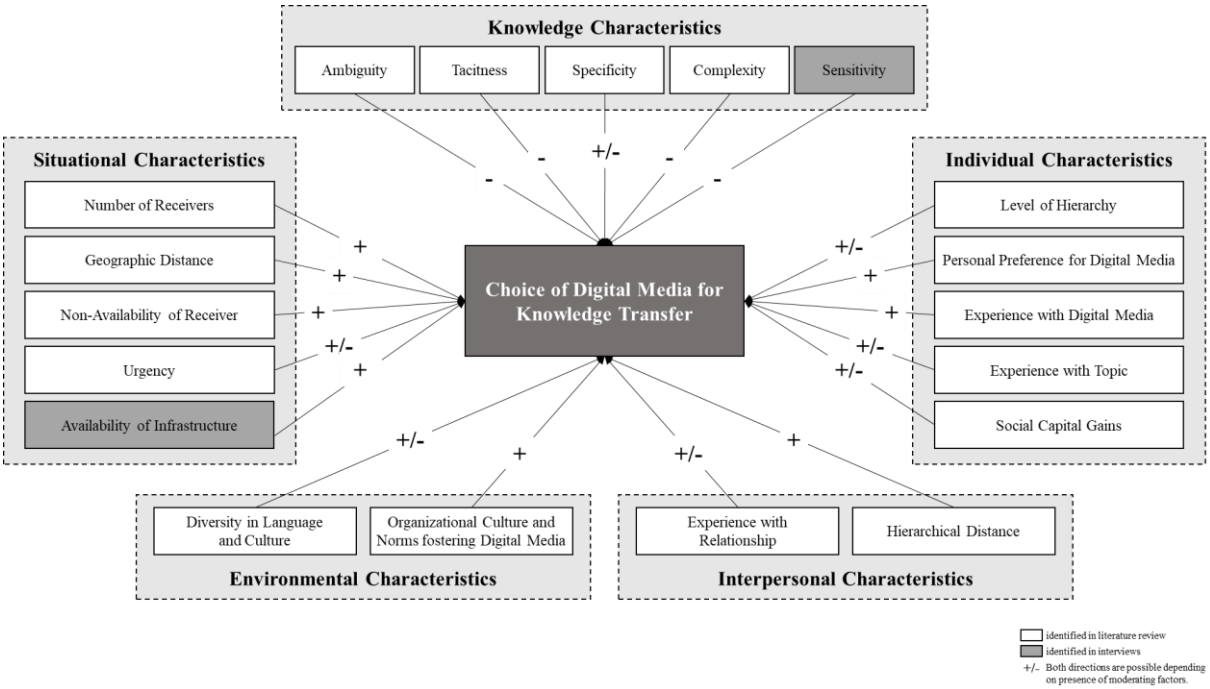

Figure 2.1-4: A Framework for Factors Influencing Media Choice for Knowledge Transfer

Table 2.1-2 shows the results for the third goal of our interviews. Overall, our interviewees propose that current developments like emerging technologies lead to an increased use of digital media for knowledge transfer. AI and its different applications like recommender systems or chatbots is the most frequently mentioned ICT-related development. It shows an impact on each of our categories as it promises to lower ambiguity, tacitness, and complexity of knowledge or as it might help overcome diversity in language and culture. Further, other general ICT-related developments in the working world to a more agile and digitally-familiar working world or the influence of the COVID-19-pandemic and the associated increase in digital work have been mentioned to affect our framework.

Developments	Affected Variable	Interview Quotes
Knowledge Characteristics		
AI, particularly recommender systems	ambiguity	"Someone writes me an e-mail with a certain issue and an AI would automatically show me similar cases and I can then much faster deduce from the context what the e-mail actually is about. Thereby, ambiguities are eliminated more quickly."
AI, particularly network analysis and semantic search	tacitness	"An AI might find relationships between two individual tacit knowledge items by identifying a connection between them. For example, a connection between completed action items in a project management tool and performance indicators."
AI, particularly chatbots	complexity	"With the use of AI […], I will be able to deliver increasingly complex topics digitally."
AI, particularly network analyses	complexity	"Certain algorithms and systems make connections clear in the first place, [i.e.] human interaction and human thinking about it would not have seen it at all because it becomes too complex and too big."
Augmented reality	complexity, tacitness, specificity	"An example would be maintenance processes in the production environment. These processes, if you describe them on a piece of paper, are difficult to express in a formalized way with pictures and a complex description [...]. This is usually a relatively high level of expert knowledge or experience and is usually also a certain complexity depending on the machine. And of course, you have the advantage if you say I somehow have my augmented reality glasses and I am standing in front of the machine and I get exactly shown how I have to press now and which screw I have to turn now and the same."
Individual Characteristics		
Virtual and augmented reality	level of hierarchy	"Managers might say 'I don't have to travel anymore' and they can use VR/AR glasses to have a look at the new car instead of going to the development department."
AI, particularly chatbots	personal preference for digital media	"Nobody has fallen in love with a chatbot yet. But maybe, at least my personal preference for digital media will increase."
AI, particularly semantic search	experience with topic	"I think there is something that can significantly improve semantic search in the future, so that I can get to the content I want more quickly, which can then balance out my experience with topic and consequently can also benefit my digital media choice, [...] because the knowledge is searchable and easily accessible."
AI, particularly the provision of context-specific information	experience with topic	"When I get displayed context-specific information [during a meeting], which is not only context-specific but also personalized to me and what I know and what I may not know. This can solve or at least weaken an inexperience in a certain topic." "With increasing experience with the topic rises the hunger for more complex, more specific knowledge, because you already know the other stuff."
Interpersonal Characteristics		
New work / future of work	hierarchical distance	"I think we have a general tendency that hierarchical distance becomes less and less important. Because on the one hand there are organizational forms that consciously aim to reduce hierarchical distances and on the other hand digital media also make it easier to overcome such hierarchical distances."

Developments	Affected Variable	Interview Quotes
Environmental Characteristics		
AI, particularly real time translation	diversity in language and culture	"When another language is translated in real time, misunderstandings can almost already be solved digitally, and we do not have to do face-to-face conversation."
Cultural change through the COVID-19-pandemic	organizational cultures and norms fostering digital media	"If I have a feature in my [video conferencing tool] for a live subtitle creation [...], then I think it is a nice example of how [...] one chooses digital medium because it helps to avoid these initial difficulties with diversity."
Situational Characteristics		
Video conferencing	geographic distance	"What I am missing is eye contact. If I do a training, can I look at people and see whether they understand me. I miss that in the digital world when I don't have the camera on."
Virtual and augmented reality	geographic distance	"I can sort of feel that group, I can put a hologram in the air or whatever. It's not that far from the teleporter either and I even care less about the proximity. But it doesn't matter to me whether the people are in Russia or America or whether they are in China or whether they are in Australia."
Chat/Collaboration system with availability display	non-availability of receiver	"When I can't reach someone face-to-face, but I see that they are online, for example, then I would briefly call them rather than writing a chat message."
Digitalization of workplaces	non-availability of receiver	"Digital media are evolving and the stronger the penetration, the less relevant this factor becomes. I would say because the availability is simply increased [by that]."
AI	urgency	"When I have to transfer some information or knowledge quickly but have no time at all to write it down and could just pronounce it and it would be typed down without errors and supported with a graphic illustration or something, then I am super fast and can transfer it digitally very quickly."
AI, particularly chatbots	urgency	"When you are on hold on the phone and it would take another 15 minutes before they put you through, they may offer an opt out […] to talk to an AI."

Table 2.1-2: Results of Semi-Structured Interviews on the Influence of Emerging Technologies and Other Developments

2.1.6. Discussion

With this study, we seek to summarize the findings of studies that have investigated antecedents of media choice for knowledge transfer. In addition, we identify potential changes in the relevance of theses influencing factors in the light of the emergence of new technologies and other ICT-related developments. In the following, we discuss our results from both the literature review and the semi-structured interviews and elaborate on how they relate to the various theories of media choice we introduced.

Knowledge Characteristics

In our review of the existing literature, we find that knowledge characteristics are frequently identified as a main driver of media choice for knowledge transfer. This is a key category that

is specific to media choice for knowledge transfer. Similar constructs have previously been studied in general media choice research as part of the construct of equivocality, which arises from the two sources personal nature and ambiguity (Webster et al. 1996). Similarly, Daft and Lengel (1984) suggest that communication regarding ambiguous tasks require richer media (Sitkin et al. 1992). In addition to the known factors, we find in our interviews that for the transfer of sensitive knowledge that is not meant to be documented or received by a third party, face-to-face interactions are often chosen.

Regarding new ICT-related developments, our interviews reveal that the necessity for face-to-face interactions to transfer ambiguous, complex, and tacit knowledge will potentially decrease with the emergence of new technology, such as AI. According to our interviewees, AI has the capacity to reduce complexity, identify links between poorly documented knowledge through recommender systems, and other algorithmic sensemaking. Chatbots will also be able to transfer less complex and less specific knowledge in an automated way. An example is an NGO that provides knowledge on pregnancy to African women, which already uses AI to answer standard questions automatically and without human involvement. This also changes the role of the sender in the transfer of knowledge. Lastly, augmented reality (AR) may improve the ability of digital media to transfer knowledge as it increases the media richness through augmentation – possibly beyond that of face-to-face interactions. Therefore, digital media could potentially be preferred over face-to-face interactions in such situations in the future.

Individual Characteristics

Our literature analysis showed that individual characteristics influence media choice. This is in line with literature channel expansion theory (Carlson and Zmud 1994) or the social information processing model (Fulk et al. 1987). For example, one basic assumption of the media richness theory (Daft and Lengel 1984) is that the level of hierarchy influences media choice: activities in high organizational levels differ systematically from lower levels and rich media is merely used on the top of an organization. Regarding experience with topic, the hypothesis from the literature is that it decreases the necessity for rich media. Our interviews further reveal that AI systems similar to the ones discussed in regard to the knowledge characteristics could counteract the influence of a lack of experience with a topic. For example, an AI could provide context-specific information to users of digital media through semantic searches and proactive recommendations. Other respondents stated that an increase in experience with a topic increases the "hunger" for more complex and specific knowledge, which in turn indirectly increases the need

for an increased information richness. For example, while chatbots work with individuals looking for basic knowledge, videoconferencing or face-to-face interactions might be necessary to further educate individuals familiar with a topic.

Interpersonal Characteristics

Regarding interpersonal characteristics and in line with channel expansion theory (Carlson and Zmud 1994) our literature review shows that experience with the relationship extends the perceived richness of media and, thus, leads to an increase in media choice that is less rich (digital media). Theory suggests that co-participants will establish knowledge that helps them encode and decode messages, i.e., establish a common language (Carlson and Zmud 1994). Yet, our results also suggest that a common bond and a trustful relationship may cause individuals to choose face-to-face interactions for reasons of personal preference. This is certainly an interesting finding, which might have various reasons, such as the urge to establish and maintain a social relationship. This is congruent with the fact that face-to-face interactions are frequently chosen when an increase in trust is desired (Trevino et al. 1987). Lastly, trustful relationships could correlate with more opportunities for informal meetings, which promote socialization (Alavi and Leidner 2001). No potential future changes regarding these factors could be identified.

Secondly, the influence of hierarchical differences between the sender and receiver has been subject to debate. The indication is that senders may follow the personal preference of a receiver that is higher up in the hierarchy. It has been studied that media perception is subject to social influence (e.g., Fulk et al. 1990) and that media richness theory should be complemented by such factors (Trevino et al. 1987; Webster and Trevino 1995). Empirical findings also suggest, that for communication across hierarchical levels, the perspective, preferences, and availability of the receiver becomes more important than in lateral communication (Zmud et al. 1990). Yet, in this study, we find that the empirical evidence for a systematical difference in media choice for knowledge transfer for different hierarchical levels is quite limited. Furthermore, the interviews revealed that hierarchical distance might become even less important with changes in the way we work, which are certainly in part driven by ICT-related changes, such as enterprise social networks.

Environmental Characteristics

Our review further suggests that organizational culture and norms, as well as diversity in language and culture, are factors that influence media choice for knowledge transfer. However, their influence is mostly not specified in the existing literature. A closer look at existing theories

on media choice reveals related aspects. First, Fulk et al. (1987) suggest that strong cultures create company-wide norms for behavior which may otherwise influence rational and effective decisions. Furthermore, they find that social norms may influence the perceived media characteristics themselves as well as the attitude towards and the use of different media (Fulk et al. 1987). These insights are complementary to the findings in our study. Additionally, Webster and Trevino (1995) suggest that symbolic cues (i.e., the meaning that is derived from the chosen media, going beyond the message content itself) are socially constructed over time. This in turn is influenced by culture and leadership and, thus, may be relevant to this dimension. Further, Schmitz and Fulk (1991) suggest that the richness of media itself may in part be socially defined. However, in their paper on media synchronicity, Dennis and Valacich (1999) refer to several other studies to subsume that this effect is minor. A relation to media richness has scarcely been drawn by the papers identified in our literature review. Yet, in our expert interviews, we find evidence that diversity in language and culture will become a less important factor because of the ability of digital media to translate different languages in real-time through AI. Further, organizational cultures and norms will become more normal fostering digital media for knowledge transfer even more. Thus, both environmental characteristics might become less of a concern in future research and practice.

Situational Characteristics

We found that several studies take situational characteristics into consideration when investigating the influence on media choice for knowledge transfer. This is in line with theories on media choice, which conclude that situational characteristics may constrain an individual's choice (e.g., Trevino et al. 1987; Webster and Trevino 1995). A result of our literature analysis is that the number of receivers as well as the geographic distance of sender and receiver influences media choice for knowledge transfer. Furthermore, the evidence regarding the non-availability of the receiver is also in line with previous literature. For example, it may be hard to reach someone for a face-to-face meeting if the person is busy or frequently absent (Trevino et al. 1987). According to media choice theory, time pressure significantly influences media choice which is congruent with the factor identified as urgency (Steinfield and Fulk 1986). Our interviewees suggest another situational characteristic to be of relevance, that is the availability of proper infrastructure for the use of digital media. While many in the developed world may take this generally for granted, this is not the case in other countries. Also, the availability of infrastructure may vary situationally. Thus, we added this factor to our framework.

2.1.7. Theoretical Contribution and Practical Implications

In our paper, we examined existing literature on media choice for knowledge transfer by means of a systematic literature review in order to qualitatively synthesize existing empirical evidence. We further extended our findings by conducting semi-structured interviews with eight experts on knowledge management and emerging technologies. We presented a framework of factors that influence media choice for knowledge transfer and relate our findings to existing media choice theories. Our findings indicate that most evidence is congruent with existing theories on media choice. Yet, and in line with recent reviews on media choice theories, we argue that the fragmentation of both the existing theories and the empirical evidence on the matter pose challenges to the field. Furthermore, we reveal two additional factors influencing media choice for knowledge transfer that have not yet been discussed in literature and we find that emerging technologies such as AI will have a heavy impact on the relevance of individual influencing factors.

By this, we make important contributions to existing literature. First, we provide a framework that summarizes influencing factors that influence media choice for knowledge transfer. Second, the framework not only builds on existing literature but is complemented by results of expert interviews that also give evidence for the direction of the influencing factors. Through our expert interviews, we identified influencing factors for which the impact on media choice seems to be moderated by other factors (i.e., the direction of the influence is not clearly positive of negative). These factors warrant additional attention by researchers from the field. Third, our interviews also revealed potential changes in the framework and to the relevance of individual factors due to emerging technologies and other ICT-related developments. For example, we found that AI can overcome constraints, such as language barriers. The general tendency towards a networked organization and the future of work may act on environmental and interpersonal factors and to shift media choice towards digital media. Knowledge ambiguity, a central part of media choice for knowledge transfer, may be reduced through AI. And lastly, virtual and augmented reality, may increase the utility and media richness of digital media, fostering its usage – particularly in the presence of geographic distance. Our framework serves as a solid basis for influencing factors on media choice for knowledge transfer and summarizes the empirical findings of previous studies. We integrate these findings with existing media choice theories. In combination with our findings on future ICT-related developments, they serve as a good basis for future research on media choice for knowledge transfer.

For practitioners, we point out that the effective management of the use of digital media for knowledge transfer starts with an understanding of the influencing factors that drive the choice. We show that technological changes do not automatically imply usage, but that there are several influencing factors that need to be considered. Conscious decisions for a particular media or habitual use of them is influenced by these factors. For example, many authors reveal that personal preferences may be at play, yet, since no influence can be specified, this represents a highly individual component. New technologies are emerging that have the potential to revolutionize knowledge transfer and flow within organizations, yet their usage often depends on the choice of individuals. Yet, organizations need to be aware of how media choice is affected by such developments, realize their potential, assess in which circumstances they want them the be utilized, and provide change management to overcome the aforementioned habitual and individual decisions. Our framework provides a starting point for such elaborations.

2.1.8. Limitations and Conclusion

Our research has some limitations. In our review, we focus on attitudes and behavior of media choice for knowledge transfer, but not on the fit of the choice. The literature on communication media choice often link media choice to performance outcomes (e.g., Daft and Lengel 1984; Hollingshead et al. 1993). The studies identified in our review regarding knowledge transfer mostly do not consider this linkage. Gaining a deeper understanding of the link between media choice and its outcomes, has important implications for practice. There are different related outcomes variables that might be interesting to study, for example, the success of the knowledge transfer which affects the knowledge stock of employees and thus group or organizational performance (Hasty et al. 2006; Hollingshead et al. 1993; Razmerita et al. 2016). Future research could, for example, investigate this through the comparison of different teams or organizations.

Additionally, with more media becoming available, employees have a wider range of media to choose from to transfer knowledge (Murray and Peyrefitte 2007; Windsperger and Gorovaia 2011). Most of the research has focused on the choice to use a single media, but it is likely that employees use multiple media for the same knowledge, “even simultaneously” (Hasty et al. 2006). For example, Massey and Montoya-Weiss (2006) propose that there are two structures for media choice: one where participants use only one medium and one where participants use multiple media simultaneously. Future studies should continue to address such detailed usage behavior.

Further, our sample of interviewees was restricted to eight experts that work in knowledge management and/or with emerging technologies such as AI. That is why in many of our results

AI plays an important role. Even though AI is one of the most influential emerging technologies in the moment, this may represent a potential bias in our results. Also, the presented directions of influences (cf. Figure 2.1-4) have not been investigated in detail. Particularly for the ones that seem to be moderated by other factors, this might be a fruitful avenue for future research.

Besides these limitations and opportunities for future research, we believe that with our evidence synthesis, considerable insights have been gained into the complex phenomenon of media choice for knowledge transfer. The findings of our research have important managerial implications as they could be useful for management in understanding and controlling media choice behavior. Further reviews may focus on the outcomes of the choices to provide guidance to managers on how they should control this complex set of factors to get the desired outcome. We further hope that the ideas and research issues of this study will encourage further research into understanding media choice for knowledge transfer.

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Appendix 2.1/A – Number of Articles Retrieved from Search by Database

Database	Number of Articles Retrieved from Search
EBSCO	5
AISeL	64
IEEE	46
ScienceDirect	30
Wiley	68
JSTOR	2
Total	215

Appendix 2.1/B – Overview of Literature Included in the Review

Author	Year	Title	Publication	Data Gathering
Alavi, M., and Leidner, D. E.	2001	Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues	Journal	Literature analysis
Büchel, B., and Raub, S.	2001	Media Choice and Organizational Learning	Book	Literature analysis
Chai, K.-H., and Liu, W.	2010	Identifying and measuring Reach and Richness: Toward a knowledge sharing mechanism selection model	Conference	Survey
Goodman, P. S., and Darr, E. D.	1998	Computer-Aided Systems and Communities: Mechanisms for Organizational Learning in Distributed Environments	Journal	Case Study
Hasty, B. K., Massey, A. P., and Brown, S. A.	2006	Experiences and Media Perceptions of Senders and Receivers in Knowledge Transfer: An Exploratory Study	Conference	Survey
Jasimuddin, S. M., Connell, C., and Klein, J. H.	2014	A decision tree conceptualization of choice of knowledge transfer mechanism: the views of software development specialists in a multinational company	Journal	Interview
Keats, D., Watson, J., and Yoong, P.	2005	Online Knowledge sharing and media selection in a community organisation: An application of the Theory of Media Synchronicity	Conference	Interview
Klitmøller, A., and Lauring, J.	2013	When global virtual teams share knowledge: Media richness, cultural difference and language commonality.	Journal	Interview
Magwenzi, R., van Waveren, C. C., and Chan, K.-Y.	2016	Factors for electronic media selection in project communication	Conference	Survey
Majchrzak, A., Rice, R. E., King, N., Malhotra, A., and Ba, S.	2000	Computer-Mediated Inter-Organizational Knowledge Sharing: Insight from a Virtual Team Innovating Using a Collaborative Tool	Journal	Observation, Survey, Interview

Massey, A. P., and Montoya-Weiss, M.	2006	Unraveling the temporal Fabric of Knowledge Conversion: A Model of Media Selection and Use	Journal	Literature analysis
Murray, S. R., and Peyrefitte, J.	2007	Knowledge Type and Communication Media Choice in the Knowledge Transfer Process	Journal	Survey
Snyder, J., Eng Lee-Partridge, J.	2013	Understanding communication channel choices in team knowledge sharing	Journal	Survey, Experiment, Interview
Windsperger, J., and Gorovaia, N.	2011	Knowledge attributes and the choice of knowledge transfer mechanism in networks: the case of franchising	Journal	Survey
Yuan, Zhao, Liao, Chi	2013	The Use of Different Information and Communication Technologies to Support Knowledge Sharing in Organizations: From E-Mail to Micro-Blogging	Journal	Interview

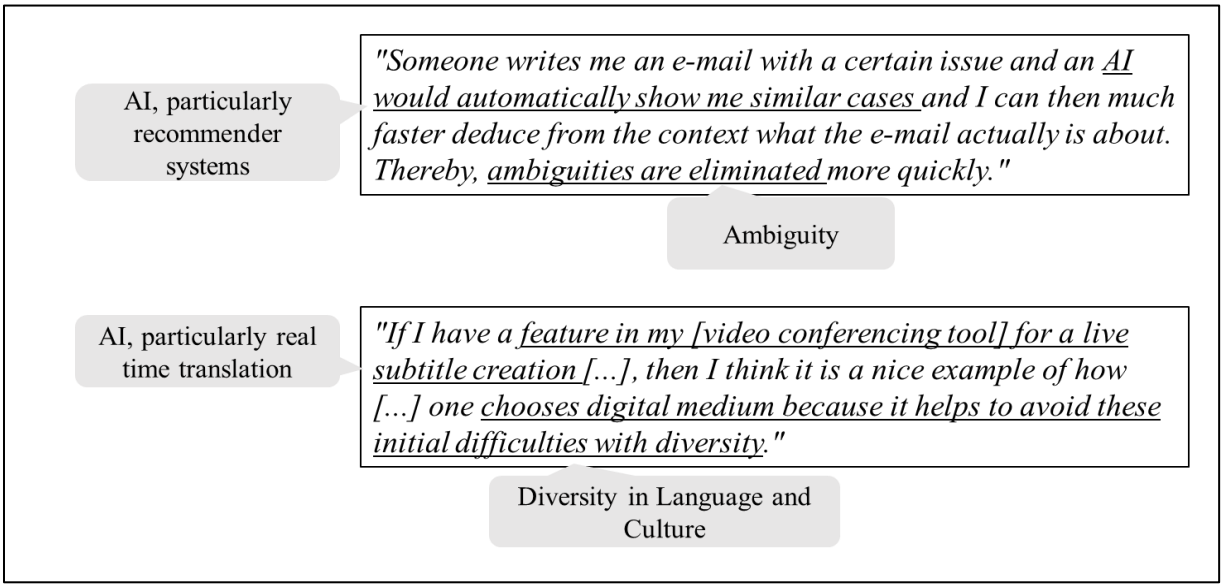
Appendix 2.1/C – Example of Literature Review Coding

ID_Construct	Code	Quote from Paper	Category	ID_Paper	Type of Investigation	Influence on Digital Media
1	Tacitness	"Media classified as having high-media richness were most likely to be chosen to transfer know-how or tacit knowledge"	Knowledge	12	Quantitively	Negative
1	Tacitness	"If the […] knowledge is more tacit, more knowledge transfer mechanisms with a higher degree of IR are sued"	Knowledge	14	Quantitively	Negative
1	…	…	…	…	…	…
2	Non-availability of Receiver	"Availability may affect whether individuals perceive a synchronous medium, such as F2F […], to have a higher utility than an asynchronous medium, such as e-mail"	Situation	11	Theoretical	Negative
3	Geographic Distance	"We can have a F2F conversation with a person who is two doors down […]. I can't do it with an individual who is in a different location"	Situation	6	Qualitatively	Positive

Appendix 2.1/D – Overview of Interviewees

Inter-viewee ID	Position	Company Area	Primary Expertise Area
01	Knowledge manager innovation department	Maintenance, repair and operations	Knowledge Management
02	Consultant and AI-Expert	Consulting	Emerging Technologies
03	Head of knowledge management	Insurance	Knowledge Management
04	Head of finance and operations	Offering OKR tools	Emerging Technologies
05	CEO	AI-based software for knowledge management	Emerging Technologies
06	Social Media Manager	NGO	Knowledge Management
07	Head of IT/ Project manager introduction collaboration platform	SME	Emerging Technologies
08	Consultant and AI-Expert	Consulting	Emerging Technologies

Appendix 2.1/E – Example of Interview Coding



2.2. Understanding Employees' IT Service Consumerization Behavior: How Post-adoptive Reasoning Drives Use

Abstract

Though IT consumerization brings chances for both individuals and organizations, some important risks, such as information security and privacy issues, arise. With mobile devices and private mobile data plans widely available, employees can use private consumer IT services for business purposes with little to no dependencies to the existing organizational infrastructure. This complicates the possibilities for governance of IT use by organizations and makes it increasingly difficult to control the disadvantages of IT consumerization. Therefore, an understanding of the mechanisms by which employees choose to engage in IT consumerization is necessary. Existing studies on IT consumerization focus primarily on the adoption of private IT devices, rather than on IT services, like file sharing or instant messaging. However, a detailed view of the relative advantages presented by these services is essential to understand the usage decisions in a post-adoptive phase. As a complementary perspective, this paper thus investigates reasons for IT service consumerization behavior using a mixed-methods approach. We use a net-valence model to analyze benefits and risks of IT service consumerization. Building on knowledge from post-adoption literature, survey data shows evidence that on the benefit side, functionalities of IT services matter. On the risk side, IT policies may be an effective way to manage IT service consumerization – but only if policy breaches lead to perceived sanctions for the individual. These quantitative results are enhanced by qualitative findings that amongst others give insights on the effect of functionalities of IT services on IT service consumerization behavior. This paper adds to the scientific body of knowledge by detailing the understanding of IT consumerization on a service layer and derives practical implications for IT departments on how to manage IT service consumerization more efficiently, that is, organizations have to provide high functionality in their own IT services to retain control over the used IT services.

Keywords: IT Consumerization, IT Services, Individual Information Systems, Technology Acceptance, Communication, Collaboration, Survey Research, Structural Equation Modelling

Authors: Manfred Schoch, M.Sc.; Julia Lanzl, Dr..; Henner Gimpel, Prof. Dr.

Status: Working paper

2.2.1. Introduction

With the rise of portable and mobile IT devices such as laptops, tablets, and smartphones, consumers have increasingly started to bring their own consumer IT into their workplaces which introduces potential chances as well as risks to the organizations (Harris et al. 2012). The trend towards work from home and mobile work during the COVID-19 pandemic has further strengthened the use of employees‘ consumer IT for work purposes. As Baskerville (2011) pointed out, the digitization of the individual has increased to the point where individuals operate, run, and administrate vast parts of their increasingly complex individual information systems (IIS) by themselves.

Many companies have adopted bring your own device (BYOD) policies in the hopes of reducing their information technology expenses and increasing productivity and convenience (Lee et al. 2017). With consumer software and mobile applications widely available at low cost, employees also start to bring their privately-owned applications and services. IT services provide aspects of different layers of an IS such as infrastructure, platforms, and software (Demirkan et al. 2008) and are often agile, scalable, and innovative and, thus, have been associated with advantages for their users, such as increased creativity, innovativeness, mobility, flexibility, and productivity (e.g., Behrens 2009; Ortbach 2015; Weeger et al. 2015). However, emerging risks, such as IT security and data privacy implications (e.g., Crossler et al. 2014; Gewald et al. 2017; Ortbach et al. 2013; Weeger et al. 2015), and a loss of organizational control (Behrens 2009) arise. In that regard, researchers and practitioners see the usage of consumer IT as a contributor to shadow IT systems (e.g., Chua et al. 2014; Haag and Eckhardt 2017). However, as such services mainly run on private devices and access the internet through private data plans, it is increasingly difficult for organizations to govern them. Thus, understanding the technology usage and its reasons as well as spill-over effects into the organizational context have become paramount to managing the benefits and risks of IT consumerization.

In the past, IT departments of organizations were able to exclude personal devices from their network through technical measures to control unauthorized IT consumerization and therefore control for unforeseeable threats. For IT services geared towards communication and collaboration, such as instant messaging and file sharing, controlling such activities is less feasible. This is because private IT services are not operated on the business computing and network infrastructure. To regain control, companies embrace policies and demand their employees to install mobile device management (MDM) software to ensure data privacy and security

(Lee et al. 2017). However, an effective enforcement is only possible for organizational resources accessed through such consumer IT (Putri and Hovav 2014). Yet, many employees today use private instant messaging services (such as WhatsApp, Facebook Messenger, and WeChat) or private file sharing services (such as Dropbox and Google Drive), which are beyond the reach and control of the organizations' IT departments, to communicate and collaborate with their colleagues, business partners, and customers.

Previous studies have analyzed the antecedents of IT consumerization using a technology adoption lens (cf. Ortbach 2015). However, many contributions focus on bring-you-own-device programs, with some exceptions that deal with IT consumerization as a whole. IT services, on the other hand, represent a different phenomenon. Because such IT services have been previously used by the users in the private context, the users are in a post-adoptive phase where they have learned about the concrete features of the IT services. The decision is thus between two alternatives that the users carefully assess. Understanding these rationales for user behavior is paramount regarding IT service consumerization, where users are highly autonomous and technical efforts to govern its usage are not applicable. Yet, to the best of our knowledge, no research endeavor has aimed to answer this important question regarding IT service consumerization:

What rationales drive IT service consumerization post-adoptive user behavior?

To address the issue, we use a feature-centric post-adoption perspective, which builds on and extends previous research on IT consumerization. Accordingly, our study investigates rationales of IT service consumerization behavior based on a benefit-risk assessment. In particular, we investigate the effect of functionalities of IT services as well as the effects of perceived sanctions of IT policy breaches and information privacy concerns. We focus on communication and collaboration services, specifically on instant messaging and file sharing services as exemplars. We use a mixed-methods approach to collect quantitative as well as qualitative data in order to provide a credible and complete picture of the phenomenon and to derive stronger inferences.

With this paper, we advance the theoretical understanding of IT service consumerization, in particular the factors that influence why users opt to use or decide not to use individual consumer IT services for the purpose of communication and collaboration on a feature-level. For practitioners, we improve the understanding of IT service consumerization which helps them tailor initiatives (such as the introduction of new functionalities or additional IT security measures) to more efficiently reach their own targets of balancing and managing IT consumerization benefits and risks.

2.2.2. Theoretical Background

2.2.2.1. The Interplay between BYOD, IT Consumerization, and Shadow IT

An IS is the combination of technology, information, and social artefacts (Lee et al. 2015). Baskerville (2011) recognized that the use of IS is not limited to the organizational context, and that its definition may need expansion into the context of private individuals. He argued that individuals build and use IIS to "perform processes and activities using information, technology, and other resources to produce informational products and/or services for use by themselves or others" (Baskerville 2011, p. 3). The complexity of such IIS is rising constantly, with private infrastructure, devices, applications, and entire services being widely available for affordable prices. Likewise, mobile devices and mobile data plans with vast amounts of data allowance have grown exponentially over the last years (Poushter 2016). This development leads to an unmatched technological autonomy with which individuals command their IIS (Baskerville and Lee 2013). Consequently, individuals can now also bring their own autonomous IIS wherever they go – for instance into the workplace. This transfer of use is known as IT consumerization, which is defined as the usage of privately-owned IIS components for business purposes (Niehaves et al. 2012). Building on Harris et al. (2012), Ortbach et al. (2013) introduced three possible types of IT consumerization: (1) the organizationally approved adoption of consumer IT, which includes BYOD strategies, (2) the usage of consumer IT which is not formally permitted by the organization, and (3) the strategic inclusion of consumer IT into the organizational IS landscape. The latter cannot be directly influenced by the individual and, thus, is not within the scope of this paper on the digitization of the individual.

The incorporation of private devices into an organization's IT governance through BYOD policies is growing and has drawn much attention from researchers (e.g., Crossler et al. 2014; Köffer et al. 2015; Lee et al. 2017; Putri and Hovav 2014). BYOD is considered a subcategory of IT consumerization (Ortbach 2015) and has many positive aspects, such as reduced costs and investments, the availability of modern devices, and increased employee satisfaction, creativity, innovativeness, mobility, flexibility, and productivity (e.g., Behrens 2009; Harris et al. 2012; Ortbach 2015; Stieglitz and Brockmann 2012). On the flipside, risks emerge, such as the undermining of official systems, lack of integration into existing IT landscapes, endangerment of organizational data flows, data quality risks, and IT security risks (e.g., György et al. 2012; Ortbach et al. 2014; Silic and Back 2014). The introduction of BYOD policies gives organizations the ability to manage aspects of private devices and, thus, mitigate some of the associated risks. For example, they can demand certain security certificates as a prerequisite to accessing their

organizational networks and resources (Ortbach et al. 2014). This way of managing private devices is called MDM and helps organizations ensure control over data privacy and data security (Lee et al. 2017). An effective enforcement, however, is only possible for organizational resources that are accessed through managed private devices (Putri and Hovav 2014). In contrast, Ortbach (2015) points out that practitioners frequently report major issues with privately-owned IS that are brought into organizations without permission. This phenomenon contributes to shadow IT, which is defined as devices and systems used by employees inside of an organization without formal IT department approval (Behrens 2009; György et al. 2012; Silic and Back 2014). This shows that IIS are not limited to devices, but also include other components that overlap with the organizational IS landscape in many ways. In the literature, the phenomenon has been called bring your own system (Baskerville and Lee 2013). Ortbach et al. (2013) mentioned applications and internet services as elements of such systems.

With the development of cloud computing, many layers of an IS are now increasingly provided as services (e.g., infrastructure as a service, platform as a service, and software as a service). This development extends into the realm of consumer IT, where web applications, data storage, and communication tools are increasingly provided as service offerings without the need for consumers to understand the different layers of the service. Weeger et al. (2015) named emailing and Haag and Eckhardt (2014) named bring your own cloud (file sharing) as examples for such consumer services. Other examples are instant messaging services, such as WhatsApp, Facebook Messenger, or WeChat. In the case of file sharing, providers like Dropbox offer the infrastructure for their services (e.g., the cloud storage), as well as desktop and mobile applications, and web interfaces through which the customer can access and share their data conveniently. Thus, complementary to the existing IT consumerization literature, which predominantly focuses on devices, we focus on IT service consumerization. It can be seen as an extension of privately-owned shadow IT services and bring your own service opportunities (if formally approved by the IT departments). Congruent with Haag and Eckhardt (2017), we depict the interplay of these research streams in Figure 2.2-1.

We expect IT consumerization regarding services to be different from devices because they are managed by the individual autonomously (Baskerville 2011) and can hence be operated fully detached from the existing organizational infrastructure. We argue that for IT service consumerization it is crucial to understand the reasons for its usage and the efficacy of indirect governance measures that may control its utilization.

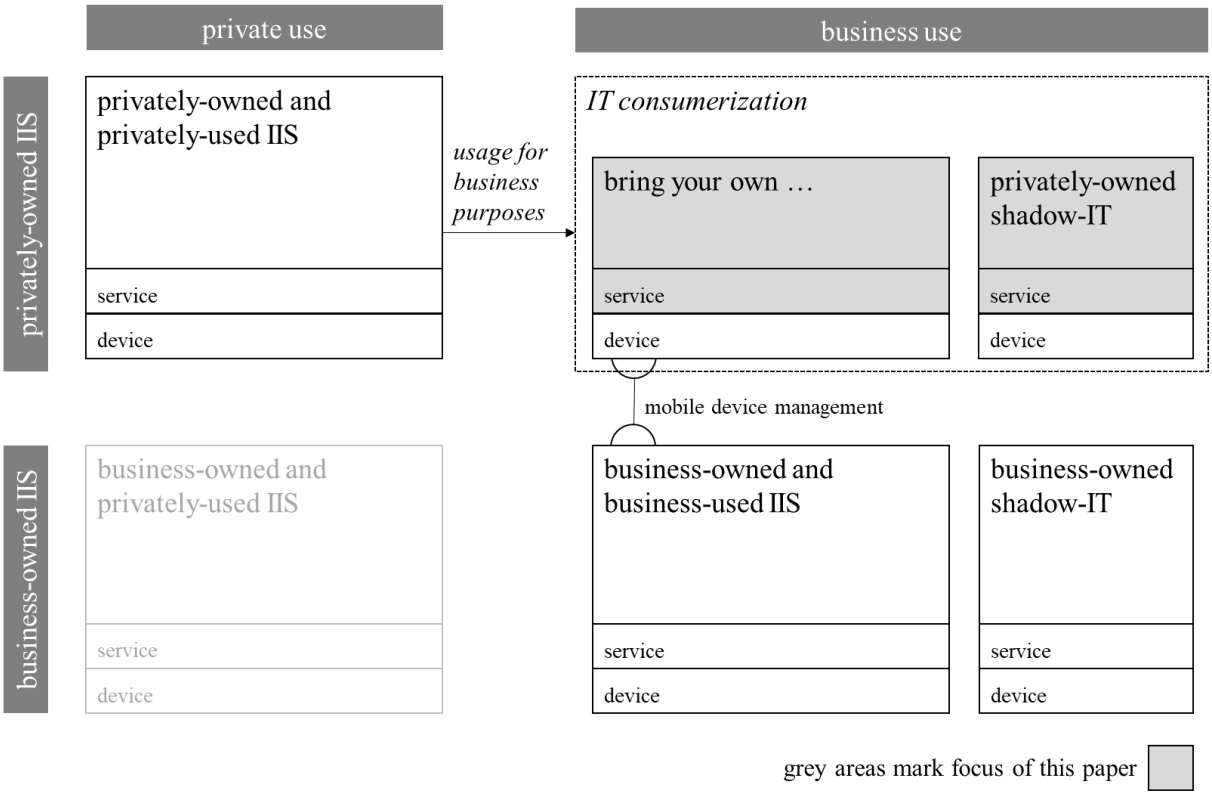


Figure 2.2-1: Interplay of Related Research Streams and Positioning of Paper 2

2.2.2.2. IS Use

Technology use can be divided into multiple phases: adoption, initial use, and post-adoptive use (Jasperson et al. 2005; Venkatesh et al. 2016b). Adoption, thereby, "refers to the stage before and right after a target technology implementation/introduction", whereas "initial use refers to the stage when users begin to apply the technology to accomplish their work/life tasks" (Venkatesh et al. 2016b). Regarding the adoption of technologies, researchers have frequently applied technology acceptance models. Numerous authors have based their works on the theory of planned behavior (TPB), the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT), as well as related models (cf. Venkatesh et al. 2003; Venkatesh et al. 2016b). The focus of such models is to understand antecedents of the use of new technologies. A key objective for organizations using new technologies is to reach acceptance and usage of new technologies to improve productivity (Venkatesh et al. 2003). Therefore, research aims to derive implications for the configuration or design of new technologies and to give suggestions for building an environment in the organization that helps employees be both motivated and able to adopt new technologies. This understanding can be and has been extended to the context of IT consumerization, where the goal is to understand why

employees transfer the use of familiar technologies from the private context to the business context (Ortbach 2015) and what factors stop them from doing so.

Post-adoptive behavior according to Jasperson et al. (2005, p. 531) is "feature use behaviors, and feature extension behaviors made by an individual user after an IT application has been […] made accessible to the user, and adoption applied by the user in accomplishing his/her work activities". Thus, post-adoption behavior is the individual's use of a subset of features of a technology after it has been installed (Jasperson et al. 2005). Viewing post-adoption in the larger context of IT adoption is generally accepted (Jasperson et al. 2005). Yet, pre-adoption decisions are based on limited information about a technology (Griffith 1999 as cited in Jasperson et al. 2005), while in the post-adoption phase users have already learned about the technology and its features (Jasperson et al. 2005). Thus, in this phase users evaluate the features and make usage decisions based on their utility. Such a feature-centric view of technology is valuable as specific features "influence and determine work outcomes" (Jasperson et al. 2005, p. 529). This view on post-adoption differentiates between different use behaviors, such as deep feature usage, more distinctly to gain a more detailed understanding of the way IS is used as well as its consequences (Burton-Jones and Straub 2006). The focus of this paper, however, lies on understanding the drivers of usage based on a more detailed understanding of the respective features in the post-adoption phase, rather than the efficiency of that use. This taps into the realm of task-technology fit, which has been analyzed with a feature-centric post-adoption lens before (Lin and Huang 2008). We proceed to analyze the theoretical lenses that have been applied in relation to IT consumerization.

2.2.2.3. Prior Use-Related Research on IT Consumerization

Ortbach (2015) provided a comprehensive literature overview on existing empirical research on IT consumerization and the analyzed antecedents. We extend upon it by identifying research contributions published from 2014 to 2019. Our own analysis results in eleven contributions (see Appendix 2.2/A). The results show that many studies regarding IT consumerization are related to technology acceptance research and are based on TPB (Lee et al. 2017; Ortbach et al. 2013), TAM (e.g., Ortbach 2015) or UTAUT (e.g., Weeger et al. 2015). The main antecedents of IS use, as unified by UTAUT, have been included in these studies.

Perceived usefulness (also referred to as performance expectancy) and other related constructs have been shown to have the strongest impact on IT consumerization intention (e.g., Gewald et al. 2017; Junglas et al. 2019; Lee et al. 2017; Ortbach et al. 2013). In other words, the positive impact on work results is a main driver of IT consumerization. Ease of use (also referred to as

effort expectancy) has further been consistently included and shown to have a substantial and significant impact (e.g., Ortbach 2015; Weeger et al. 2015). The strong role of those two constructs is congruent with the vast majority of technology acceptance literature and therefore integrates well with previous research on IS use (Venkatesh et al. 2003; Venkatesh et al. 2012). Other UTAUT constructs, such as social influence (e.g., Bautista et al. 2018; Weeger et al. 2015) and facilitating conditions (e.g., Bautista et al. 2018; Hopkins et al. 2013) have been shown to have substantial and significant impact.

Several IT consumerization papers have further introduced risk and threat constructs (e.g., Gewald et al. 2017; Weeger et al. 2020). This is congruent with Venkatesh et al. (2016b) who showed risk (and its counterpart trust) to be one of the most frequent endogenous mechanisms extending UTAUT models in the literature. Further, several IT consumerization studies compare these risks with the benefits of IT consumerization (such as increased performance) and find that the benefits generally outweigh the risks. An exception is Ortbach et al. (2013) who found that IT security risks do in fact contribute to behavioral beliefs amongst highly educated respondents.

This taps into insights on individual differences between users. Other individual characteristics that have been studied regarding their ability to promote IT consumerization behavior include self-efficacy (e.g., Crossler et al. 2014; Lee et al. 2017) and personal innovativeness (e.g., Junglas et al. 2019; Ortbach 2015). Such characteristics have been shown to promote general IT use as well (e.g., Venkatesh et al. 2016b).

Regarding employee expectations, Weeger et al. (2015) found evidence that employees expect employers to allow private devices on the job. According to the study, the main reasons for this are, again, performance related. Employers face substantial challenges with this demand, as they must consider the increasing potential for privacy and security threats. As an effective way of mitigating such risks, practitioners and researchers alike suggest clear BYOD policies.

Restrictive BYOD policies may demand employees to install monitoring mechanisms (such as MDM) onto their devices in order to access organizational resources. Yet, Lee et al. (2017) found that employees have concerns regarding such monitoring mechanisms, and thus their personal privacy. Lebek et al. (2013) echoed this by finding that security concerns limit BYOD adoption.

In contrast to hardware devices, the usage of consumer IT services stays largely unnoticed by organizations and, thus, the management of IT service consumerization is much more difficult than the management of devices that access company resources. While this aspect of the IT

consumerization phenomenon is growing rapidly, it has yet to be studied. A detailed understanding of user behavior and the underlying rational, however, is paramount to managing and harnessing IT service consumerization.

Previous research indicates that IT consumerization behavior heavily depends on performance expectations. Yet, our literature analysis concludes that to this date research lacks key contributions regarding the post-adoption stage and a feature-centric view of the phenomenon. However, since many private services, particularly for communication and collaboration, are already used in the private context, we consider it necessary to view private and business services as components of an IT portfolio where the users base their usage decisions on relative utility and comparative advantages.

2.2.3. Method and Model Development

2.2.3.1. Mixed-Methods

This study follows a mixed-methods approach (Venkatesh et al. 2013; Venkatesh et al. 2016a). We follow two purposes with this approach. First, corroboration: qualitative insights will help us assess the credibility of the findings of our quantitative model. We do so concurrently and in an embedded way through mixing in the data collection phase. This approach allows us to provide stronger inferences and to explain our empirical findings from the quantitative strand through qualitative insights. In doing so, we pursue the secondary purpose of completeness. In other words, we aim to provide a more meaningful picture and richer explanations of the phenomenon (Venkatesh et al. 2013). The quantitative part uses a structural equation model and the qualitative part uses coding principles (open and axial coding) that are known from grounded theory (Strauss and Corbin 1990). Details on the individual methods are provided after the model development.

2.2.3.2. Pre-Test

Before our main study, we conducted a qualitative pre-study, in which 15 doctoral students from the field of IS were asked to provide reasons for their usage of consumer IT for business purposes. After clustering the answers, we matched most of them to existing UTAUT constructs. In addition, more or better features, as well as habit and experience were frequently named. This indicates that a post-adoption view is necessary to fully understand the phenomenon. Furthermore, and congruent with previous research on IT consumerization, privacy and security risks were mentioned. We used these insights to develop our model which we solely base on literature in the following.

2.2.3.3. Model Development

Our research model builds on an individual's assessment of benefits and risks of engaging in a certain behavior. This principle is used in net-valence models, which say that for engaging in the behavior the perceived benefits (positive valence) of the behavior have to outweigh the risks (negative valence) (Fishbein 1967; Lewin et al. 1944). In the context of IT consumerization, Weeger et al. (2020) and others have shown that individuals balance the perceived benefits and risks of engaging in BYOD-programs and build their behavioral intention on that assessment. Thus, consistent with net-valence models, we suggest that individuals assess whether the benefits of IT consumerization outweigh its risks (Weeger et al. 2020).

In terms of benefits and consistent with previous research regarding technology acceptance, we propose that usefulness and ease of use are the main benefits that have to be considered. We suggest that both constructs can be traced back to different functionalities of the technology that make them either useful (e.g., due to functionalities that allow for more flexibility in communicating with colleagues) or easy to use (e.g., due to an easily understandable user interface). Therefore, and consistent with prior work on post-adoption as well as task-technology-fit, we consider individual functionalities in our research model (Jasperson et al. 2005; Sykes and Venkatesh 2017). In the context of IT consumerization, the assessment of benefits is always based on the comparison of both privately-owned IT and business provided solutions as part of a deliberate portfolio decision (Briggs et al. 1998; Harris et al. 2012; Junglas et al. 2019). This decision is between the standard work solution provided by the organization and the individual private solution where use could be transferred to the work context. Thus, we include relative usefulness and relative ease of use of the consumer IT service in contrast to the business offered IT service to our model.

In terms of risks, employees are faced with the risk of losing their job by violating the organization's policies of IT usage with respective sanctions or by causing the organization some kind of harm by engaging in IT consumerization. Such harm may be caused due to a loss of the organization's data. Furthermore, by blurring the contexts of business and private lives by using the private IT service in the business context, individuals also risk their own private data to be unintendedly disclosed to others.

Figure 2.2-2 provides a graphical overview of the research model. In the following sub-sections, we derive the corresponding hypotheses in detail.

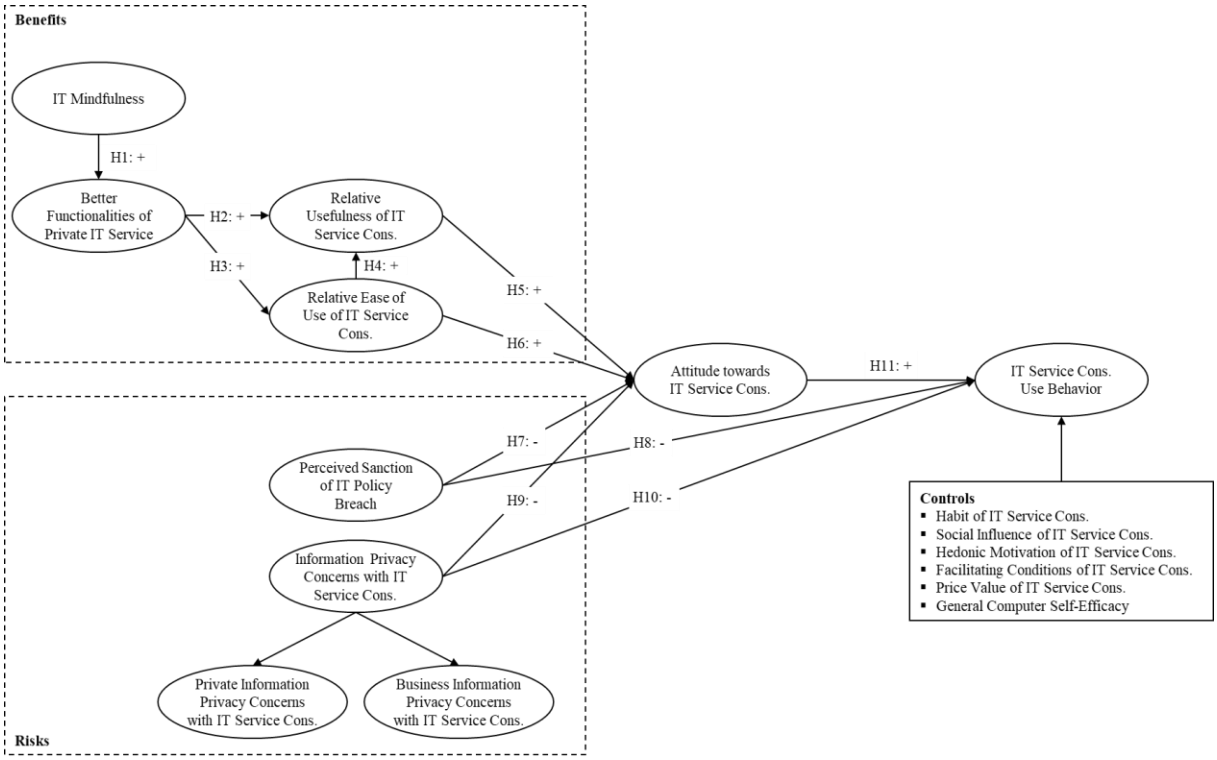


Figure 2.2-2: Research Model of Paper 2

The Influence of Benefits

Powerful, innovative, and rapidly improving private IT has been mentioned as a reason for IT consumerization since its alleged first appearance in the literature (Moschella et al. 2004). Congruently, Ruch and Gregory (2014) mention capabilities and functionalities of technologies as an important aspect for assessing why employees prefer consumer over business IT. Hence, better functionalities of the private IT service as compared to the business IT service is an important factor for individual's benefit-risk-assessment.

According to post-adoption literature, a simple quantitative increase in features does not automatically yield performance outcomes. Rather, "performance benefits are most likely to occur when individuals recognize a match between the requirement of a work task and the features" of a technology (Jasperson et al. 2005, p. 531). This is congruent with the view of Goodhue and Thompson (1995) who proposed that benefits arise from a fit between a job's tasks and the technology in use. Yet, which features a user considers to be helpful depends on multiple factors, amongst which are also the experience with the application in use (Jasperson et al. 2005). Individuals expect to be able to better fulfill their job tasks as the functionalities either allow for high efficiency or effectiveness in doing the job (e.g., by being able to share large files with people outside the organization) or make the technology easy to use and integrate it in the workplace (e.g., a business-owned and managed emailing service might be more difficult to use

than a consumer service, which may be easily integrated into private mobile devices) (Goodhue and Thompson 1995; Jasperson et al. 2005). The first expectation, perceived usefulness, reflects the degree to which individuals expect an IT service to help them improve their job performance (Venkatesh et al. 2003). The second expectation, perceived ease of use, represents "the degree of ease an individual associates with using a privately-owned [service] compared to one provided by an IT department" (Gewald et al. 2017, p. 64).

Jasperson et al. (2005) further suggested that the individual evaluates the features in the post-adoption phase in a process that they refer to as "technology sensemaking". These cognitive processes of the individual may go beyond the mere exploitation of feature sets of a given technology and rather lead to the extension of features "that go beyond the uses intended by the application's designers" (Jasperson et al. 2005, p. 532). Such deliberations are said to be dependent on the individual's awareness of and openness to value added use of IT (Thatcher et al. 2018). This shows that employees are able to assess the tools and services they utilize for business purposes and that this assessment does influence use decisions. A constant assessment is a key element of IT mindfulness that "refers to an individual's continuous scrutiny and refinement of expectations based on new experiences, appreciation of subtleties, and identification of novel aspects of context that can improve foresight and functioning" (Thatcher et al. 2018, p. 832). Thus, if individuals are IT mindful, they better recognize and identify IT functionalities that are important for their job. Thus, we pose our first hypotheses:

H1: IT mindfulness has a positive effect on perceiving better functionalities of private IT services as compared to business IT services.

H2: Perceiving better functionalities of private IT services as compared to business IT services has a positive effect on the perceived relative usefulness of using a private IT service in the business context.

H3: Perceiving better functionalities of private IT services as compared to business IT services has a positive effect on the perceived relative ease of use of using a private IT service in the business context.

Congruent with the technology acceptance model (Davis et al. 1989), we consider a positive effect of relative ease of use on relative usefulness of IT service consumerization and hypothesize:

H4: Higher perceived relative ease of use of using a private IT service in the business context has a positive effect on its perceived relative usefulness.

The effect of higher usefulness and higher ease of use reflects the previously described fundament of net-valence models: Perceived benefits positively influence the attitude towards IT service consumerization. This is consistent with other studies which show that increased usefulness and ease of use are important reasons for IT adoption decisions in general (e.g., Davis et al. 1989; Venkatesh et al. 2012) as well as in the IT consumerization context (Gewald et al. 2017; Ortbach 2015; Weeger et al. 2015). Thus, we formulate the following two hypotheses:

H5: Higher perceived relative usefulness of using a private IT service in the business context has a positive effect on the attitude toward IT service consumerization.

H6: Higher perceived relative ease of use of using a private IT service in the business context has a positive effect on the attitude toward IT service consumerization.

The Influence of Risks

To control and manage consumer IT in the workplace, some authors mentioned the prohibition of its usage as an important factor. For example, Ortbach et al. (2013) found that organizational policies may be able to influence consumerization behavior and that IT policies are effective in that regard. However, such IT policies often only influence employees' attitude towards IT consumerization as well as the actual use behavior if a breach is perceived to have severe consequences (Herath and Rao 2009; Klesel et al. 2019). In the context of net-valence assumptions, such sanctions of IT policy breaches are assessed as risks lowering the attitude toward the behavior. Thus, we hypothesize:

H7: Higher perceived sanction of IT policy breach has a negative effect on the attitude toward IT service consumerization.

H8: Higher perceived sanction of IT policy breach has a negative effect on the use of IT service consumerization.

It has been argued that data security plays an important role in IT consumerization decisions (Crossler et al. 2014; Niehaves et al. 2012). With the usage of private services for business purposes the employee gives up control over information to the service provider, which should raise concerns over the privacy of information. The unsanctioned usage of IT (shadow IT) has been associated with an increased risk for business data loss or leaks (Silic and Back 2014). Thus, we expect IT consumerization to be assessed as a potential information privacy risk. This is congruent with Gewald et al. (2017) and Weeger et al. (2015) who investigated information privacy risks – and thereby covered both private and business information – as antecedents for

IT consumerization intention and attitude. Moreover, Ortbach et al. (2013) found risking important data to be a strong inhibitor of actual IT consumerization use behavior. Hence, we propose:

H9: Higher information privacy concerns with IT consumerization have a negative effect on the attitude toward IT service consumerization.

H10: Higher information privacy concerns with IT consumerization have a negative effect on the use of IT service consumerization.

The Influence of Attitude

Congruent with TBP, TAM, and UTAUT, we expect a significantly positive effect of attitude towards use on the actual use behavior (Venkatesh et al. 2003).

H11: Higher attitude towards IT Service Consumerization has a positive effect on use of IT service consumerization.

Control Variables

As proposed in the well-studied UTAUT2 model, there are several other variables that are important antecedents of the use of technologies (Venkatesh et al. 2012). Therefore, we include these further variables (habit, social influence, hedonic motivation, facilitating conditions, and price value) as controls in our model. Further, we include general computer-self-efficacy (Marakas et al. 2007).

2.2.4. Empirical Analysis

2.2.4.1. Survey Design and Procedures

To test the model empirically, we design an online survey. Since this survey seeks to collect data concerning IT usage in the business context, we restrict participation to current full-time employees. We choose instant messaging and file sharing as the analyzed consumer IT services. Communication and collaboration do not follow the set perimeters of organization-specific business processes and thus leave room for spontaneous personal interactions (Frank et al. 2017). Therefore, these services appear more susceptible to IT consumerization as they can largely be operated separately from existing organizational resources. The chosen services are important for digital communication and collaboration and provided in most commercial office suites (Gotta et al. 2015). This approach enables us to validate the impact of the antecedents and moderators across services, and thereby increases our study's rigor. Thus, all participants of the survey are asked to answer all items twice for the two services.

The questionnaire starts with a detailed explanation of the scope of communication and collaboration services and what consumerization of such services means (see Appendix 2.2/B). Next, participants are asked to indicate their IT consumerization behavior. For that, we use the item from Carter and Petter (2015) who measure use behavior on a six-point Likert scale ranging from "not at all" to "very many times". Likewise, we use existing item scales for all our constructs. We use Thatcher et al.'s (2018) scale on IT mindfulness and Lin and Huang's (2008) scale on perceived task-technology-fit to measure better functionalities of the private service in contrast to the business service. For relative usefulness and relative ease of use, we use items from Venkatesh et al. (2012) and for perceived sanction of IT policy breach items from Herath and Rao (2009). We operationalize information privacy concerns as a second-order construct of private information privacy concerns and business information privacy concerns. For those two first-order constructs, we build on the perceived privacy risk scale from Cocosila et al. (2009) and adapt it to the context of business and private information. For attitude, we use Degirmenci et al.'s (2019) scale that is based on Nysveen et al. (2005) and Taylor and Todd (1995). For the controls from UTAUT2 (i.e., habit, social influence, hedonic motivation, facilitating conditions, and price value), we again use items from Venkatesh et al. (2012). Lastly, we use Marakas et al.'s (2007) scale for general computer self-efficacy. Finally, we add theoretically unrelated marker questions to control for common method variance (CMV) (Lindell and Whitney 2001; Richardson et al. 2009). Where necessary, we adopt the items to the IT consumerization context. All measurements are reflective. We measure all items on a seven-point Likert scale. Appendix 2.2/B provides an overview of all items.

We distributed the questionnaire via the online crowdsourcing market Amazon Mechanical Turk. Such online crowdsourcing markets are internet-based platforms that allow recruiting participants for surveys and other tasks (Steelman et al. 2014). Research on MTurk's participant pool indicates that it is closer to the U.S. population than participants from traditional university subject pools (Paolacci et al. 2010). Further, MTurk participants are seen to be undistinguishable from an internet sample on several psychometric scales such as the big five personality traits (Buhrmester et al. 2011). MTurk has also been used in IS research before (e.g., James et al. 2019; Kehr et al. 2015; Lowry et al. 2016; Soror et al. 2015). We restricted participation to MTurk workers from the U.S. having worked on at least 50 tasks via the platform and with a work approval rate of at least 90%. Participants received a monetary reward of USD 2 for completing the survey (average time 12 minutes). Prior research suggests that this level of compensation is adequate on MTurk and encourages valid responses (Buhrmester et al. 2011; Jia et al. 2017; Mason and Suri 2012; Steelman et al. 2014). To ensure data quality, we implemented

several measures. Next to a traditional attention check ("If you are answering this survey cautiously, tick the second box from the left.") and an instructional manipulation check (Oppenheimer et al. 2009), we used free text questions to identify "unusual comments" (Chmielewski and Kucker 2020, p. 466).

2.2.5. Quantitative Results

2.2.5.1. Descriptive Statistics

After rigorously cleaning the data as described, 221 completed data sets remained. 46% of participants are female and 54% male with an average age of 37 years. 83% of the respondents do not live alone, more than 50% with at least two other people indicating private responsibilities. More than 77% of the participants have a managerial position in their job (lower, middle, or upper management) indicating high business responsibilities.

Of the two communication and collaboration services, instant messaging is the service with the higher average level of use of the private service for business purposes. On average, respondents used the private instant messaging services more than several times in the last three weeks. For consumerization of file sharing, the average user reported a use between a couple of times and several times. The corresponding histograms appear in Figure 2.2-3.

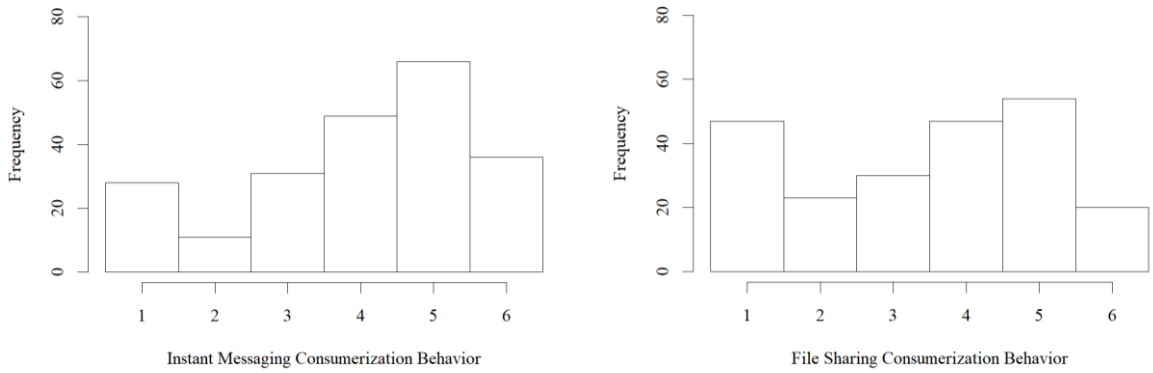


Figure 2.2-3: Histograms for Use of IT Consumerization of the Two Services (n = 221) in the Previous Three Weeks

2.2.5.2. Evaluation of the Measurement Model

Each of the two models – one per service – is assessed through PLS-based structural equation modelling (PLS-SEM) because of the relatively small sample size (Urbach and Ahlemann 2010) using SmartPLS 3.2 (Ringle et al. 2015). We follow Hair et al.'s (2017) guidelines for the evaluation of reflective measures and for assessing the second-order construct information privacy concerns. Thus, we start by examining internal consistency reliability (ICR) which is

assessed via Cronbach's Alpha (Alpha) and composite reliability (CR) (Hair et al. 2017; Nunnally and Bernstein 1994). All scales exceed the threshold of 0.708 with a minimum of 0.825 for Alpha and 0.883 for CR. Convergent validity is satisfactory as the minimum of all indicators' outer loadings on their respective factor is 0.689 and the minimum AVE for all constructs is 0.653 (Hair et al. 2017). For discriminant validity, we first examine each indicator's cross-loadings with all other constructs, to check whether they are lower than the indicator's outer loading on the construct. Our data meets this criterion. Second, each construct's square root of the AVE is higher than the highest correlation with other constructs (Fornell-Larcker criterion) (Fornell and Larcker 1981). Third, the heterotrait-heteromethod (HTMT) ratios of all first-order constructs are below 0.85 or at least below 0.9 (Henseler et al. 2015). Thus, discriminant validity is supported. Table 2.2-1 and Table 2.2-2 show means, standard deviations (SD), Alpha and CR values as well as the AVE values for all constructs with multi-item scales. Information for control variables as well as on (Cross-)Loadings, the Fornell-Larcker criterion and the HTMT ratios can be found in Appendix 2.2./C. Appendix 2.2./D shows the results of testing for CMV.

	# Items	Mean	SD	Loadings	Alpha	CR	AVE
IT Mindfulness	11	5.613	1.379	0.726-0.857	0.951	0.958	0.673
Better Functionalities	7	4.903	1.855	0.852-0.916	0.957	0.964	0.795
Usefulness	3	5.201	1.796	0.876-0.924	0.890	0.932	0.820
Ease of Use	4	5.061	1.827	0.898-0.929	0.930	0.950	0.827
Sanction	3	4.353	2.004	0.858-0.957	0.910	0.940	0.840
Information Privacy Concerns	6	3.775	2.047	0.854-0.872	0.943	0.955	0.780
Private Information Privacy Concerns	3	3.703	2.029	0.877-0.939	0.905	0.941	0.841
Business Information Privacy Concerns	3	3.846	2.064	0.931-0.954	0.942	0.963	0.895
Attitude	6	4.974	2.059	0.923-0.970	0.977	0.981	0.898

Table 2.2-1: Descriptive Statistics, Main Factor Loadings, Internal Consistency, and Average Variance Extracted for Consumerization of Instant Messaging

	# Items	Mean	SD	Loadings	Alpha	CR	AVE
IT Mindfulness	11	5.613	1.379	0.734-0.857	0.951	0.957	0.669
Better Functionalities	7	4.431	2.057	0.885-0.938	0.969	0.974	0.845
Usefulness	3	4.787	2.040	0.887-0.960	0.921	0.950	0.865
Ease of Use	4	4.712	1.987	0.933-0.944	0.954	0.966	0.878
Sanction	3	4.353	2.004	0.855-0.951	0.910	0.940	0.840
Information Privacy Concerns	6	4.035	2.119	0.881-0.888	0.952	0.962	0.807
Private Information Privacy Concerns	3	4.006	2.115	0.889-0.945	0.916	0.947	0.858
Business Information Privacy Concerns	3	4.065	2.125	0.945-0.956	0.947	0.966	0.904
Attitude	6	4.605	2.196	0.933-0.965	0.981	0.984	0.913

Table 2.2-2: Descriptive Statistics, Main Factor Loadings, Internal Consistency, and Average Variance Extracted for Consumerization of File Sharing

2.2.5.3. Evaluation of the Structural Model and Hypotheses Testing

Collinearity is not an issue, since all variance inflation factors are lower than 5.000 (maximum of 3.259). Figure 2.2-4 and Figure 2.2-5 present the estimates and R^2 values for the models of the two different communication and collaboration services. The results for the control variables (only habit has a significant effect on use) as well as adjusted R^2 values can be found in Appendix 2.2/E and Appendix 2.2/F.

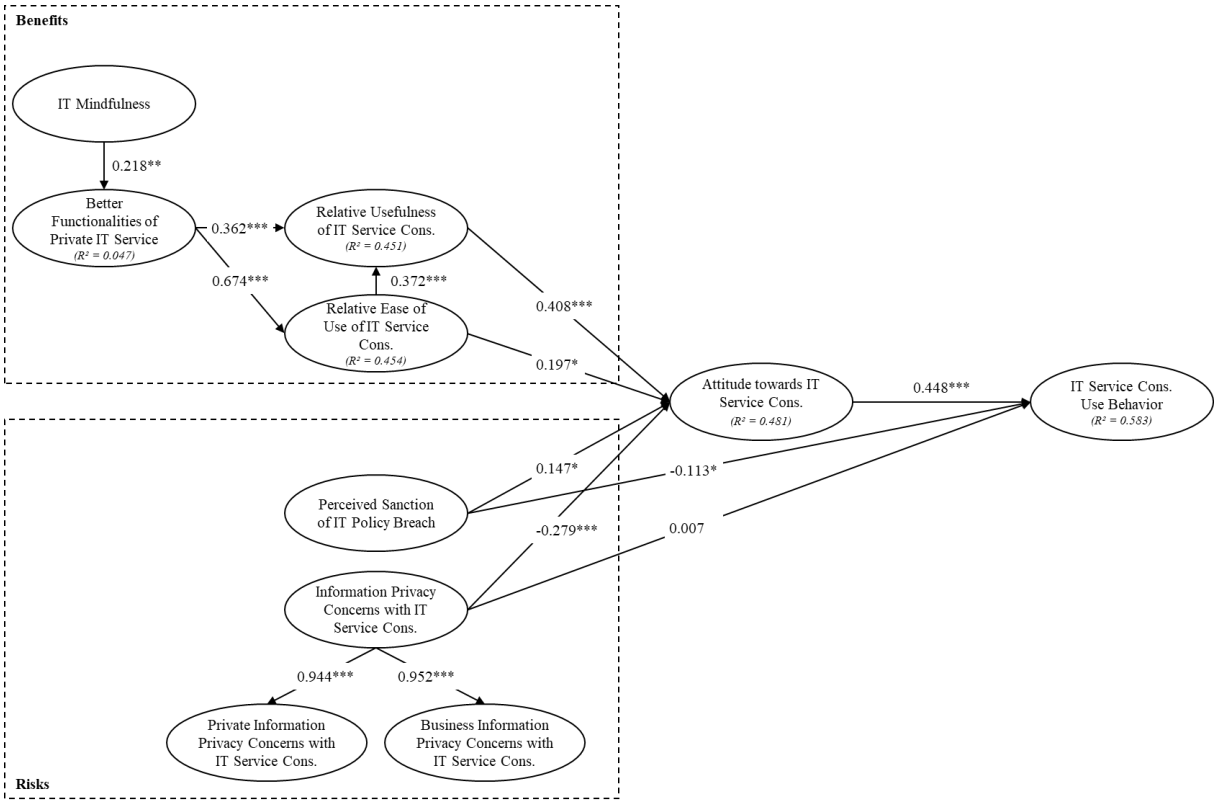


Figure 2.2-4: Model Results for Consumerization of Instant Messaging

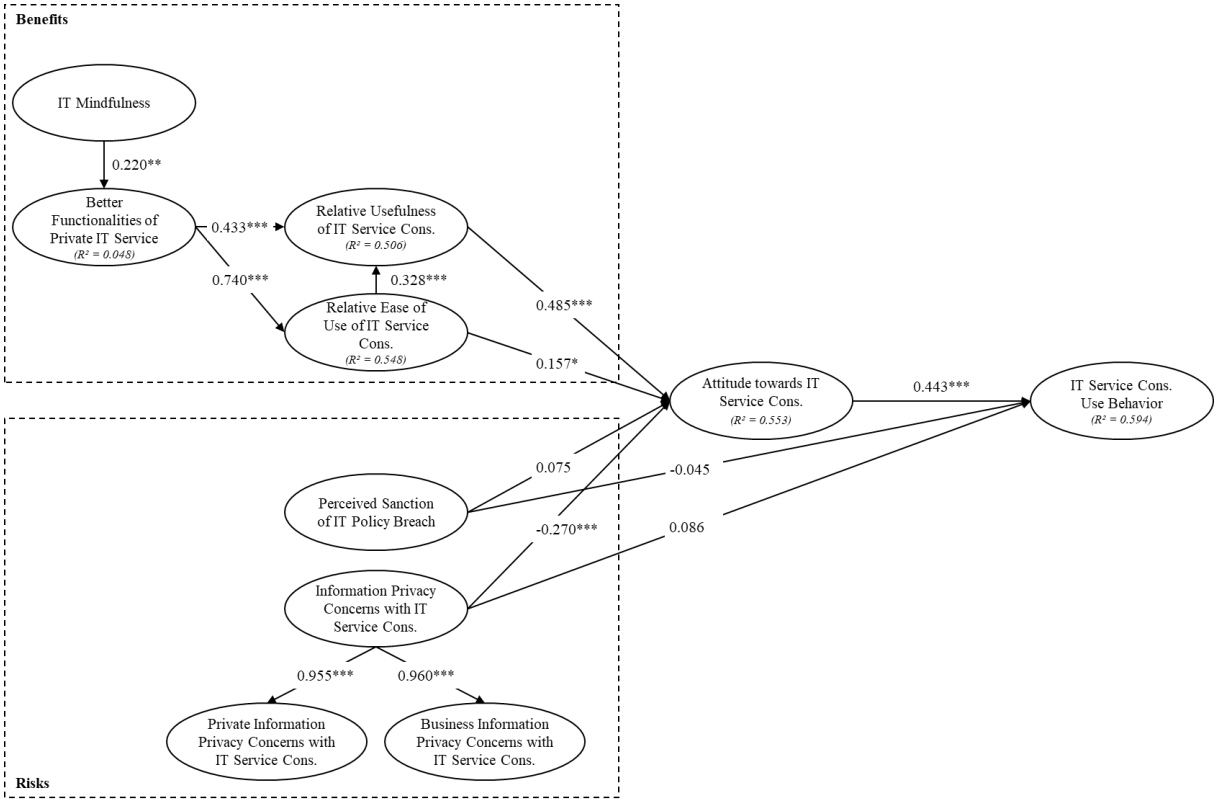


Figure 2.2-5: Model Results for Consumerization of File Sharing

Table 2.2-3 summarizes the hypotheses and the respective empirical results observed in this study. The resulting effects will be discussed in the next section.

Theoretical Hypotheses			Empirical Results	
			Instant Messaging	File Sharing
H1	pos.	IT Mindfulness → Better Functionalities	+	+
H2	pos.	Better Functionalities → Usefulness	+	++
H3	pos.	Better Functionalities → Ease of Use	+++	+++
H4	pos.	Ease of Use → Usefulness	+	+
H5	pos.	Usefulness → Attitude	++	++
H6	pos.	Ease of Use → Attitude	+	+
H7	neg.	Sanction → Attitude	+	n.s.
H8	neg.	Sanction → Use	-	n.s.
H9	neg.	Information Privacy Concerns → Attitude	-	-
H10	neg.	Information Privacy Concerns → Use	n.s.	n.s.
H11	pos.	Attitude → Use	++	++

Note: plus signs indicate a significant and positive effect, minus signs a significant and negative effect, n.s. a non-significant effect at the 5% level.
For significant effects, +/- indicates a small ($f^2 \geq 0.02$), ++/-- a medium ($f^2 \geq 0.15$), and +++/--- a large ($f^2 > 0.35$) effect size.

Table 2.2-3: Overview of Hypotheses and Empirical Results of Paper 2

2.2.5.4. Qualitative Insights and Meta-Inferences

For the qualitative strand of our analysis, we asked the respondents to name reasons for why they are using private IT for work purposes. This part consisted of two question, one regarding file sharing and one regarding instant messaging. We collected 348 valid responses to this question (192 for instant messaging, 156 for file sharing). These answers were coded using open coding in a first step. We proceeded with axial coding to relate codes to core coding categories. These coding categories were matched with the model constructs in a last step to integrate findings from the qualitative and quantitative strand of our research in meta-findings (Venkatesh et al. 2013). Our findings are presented in Table 2.2-4.

The findings indicate that the two constructs regarding performance and ease of use can be related back to concrete features of the private IT that are better than the business IT (or the limited availability of adequate business IT). A number of other constructs were identified that match with our model. This includes privacy and security considerations, as well as policy rules. Interestingly, several respondents are aware of policies and security issues but justify their use of private IT because they claim to know the boundaries where information becomes critical enough to not be communicated through private channels. However, these judgement calls appear to be a fine line. Lastly, there were three categories that have not been considered in prior literature using quantitative models. First, respondents indicate that private IT is used with an inner circle of colleagues where informal relationships exist. Second, and contrary to our hypotheses, some employees are hesitant to use business IT because of privacy concerns. They appear to distrust their employer or actively hide information from the employer. Lastly, personal preferences for using only one service exist (integration preference). The overwhelming majority of codes could be matched to those categories mentioned above. Noteworthy but rare exceptions are monetary considerations of what appear to be self-employed individuals.

Model Construct	Coding Category	Description of Category	Example for Instant Messaging	Example for File Sharing
Better functionalities of private IT service	Ubiquitous access of private IT	A lack of flexible and mobile access to business resources, mainly due to technical restrictions.	*"There is a lot of pressure from my job to be on call and be available outside of business hours, […] IM makes the task of responding easy and it shows leadership [that] I am tethered to my job."*	*"Our in-house server is not accessible via smartphone. I have to be at my desk and the system the IT has there [is bad] anyway."*
	Collaboration efficiency	Collaboration features provided by private IT that business solution does not offer, e.g., chat history, labeled chats, ability to share documents and picture (IM), real-time collaboration, change history, storage space (FS).	*"This way we can all have things organized and in one location, and I am able to label chats by who is in what group."*	*"The file sharing I use allows for comments, history, and a lot of meta data to be seen by the people who share it so it has a large impact on accountability and seeing who made what changes and if the ball got dropped somewhere in that chain."*
	Speed	Getting the job done faster, e.g., through reduced response time, even if business IT is not checked regularly.	*"I use it because I can reach work colleagues and those I need information from faster."*	*"Makes it very easy to send and receive documents that make the workday flow better."*
	Convenience and ease	Getting the job done more conveniently through familiar and easy-to-use IT. Often related to concrete features, e.g., organization of files, easy to change password, availability of notifications.	*"Because it is easier and quicker for me to use this, it is already downloaded and updates me when I get a message."*	*"I use this because it also is convenient […] It is easy for me to organize and find what I need without having to search or scroll through hundreds of other files."*
	Information security	Perceived security of the private service is superior to the business service, e.g., due to end-to-end encryption.	*"I felt that it was the smartest thing to do for security purposes. I'm able to have some sense of security and not feel like my data is being compromised, that's the most important reason."*	*"The cloud storage I use claims to encrypt data stored which is something that is necessary when I am working with sensitive projects. "*
	No adequate business alternative	The business does not provide the service, yet the service benefits the job requirements or is perceived to be necessary to fulfill the job.	*"I have used the private instant message service for business purposes before because at the time, my company did not have a business instant messaging service."*	*"Sometimes it's necessary for me to share my files for business reasons. Since I don't have a business file sharing account, I don't have much of a choice."*

Policy and perceived sanction	Policy and sanction	Company policy does not allow the use of private IT for work purposes and employees follow those rules.	*“I do not use my private IM service for business. We are not allowed to download anything or use unauthorized programs on our machines at work."*	*"The company I work for does not want to risk company files being downloaded on an employee's private file sharing service. [...] An employee will be fired on the spot if he/she is caught using private instant messaging services or private file sharing services on the job."*
Information privacy concerns	Security concerns (prerequisite of privacy)	Concerns regarding the security of data or mishandling proprietary information when stored outside of the organization's IT systems.	*"I don't. It's insecure and compromising of internal data."*	*"I never share files through my private file sharing service. I don't feel its right to do that and I worry about security issues."*
	Privacy concerns	Using private services crosses boundaries for some users. They prefer to keep things separated.	*"I don't use my private instant messaging for business. I prefer to keep everything separate because I don't want colleagues intruding on my personal time by tracking me down on my private services."*	-
	Know boundaries	Employees perceive certain communication activities as "okay", based on their own judgement of topic criticality.	*"Scheduling meetings, informal chit chats and check ins are all perfectly fine. It's mostly about knowing the boundaries here. I'm not going to be exchanging info about customer accounts on a private IM."*	*"It's a judgement call"*
Habit	Habit	Prior use has created a habit of using private services for both sender and receiver.	*"Most of my clients that I communicate with have already become used to dealing with me through my private instant messaging service."*	*"I really just haven't thought about changing it […] even though it makes me a little uncomfortable. I could change over to a business account, but […] I just haven't gotten to it."*

Social Influence	Social norms	Coworkers and superiors use the service and thereby (directly or indirectly) influence others to do the same.	*"The only reason I ever use my private instant messaging for business purposes, is in response to a coworker using theirs to contact me using that avenue first."*	*"Just since it makes it easier to share information with my coworkers, and everyone else in the company also uses the service."*
	Networking	Networking with others is considered more personal by some when private IT is used.	*"Because I am a manager, it is important to maintain meaningful contact not only between other managers and myself but also between my workers and me."*	*"To present myself as a more personal businessman."*
Others	Informal relationships	Informal and private relationships with co-workers contribute to the usage of private channels for communication and collaboration.	*"I'm outside friends with some of my coworkers so it is easier to talk business with them with the contact that I already had."*	*"For the reason that my closest friends work with me, so we will often share our files this way."*
	Privacy concerns with business IT	The usage of private services allows for privacy regarding informal conversations with co-workers. It is sometimes deliberately used to avoid organizational communication tools.	*"Users deliberately try to hide what they're doing like little kids. Whether its photo sharing, snide comments about co-workers, or forgetting a password and asking someone over text message instead of asking IT."*	*"You can quickly send files between people and only those people can see it. You can set passwords and rename the files, so people don't know what you are sending, etc."*
	Integration Preference	Some employees simply prefer the use of only one platform for business and private purposes.	*"I like that I can do business things from a personal platform instead of separating everything such as contacts "*	*"I like having everything I use, personal and business, on one shared platform."*

Table 2.2-4: Qualitative Insights and Meta-Inferences of Paper 2

2.2.6. Discussion

2.2.6.1. Theoretical Implications

To the best of our knowledge, this study is the first to investigate IT consumerization on a service level. On a device level, Harris et al. (2012) suggested that providing consumer devices to employees can help manage the adoption of consumerization. Such initiatives are known as *choose your own device* policies (Köffer et al. 2015; Weeger et al. 2015). This enables the effective use of MDM and thus governance of such devices. Our research suggests that such initiatives are not feasible for the service component of IT consumerization and, thus, cannot manage the phenomenon fully. To close this gap, we investigate IT consumerization antecedents for private services. In our study, we use a net-valence model to differentiate between benefits and risks as influencing factors for the use decision of such services.

Combining the qualitative and quantitative strand of our study, we contribute to the theoretical body of knowledge on IT consumerization in four ways, which are depicted and summarized in Table 2.2-5 and will be discussed in the following.

First, and consistent with previous research on IT consumerization, we show that net-valence models of IT service consumerization are driven by benefits, which outweigh the risks attributed to the usage (e.g., Weeger et al. 2020). Regarding benefits and congruent with existing literature on IT use in general and IT consumerization in particular, we find constructs related to performance and ease of use to be the key drivers (e.g., Lee et al. 2017; Ortbach 2015; Venkatesh et al. 2003; Venkatesh et al. 2012, 2016b; Weeger et al. 2015). Contrary to some parts of the existing literature on IT device consumerization, we do not find IT security risks to be preventing employees from using IT service consumerization (e.g., Crossler et al. 2014). Yet, our findings are congruent with the empirical results of Gewald et al. (2017, p. 62) who stated that individuals "dramatically neglect the risks their actions might pose" in regards to IT consumerization. Prohibitions and sanctions play a role in the usage decisions, yet, their influence is limited. While these results are somewhat consistent with IT consumerization on a device level, they have substantially higher implications. This is because the usage of autonomous IT services cannot be feasibly governed through technical measures. Combined with the comparatively low impact of sanctions (and thus prohibitions), this highlights the need to focus on adequate business alternatives as a feasible way to govern the risks of IT service consumerization.

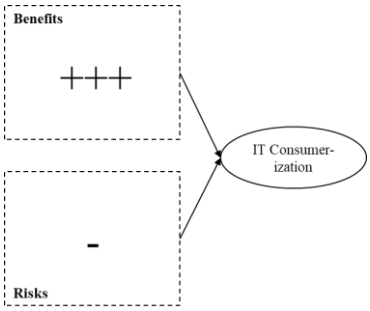
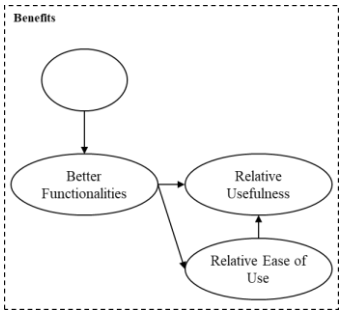
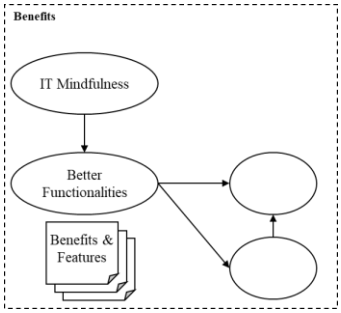
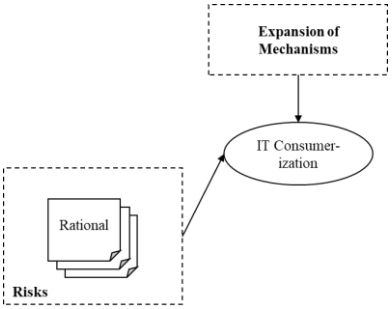
Net-valence Model for IT Service Consumerization Driven by Benefits	IT Service Consumerization as Portfolio Decision
	
○ Showed that benefits substantially outweigh risks in the users' rational ○ The lack of options to govern IT service consumerization puts particular emphasis on business alternatives	○ Established IT service consumerization as deliberate portfolio decision ○ Introduced relative constructs to do the comparative nature justice
Post-Adoptive Exogenous Mechanisms for IT Service Consumerization	**Exploratory Expansion of Mechanisms for IT Service Consumerization**
	
○ Established better functionality as driver of usefulness and ease of use ○ Provided qualitative insights regarding features and benefits ○ Introduced IT Mindfulness as proxy for deliberate technology sensemaking	○ Identified additional drivers and explanation for usage decisions from qualitative analysis, such as integration preference ○ Deepened understanding for the small impact of privacy risks

Table 2.2-5: Meta-Inferences of the Qualitative and Quantitative Strand of Paper 2

Secondly, extending on previous research, we suggest that IT service consumerization decisions are portfolio decisions where employees decide between multiple different solutions for the same task. They can either use the standard business solution or transfer their use of a private service to the work context. The dilemma that organizations are confronted with is that today, employees are familiar with innovative platforms and IT services for collaboration and communication from their private lives. They are aware of the productivity and performance gains such platforms can offer and are able to compare them to the existing business alternatives (Ortbach 2015). Thus, consistent with research on technology transition, we find that such IT service consumerization use decisions are deliberate portfolio decisions where users carefully

analyze the comparative advantage of the alternatives that are available to them (Briggs et al. 1998; Junglas et al. 2019). Besides an overall sense of relative advantages, we show that this deliberation happens on a feature level and includes deliberations on the task-technology fit for the provided features (Jasperson et al. 2005).

Thirdly, in line with research on post-adoptive feature usage, we show that the assessment of better functionality relies in part on a form of technology sensemaking, which breaks habitual use (Jasperson et al. 2005). Post adoption considers that the effect of intentionality on behavior becomes less important as technology use becomes habitual (Venkatesh et al. 2012). Prior work on post-adoption suggests that such habit can be broken through technology sensemaking, where users reflect on their usage behavior and make deliberate decisions (Jasperson et al. 2005). We approximate this with the construct of IT mindfulness, a personal characteristic of the individual that reflects such an awareness (Thatcher et al. 2018). By doing so, we are first to show the construct's role in the context of IT consumerization. We find that the extent to which users think about their use does indeed drive the recognition of better functionality in the services. Based in parts on our qualitative strand, we extend this understanding by identifying an array of benefits that are driven by such better functionalities. These include added convenience, higher work speed, and more collaboration efficiency. We show that the provision of an adequate, ubiquitously accessible business solution which offers functionalities that are on par with consumer IT is the best way to govern the use private IT in the workplace. In other words, organizations need to invest in adequate solutions for communication and collaboration or they risk that employees take action themselves.

Fourth, our qualitative results show that aspects which are generally considered disadvantages of IT consumerization (such as IT security, a prerequisite of information privacy) are in fact drivers of IT consumerization for some individuals when the private IT is perceived to provide better functionality. Such individuals report that they consider the security features of private IT, e.g., end-to-end encryption, as reasons for their usage. A similar paradox was observed regarding privacy concerns: Employees report that they use private IT to avoid organizational channels and the recognition of supervisors. While this can hardly be governed it has scarcely been considered in research in IT consumerization. We suggest that it should be recognized as a possible factor interfering with the measurement of privacy risks, which have produced mixed results in the IT consumerization literature (e.g., Lee et al. 2017). Several respondents also

mention that they make judgement calls based on their perception of boundaries between sensitive and unproblematic communication. This is potentially problematic, as it puts the decision of information criticality solely in the hands of the employees.

Lastly, our qualitative analysis provided hints regarding reasons for unexplained variance in our model. In particular, these are personal preferences regarding the use of only one solution, which we refer to as an integration preference that can be considered the opposite of a segmentation preference (Kreiner et al. 2009). In addition, some employees mention increased networking opportunities through the informal character of private IT and existing informal relationships as drivers for communication and collaboration through private channels. These findings provide avenues for future research.

2.2.6.2. Practical Implications

In an environment where IIS are largely autonomous and can be brought into the business context with or without consent of the organization, it becomes increasingly important to understand why users adopt private consumer IT services, rather than the provided business services. Such knowledge can help organizations to better manage IT consumerization. To contribute to this understanding, we examined drivers of IT service consumerization theoretically and empirically.

First, we point out that IT consumerization cannot be solely managed on a device level, but that IT services need to be considered to grasp the entire phenomenon which includes shadow IT. This means that individuals often choose between existing private technology that can be transferred to the work context and technology provided by the businesses. They only use business IT if they arrive at the conclusion that it is better fit from a net-valence perspective. This is particularly important as business alternatives are usually in an uphill battle against the habitually used existing private solutions.

Second, we confirm that IT consumerization usage decisions are largely driven by perceived benefits rather than potential risks. Still, previous research suggests that organizations define clear policies and guidelines for the use of IT consumerization and try to create a security-aware culture in order to control for the associated risks (Köffer 2015). However, our results indicate that it is not sufficient to only prohibit or sanction the usage of private consumer IT services. Although employees are aware of the risks associated with their actions, they do not comply with the rules, but make judgements call on where the usage of private IT may be acceptable or

unproblematic. IT-security literature suggests that there might be possible reasons for such a behavior. For example, that negative business impacts are not made clear enough and, therefore, policies are circumvented (Guo et al. 2011).

Third, to foster use, we show that organizations have to provide business alternatives for the IT services which offer similar performance on a feature level, as employees make deliberate portfolio decisions based on the comparison of the available alternatives. First, such alternatives need to be accessible ubiquitously, if they are to substitute private IT services. According to our qualitative results, they also should provide adequate functionality to foster efficient collaboration, secure data transfer, and convenience of use to be assessed as the better IS.

Our findings also have implications for individuals. While it is understandable that benefits of IT consumerization outweigh the perceived associated risks, individuals should not disregard its risks entirely. Particularly with regards to file sharing, the storage of business data on external servers should not be taken lightly, as the theft of such data may imply severe consequences for the individual and the organization.

2.2.7. Limitations and Future Work

Our study has a number of limitations and leaves room for further research. In the empirical part, we use data from a single cross-sectional survey, which leads to limitations in testing robustness and generalizability of the results. Furthermore, we queried the participants on both IT services in a single survey. While this accounts for unobserved participant characteristics and increases comparability across data on the services, it might have biased the data in the direction of unwarranted consistency across the two services. Also, we restricted our data collection to two IT services – one communication and one collaboration service. While these are important service types available in most office suites and in many individuals' private IS, it does not consider additional services, such as emailing, and online social networks, which may impair generalizability of our results.

In the qualitative part of our analysis, we identified additional mechanisms, such as the integration preference, networking, and the fostering of informal contacts using private services. This indicates that there are more rationales focusing on individual preferences and social relationships between individuals. Future work should investigate the role of different IS used to foster

such relationships in more detail. For example, moderating variables of use, such as segmentation or integration preferences concerning the private and business domain (cf. Sarker et al. 2012) may be considered.

One other particularly noteworthy observation from the qualitative part of our analysis is that there are multiple accounts of employees who value the security features of consumer IT (such as end-to-end encryption). Others, however, report that security concerns are strong inhibitors of use. This duality could be due to different positions, organizational cultures, or other perceptions of boundaries. Investigating the root of these differences should be subject to future research and would contribute to our understanding of IT policies and security related to IT consumerization.

2.2.8. Conclusion

This paper contributes to the understanding of the phenomenon of IT consumerization. With a focus on IT services, it complements extant literature on IT device consumerization. We investigated factors influencing individuals‘ behavior in whether or not they use private consumer IT services in a business context. To do so, we analyzed the relevant literature and developed a theoretical model based on benefit-risk assessments, which we tested in an empirical study with mixed quantitative and qualitative elements. Regarding risks, we find that a prohibition of IT service consumerization does not prevent individuals from using their private IT services for business purposes. Contrarily, we find benefits to be the driver of use and that users make deliberate decisions based on the assessment of the functionalities of the services. To this end, we have deepened the understanding of IT service consumerization and the reasons for use behavior in a post-adoptive phase. We urge practitioners to recognize the relevance of adequate business alternatives in order to manage IT service consumerization.

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Appendix 2.2/A – Empirical Research Regarding IT Consumerization Antecedents

Author	Year	Title	Dependent Construct	Significant Antecedents	Theoretical Lens	N
Bautista et al.	2018	Predictors and Outcomes of Nurses' Use of Smartphones for Work Purposes	Intention/Use of smartphones for Work Purposes	Injunctive Norm, Descriptive Norm, Perceived Behavioral Control	own model based on TPB	517
Crossler et al.	2014	Understanding Compliance with Bring Your Own Device Policies Utilizing Protection Motivation Theory	Intentions/ Behavior to comply with BYOD Policy	Threat Severity, Self-Efficacy, Response Efficacy	Protection motivation theory	444
Degirmenci et al.	2019	Future of Flexible Work in the Digital Age: Bring Your Own Device Challenges of Privacy Protection	Behavioral Intention	BYOD Benefits, BYOD Risks, Privacy Concerns	Privacy calculus theory (risk-benefit analysis)	542
Gewald et al.	2017	Millennials' Attitudes Toward It Consumerization in the Workplace	Behavioral Intention (to participate in a BYOD program)	Perceived Risks (Performance, Privacy, Security), Perceived Benefits (Performance, Effort, Compatibility)	net valence model incl. UTAUT-constructs	402
Junglas et al.	2019	Innovation at work: The Relative Advantage of Using Consumer IT in the Workplace	IT Consumerization behavior	IT Empowerment, Relative Advantage, Permission to Use	own model	254
Lee et al.	2017	Implications of Monitoring Mechanisms on Bring Your Own Device Adoption	BYOD Adoption Intention	Information Privacy Concerns, Tasks Measured, Monitoring Frequency, Organizational Control, Job Performance Expectancy	own model based on TPB and UTAUT	275
Ortbach	2015	Unraveling the Effect of Personal Innovativeness on Bring-your-own-Device (BYOD) Intention	BYOD Intention	Personal Innovativeness in IT, Perceived Usefulness of Private IT, Perceived Ease of Use of Private/Enterprise Mobile IT	TAM	151
Weeger et al.	2015	IT Consumerization: BYOD Acceptance and its Impact on Employee Attractiveness	Behavioral Intention (to participate in BYOD program)	Performance Expectancy, Effort Expectancy, Social Influence, Perceived Business Threats	extended UTAUT	444
Weeger et al.	2020	Determinants of Intention to Participate in Corporate BYOD-Programs: The Case of Digital Natives	Behavioral Intention	Performance Risk, Safety Risk, Performance Expectancy, Effort Expectancy, Compatibility	Net-valence model	476

Studies from 2014 to 2019 – older research is summarized by Ortbach (2015)

Appendix 2.2/B – Questionnaire

The questionnaire starts with a detailed explanation of the scope of communication and collaboration services and what consumerization of such services means:

Communication and collaboration services comprise software applications, mobile apps, or other online services like cloud storage. We examine two specific types of services in our study:

- instant messaging

- file sharing

Instant messages are used for communication of shorter text messages and are sent in real time. Filesharing, on the other hand, is used to share larger files such as documents, images, or videos with collaborators.

Your private communication service is the service that you primarily use for private purposes, e.g., your private instant messaging service such as What's App, iMessage or WeChat.

The questionnaire then proceeds with the item scales for all the models' constructs.

Note: When "instant messaging/file sharing" is written in italics, two separate questions were asked, one for each service.

IT Mindfulness (source: Thatcher et al. 2018)	
ITM01	I find it easy to create new and effective ways of using IT.
ITM02	I am very creative when using IT.
ITM03	I make many novel contributions to my work-related tasks through the use of IT.
ITM04	I am often open to learning new ways of using IT.
ITM05	I have an open mind about new ways of using IT.
ITM06	I like to investigate different ways of using IT.
ITM07	I am very curious about different ways of using IT.
ITM08	I like to figure out different ways of using IT.
ITM09	I often notice how other people are using IT.
ITM10	I attend to the 'big picture' of a project when using IT.
ITM11	I 'get involved' when using IT.
Better Functionalities of Private Service in contrast to Business Service (source: Lin & Huang 2008)	
	In helping me to perform my job,...
BF01	the functionalities of my private *instant messaging/file sharing* service are more adequate than the functionalities of my business *instant messaging/file sharing* service.
BF02	the functionalities of my private *instant messaging/file sharing* service are more appropriate than the functionalities of my business *instant messaging/file sharing* service.
BF03	the functionalities of my private *instant messaging/file sharing* service are more compatible with my job than the functionalities of my business *instant messaging/file sharing* service.

BF04	the functionalities of my private *instant messaging/file sharing* service are more helpful than the functionalities of my business *instant messaging/file sharing* service.
BF05	the functionalities of my private *instant messaging/file sharing* service are more sufficient than the functionalities of my business *instant messaging/file sharing* service.
BF06	the functionalities of my private *instant messaging/file sharing* service make my job easier than the functionalities of my business *instant messaging/file sharing* service.
BF06	In general, the functionalities of my private *instant messaging/file sharing* service are more fit my job than the functionalities of my business *instant messaging/file sharing* service.
Relative Usefulness of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
UF01	I find using my private *instant messaging/file sharing* service for business purposes more useful in my daily life than using my business *instant messaging/file sharing* service.
UF02	Using my private *instant messaging/file sharing* service for business purposes helps me accomplish things more quickly than using my business *instant messaging/file sharing* service.
UF03	Using my private *instant messaging/file sharing* service for business purposes increases my productivity in contrast to using my business *instant messaging/file sharing* service.
Relative Ease of Use of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
EoU01	Learning how to use my private *instant messaging/file sharing* service for business purposes is easier for me than learning how to use my business *instant messaging/file sharing* service.
EoU02	My interaction with my private *instant messaging/file sharing* service for business purposes is more clear and understandable than the interaction with my business *instant messaging/file sharing* service.
EoU03	I find my private *instant messaging/file sharing* service for business purposes easier to use than my business *instant messaging/file sharing* service.
EoU04	It is easier for me to become skillful at using my private i*nstant messaging/file sharing* service for business purposes than using my business *instant messaging/file sharing* service.
Perceived Sanction of IT Policy Breach	
(source: Herath & Rao 2009)	
SA01	The organization disciplines employees who break IT policies.
SA02	My organization terminates employees who repeatedly break IT policies.
SA03	If I were caught violating organizational IT policies, I would be severely punished.
Private Information Privacy Concerns with IT Service Consumerization	
(source: Cocosila et al. 2009; Dinev & Hart 2006; Featherman & Pavlou 2003)	
PIC01	Using my private *instant messaging/file sharing* service for business purposes would cause me to lose control over my private information.
PIC02	Using my private *instant messaging/file sharing* service for business purposes would lead to a loss of control over my private information because it could be used without my knowledge.
PIC03	Internet hackers (criminals) might take control of my private information if I used my private *instant messaging/file sharing* service for business purposes.
Business Information Privacy Concerns with IT Service Consumerization	
(source: Cocosila et al. 2009; Dinev & Hart 2006; Featherman & Pavlou 2003)	
BIC01	Using my private *instant messaging/file sharing* service for business purposes would cause me to lose control over my company's information.
BIC02	Using my private *instant messaging/file sharing* service for business purposes would lead to a loss of control over my company's information because it could be used without my knowledge.
BIC03	Internet hackers (criminals) might take control of my company's information if I used my private *instant messaging/file sharing* service for business purposes.

Attitude towards IT Service Consumerization	
(source: Degirmenci et al. 2019; Nysveen et al. 2005; Taylor and Todd 1995)	
	Using my private *instant messaging/file sharing* service for business purposes…
AT01	is a good idea.
AT02	is a wise idea.
AT03	is positive.
AT04	is beneficial.
AT05	is favorable.
AT06	I like the idea of using my private *instant messaging/file sharing* service for business purposes.
IT Service Consumerization Use Behavior	
(source: Carter and Petter 2015)	
	Thinking of your use of your private *instant messaging/file sharing* service during the past 3 weeks, please indicate how often you have used your private *instant messaging/file sharing* service for business purposes.
U01	not at all - once - a couple of times - several times - many times - very many times
Habit of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
HA01	The use of my private *instant messaging/file sharing* service for business purposes has become a habit for me.
HA02	I am addicted to using my private *instant messaging/file sharing* service for business purposes.
HA03	I must use my private *instant messaging/file sharing* service for business purposes.
Social Influence of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
SI01	People who are important to me think that I should use my private *instant messaging/file sharing* service for business purposes.
SI02	People who influence my behavior think that I should use my private *instant messaging/file sharing* service for business purposes.
SI03	People whose opinions that I value prefer that I use my private *instant messaging/file sharing* service for business purposes.
Hedonic Motivation of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
HM01	Using my private *instant messaging/file sharing* service for business purposes is fun.
HM02	Using my private *instant messaging/file sharing* service for business purposes is enjoyable.
HM03	Using my private *instant messaging/file sharing* service for business purposes is very entertaining.
Facilitating Conditions of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
FC01	I have the resources necessary to use my private *instant messaging/file sharing* service for business purposes.
FC02	I have the knowledge necessary to use my private *instant messaging/file sharing* service for business purposes.
FC03	Using my private *instant messaging/file sharing* service for business purposes is compatible with other technologies I use.
FC04	I can get help from others when I have difficulties using my private *instant messaging/file sharing* service for business purposes.

Price Value of IT Service Consumerization	
(source: Venkatesh et al. 2012)	
PV01	Using my private *instant messaging/file sharing* service for business purposes is reasonably priced.
PV02	Using my private *instant messaging/file sharing* service for business purposes is a good value for the money.
PV03	At the current price, using my private *instant messaging/file sharing* service for business purposes provides a good value.
General Computer Self-Efficacy	
(source: Marakas et al. 2007)	
CSE01	I believe I have the ability to describe how a computer works.*
CSE02	I believe I have the ability to install new software applications on a computer.
CSE03	I believe I have the ability to identify and correct common operational problems with a computer.*
CSE04	I believe I have the ability to unpack and set up a new computer.
CSE05	I believe I have the ability to remove information from a computer that I no longer need.
CSE06	I believe I have the ability to use a computer to display or present information in a desired manner.
Theoretically Unrelated Marker Questions for Control of CMV	
(source: self-developed)	
CMV01	I do not trust any classical and conventional medical therapies.
CMV02	I want to be independent from classical and conventional medical therapies.

* Item dropped after measurement model evaluation.

Appendix 2.2/C – Further Results for the Evaluation of the Measurement Models

Descriptive Statistics, Main Factor Loadings, Internal Consistency, and Average Variance Extracted for Control Variable for Consumerization of Instant Messaging

	# Items	Mean	SD	Loadings	Alpha	CR	AVE
Habit	3	4.540	2.183	0.873-0.916	0.867	0.918	0.789
Social Influence	3	4.103	1.888	0.947-0.958	0.947	0.966	0.903
Hedonic Motivation	3	4.483	1.975	0.948-0.954	0.948	0.966	0.905
Facilitating Conditions	4	5.680	1.473	0.782-0.842	0.825	0.883	0.653
Price Value	3	5.789	1.548	0.932-0.945	0.930	0.956	0.878
Computer-Self-Efficacy	4	6.245	1.146	0.689-0.904	0.873	0.890	0.671

Descriptive Statistics, Main Factor Loadings, Internal Consistency, and Average Variance Extracted for Control Variable for Consumerization of File Sharing

	# Items	Mean	SD	Loadings	Alpha	CR	AVE
Habit	3	3.986	2.270	0.905-0.930	0.901	0.938	0.835
Social Influence	3	3.861	2.035	0.955-0.976	0.966	0.978	0.936
Hedonic Motivation	3	4.029	2.033	0.944-0.964	0.952	0.969	0.912
Facilitating Conditions	4	5.360	1.760	0.852-0.892	0.894	0.925	0.754
Price Value	3	5.446	1.738	0.960-0.965	0.961	0.975	0.928
Computer-Self-Efficacy	4	6.245	1.146	0.759-0.927	0.873	0.897	0.687

Loadings for Consumerization of Instant Messaging (main loading in bold font)

		ITM	BF	UF	EoU	SA	IC	PIC	BIC	AT	HA	SI	HM	FC	PV	CSE
IT Mindfulness	ITM01	**0.816**	0.205	0.304	0.169	0.088	-0.185	-0.124	-0.224	0.297	0.350	0.270	0.290	0.345	0.354	0.336
	ITM02	**0.843**	0.227	0.319	0.142	0.039	-0.219	-0.177	-0.237	0.314	0.347	0.261	0.245	0.318	0.378	0.398
	ITM03	**0.848**	0.174	0.273	0.130	0.105	-0.132	-0.098	-0.150	0.274	0.308	0.263	0.231	0.324	0.289	0.406
	ITM04	**0.779**	0.131	0.185	0.062	0.064	-0.128	-0.145	-0.100	0.137	0.126	0.015	0.056	0.354	0.314	0.608
	ITM05	**0.792**	0.148	0.215	0.040	0.021	-0.206	-0.204	-0.187	0.141	0.132	0.037	0.085	0.372	0.316	0.658
	ITM06	**0.857**	0.197	0.277	0.130	0.019	-0.171	-0.147	-0.177	0.278	0.280	0.192	0.206	0.353	0.371	0.447
	ITM07	**0.856**	0.167	0.232	0.056	0.010	-0.173	-0.172	-0.156	0.243	0.275	0.166	0.163	0.350	0.391	0.472
	ITM08	**0.853**	0.198	0.233	0.120	0.037	-0.182	-0.166	-0.179	0.252	0.311	0.225	0.185	0.327	0.284	0.496
	ITM09	**0.726**	0.158	0.201	0.043	0.125	-0.172	-0.168	-0.159	0.231	0.260	0.143	0.198	0.228	0.225	0.367
	ITM10	**0.817**	0.181	0.243	0.061	0.100	-0.152	-0.142	-0.147	0.288	0.343	0.250	0.265	0.323	0.360	0.385
	ITM11	**0.827**	0.123	0.186	-0.010	0.138	-0.178	-0.166	-0.171	0.220	0.255	0.147	0.246	0.253	0.300	0.393
Better Functionalities	BF01	0.153	**0.899**	0.545	0.660	0.097	-0.085	-0.047	-0.112	0.394	0.529	0.489	0.402	0.359	0.381	-0.072
	BF02	0.222	**0.866**	0.538	0.585	0.077	-0.176	-0.128	-0.204	0.489	0.541	0.514	0.461	0.346	0.350	-0.070
	BF03	0.258	**0.907**	0.517	0.534	0.112	-0.191	-0.145	-0.215	0.408	0.548	0.519	0.429	0.353	0.353	-0.014
	BF04	0.195	**0.892**	0.518	0.626	0.043	-0.200	-0.166	-0.213	0.373	0.508	0.457	0.420	0.408	0.371	0.037
	BF05	0.158	**0.908**	0.519	0.620	0.098	-0.201	-0.147	-0.231	0.416	0.545	0.471	0.405	0.370	0.382	-0.065
	BF06	0.166	**0.852**	0.589	0.586	0.042	-0.216	-0.185	-0.223	0.411	0.538	0.410	0.381	0.462	0.352	0.026
	BF07	0.211	**0.916**	0.593	0.588	0.078	-0.211	-0.164	-0.233	0.481	0.614	0.555	0.464	0.420	0.340	-0.028
Usefulness	UF01	0.189	0.560	**0.876**	0.547	0.063	-0.305	-0.257	-0.319	0.545	0.594	0.442	0.429	0.377	0.352	-0.048
	UF02	0.288	0.545	**0.916**	0.547	-0.002	-0.319	-0.248	-0.353	0.554	0.628	0.510	0.474	0.446	0.395	0.082
	UF03	0.344	0.559	**0.924**	0.579	-0.037	-0.291	-0.231	-0.317	0.595	0.668	0.564	0.505	0.439	0.359	0.068
Ease of Use	EoU01	0.081	0.547	0.530	**0.912**	-0.005	-0.124	-0.079	-0.154	0.416	0.505	0.448	0.406	0.245	0.268	-0.109
	EoU02	0.119	0.630	0.529	**0.899**	-0.053	-0.183	-0.130	-0.213	0.399	0.483	0.421	0.360	0.316	0.282	0.030
	EoU03	0.133	0.623	0.600	**0.898**	-0.065	-0.149	-0.125	-0.155	0.493	0.528	0.468	0.412	0.422	0.325	0.037
	EoU04	0.080	0.645	0.576	**0.929**	-0.021	-0.109	-0.055	-0.148	0.451	0.515	0.487	0.407	0.307	0.297	-0.099
Sanction	SA01	0.032	0.008	-0.039	-0.087	**0.858**	0.134	0.094	0.158	0.043	0.060	0.100	0.120	-0.044	-0.081	-0.009
	SA02	0.103	0.109	0.007	-0.033	**0.931**	0.168	0.132	0.184	0.075	0.137	0.183	0.176	0.057	-0.006	-0.033
	SA03	0.068	0.090	0.027	-0.021	**0.957**	0.169	0.145	0.174	0.113	0.155	0.219	0.206	-0.024	-0.071	-0.077
Private Information Privacy Concerns	PIC01	-0.154	-0.138	-0.274	-0.089	0.132	**0.854**	**0.934**	0.694	-0.353	-0.235	-0.075	-0.160	-0.321	-0.199	-0.178
	PIC02	-0.150	-0.142	-0.255	-0.099	0.105	**0.869**	**0.939**	0.717	-0.354	-0.257	-0.096	-0.176	-0.267	-0.157	-0.125
	PIC03	-0.212	-0.151	-0.216	-0.106	0.150	**0.872**	**0.877**	0.781	-0.340	-0.260	-0.093	-0.185	-0.282	-0.227	-0.129

Business Information Privacy Concerns	BIC01	-0.206	-0.233	-0.358	-0.160	0.194	**0.909**	0.763	**0.954**	-0.409	-0.292	-0.196	-0.249	-0.321	-0.240	-0.188
	BIC02	-0.219	-0.210	-0.344	-0.142	0.169	**0.912**	0.769	**0.954**	-0.403	-0.323	-0.184	-0.241	-0.318	-0.233	-0.159
	BIC03	-0.181	-0.206	-0.332	-0.221	0.170	**0.880**	0.732	**0.931**	-0.372	-0.316	-0.182	-0.216	-0.238	-0.174	-0.113
Attitude	AT01	0.263	0.430	0.556	0.446	0.091	-0.350	-0.317	-0.347	**0.950**	0.670	0.628	0.531	0.483	0.340	-0.101
	AT02	0.280	0.409	0.553	0.434	0.075	-0.391	-0.362	-0.379	**0.945**	0.647	0.590	0.506	0.474	0.335	-0.044
	AT03	0.309	0.446	0.581	0.451	0.093	-0.398	-0.360	-0.393	**0.970**	0.688	0.618	0.524	0.513	0.359	-0.031
	AT04	0.350	0.462	0.625	0.470	0.055	-0.452	-0.411	-0.446	**0.939**	0.689	0.559	0.531	0.532	0.429	0.042
	AT05	0.268	0.440	0.586	0.465	0.105	-0.398	-0.366	-0.387	**0.958**	0.697	0.596	0.546	0.442	0.353	-0.073
	AT06	0.264	0.516	0.641	0.489	0.110	-0.401	-0.344	-0.415	**0.923**	0.732	0.652	0.576	0.479	0.326	-0.078
Habit	HA01	0.288	0.583	0.704	0.524	0.026	-0.362	-0.317	-0.367	0.669	**0.876**	0.583	0.572	0.490	0.429	-0.023
	HA02	0.304	0.514	0.543	0.491	0.198	-0.206	-0.167	-0.222	0.596	**0.873**	0.617	0.618	0.270	0.219	-0.141
	HA03	0.322	0.531	0.596	0.473	0.166	-0.267	-0.232	-0.273	0.663	**0.916**	0.653	0.607	0.375	0.308	-0.133
Social Influence	SI01	0.176	0.511	0.525	0.482	0.169	-0.145	-0.088	-0.184	0.600	0.642	**0.947**	0.500	0.354	0.199	-0.156
	SI02	0.253	0.520	0.528	0.458	0.204	-0.175	-0.117	-0.211	0.604	0.660	**0.947**	0.510	0.377	0.242	-0.045
	SI03	0.234	0.529	0.541	0.491	0.193	-0.130	-0.072	-0.171	0.623	0.679	**0.958**	0.548	0.329	0.216	-0.131
Hedonic Motivation	HM01	0.199	0.427	0.471	0.394	0.160	-0.235	-0.202	-0.243	0.532	0.632	0.500	**0.953**	0.316	0.317	-0.172
	HM02	0.276	0.475	0.511	0.423	0.173	-0.218	-0.169	-0.241	0.535	0.629	0.513	**0.948**	0.371	0.396	-0.085
	HM03	0.232	0.452	0.499	0.428	0.219	-0.210	-0.170	-0.226	0.548	0.657	0.546	**0.954**	0.328	0.318	-0.144
Facilitating Conditions	FC01	0.313	0.333	0.367	0.241	0.013	-0.271	-0.256	-0.257	0.426	0.344	0.301	0.232	**0.842**	0.490	0.227
	FC02	0.383	0.303	0.244	0.245	-0.014	-0.213	-0.230	-0.175	0.303	0.212	0.153	0.117	**0.782**	0.537	0.421
	FC03	0.347	0.307	0.380	0.302	-0.042	-0.299	-0.287	-0.280	0.389	0.335	0.260	0.315	**0.813**	0.588	0.315
	FC04	0.265	0.436	0.464	0.353	0.026	-0.273	-0.249	-0.268	0.498	0.453	0.421	0.425	**0.793**	0.470	0.076
Price Value	PV01	0.348	0.378	0.381	0.298	-0.047	-0.203	-0.169	-0.214	0.352	0.347	0.247	0.350	0.595	**0.933**	0.157
	PV02	0.405	0.371	0.339	0.275	-0.057	-0.261	-0.255	-0.240	0.319	0.305	0.162	0.304	0.569	**0.932**	0.272
	PV03	0.376	0.390	0.419	0.333	-0.049	-0.195	-0.177	-0.191	0.386	0.372	0.231	0.359	0.619	**0.945**	0.163
Computer Self-Efficacy	CSE01	0.451	0.037	0.061	0.052	-0.031	-0.188	-0.164	-0.192	0.032	-0.036	-0.065	-0.058	0.338	0.282	**0.778**
	CSE02	0.412	-0.077	0.005	-0.068	-0.068	-0.128	-0.121	-0.121	-0.105	-0.173	-0.168	-0.191	0.206	0.115	**0.904**
	CSE03	0.463	0.004	0.022	-0.015	-0.001	-0.107	-0.135	-0.070	0.033	-0.018	-0.063	-0.056	0.250	0.192	**0.689**
	CSE04	0.571	0.009	0.056	-0.028	-0.022	-0.152	-0.148	-0.140	0.007	-0.018	-0.037	-0.064	0.287	0.224	**0.887**

Note: ITM = IT Mindfulness, BF = Better Functionalities, UF = Usefulness, EoU = Ease of Use, SA = Sanction, IC = Information Privacy Concerns, PIC = Private Information Privacy Concerns, BIC = Business Information Privacy Concerns, AT = Attitude, HA = Habit, SI = Social Influence, HM = Hedonic Motivation, FC = Facilitating Conditions, PV = Price Value, CSE = Computer Self-Efficacy

Loadings for Consumerization of File Sharing (main loading in bold font)

		ITM	BF	UF	EoU	SA	IC	PIC	BIC	AT	HA	SI	HM	FC	PV	CSE
IT Mindfulness	ITM01	**0.828**	0.233	0.323	0.211	0.088	-0.230	-0.178	-0.261	0.340	0.346	0.283	0.283	0.391	0.342	0.340
	ITM02	**0.850**	0.224	0.317	0.220	0.039	-0.243	-0.185	-0.279	0.325	0.313	0.271	0.260	0.348	0.325	0.382
	ITM03	**0.857**	0.197	0.283	0.179	0.106	-0.150	-0.112	-0.173	0.271	0.284	0.240	0.239	0.309	0.254	0.386
	ITM04	**0.749**	0.061	0.128	0.068	0.065	-0.112	-0.126	-0.088	0.163	0.083	0.007	0.031	0.282	0.273	0.587
	ITM05	**0.769**	0.099	0.167	0.077	0.024	-0.167	-0.159	-0.160	0.181	0.082	0.045	0.091	0.301	0.316	0.648
	ITM06	**0.847**	0.164	0.253	0.111	0.021	-0.179	-0.146	-0.197	0.264	0.223	0.182	0.217	0.278	0.307	0.445
	ITM07	**0.842**	0.124	0.194	0.093	0.012	-0.186	-0.167	-0.188	0.282	0.230	0.154	0.139	0.308	0.284	0.468
	ITM08	**0.843**	0.160	0.197	0.139	0.040	-0.198	-0.194	-0.186	0.266	0.263	0.216	0.203	0.282	0.241	0.469
	ITM09	**0.734**	0.175	0.201	0.080	0.126	-0.158	-0.141	-0.161	0.241	0.230	0.174	0.193	0.264	0.208	0.362
	ITM10	**0.829**	0.219	0.280	0.152	0.102	-0.165	-0.153	-0.163	0.326	0.323	0.249	0.292	0.346	0.348	0.361
	ITM11	**0.837**	0.157	0.240	0.048	0.139	-0.209	-0.189	-0.211	0.266	0.237	0.141	0.265	0.303	0.260	0.376
Better Functionalities	BF01	0.202	**0.921**	0.621	0.679	0.126	-0.282	-0.230	-0.308	0.495	0.655	0.535	0.530	0.480	0.478	-0.083
	BF02	0.213	**0.904**	0.589	0.638	0.126	-0.322	-0.266	-0.347	0.529	0.670	0.586	0.567	0.433	0.420	-0.085
	BF03	0.221	**0.929**	0.655	0.692	0.160	-0.293	-0.232	-0.326	0.542	0.658	0.633	0.542	0.504	0.435	-0.132
	BF04	0.200	**0.926**	0.597	0.698	0.106	-0.308	-0.252	-0.335	0.486	0.581	0.508	0.517	0.504	0.445	-0.055
	BF05	0.171	**0.938**	0.606	0.702	0.103	-0.290	-0.242	-0.312	0.492	0.626	0.539	0.493	0.483	0.466	-0.055
	BF06	0.214	**0.885**	0.654	0.678	0.083	-0.318	-0.273	-0.334	0.558	0.651	0.526	0.519	0.597	0.503	-0.045
	BF07	0.192	**0.931**	0.624	0.674	0.134	-0.331	-0.274	-0.357	0.548	0.703	0.636	0.604	0.501	0.428	-0.156
Usefulness	UF01	0.271	0.589	**0.887**	0.581	0.101	-0.293	-0.259	-0.300	0.578	0.645	0.500	0.524	0.489	0.421	-0.006
	UF02	0.286	0.645	**0.941**	0.591	0.052	-0.389	-0.339	-0.404	0.673	0.673	0.534	0.493	0.508	0.430	-0.023
	UF03	0.298	0.650	**0.960**	0.638	0.080	-0.333	-0.275	-0.361	0.672	0.700	0.574	0.551	0.520	0.448	-0.091
Ease of Use	EoU01	0.164	0.689	0.601	**0.935**	0.096	-0.215	-0.169	-0.241	0.515	0.565	0.526	0.480	0.486	0.438	-0.060
	EoU02	0.142	0.685	0.609	**0.944**	0.059	-0.196	-0.156	-0.217	0.501	0.529	0.552	0.462	0.466	0.399	-0.082
	EoU03	0.195	0.720	0.642	**0.933**	0.078	-0.260	-0.217	-0.280	0.549	0.587	0.533	0.452	0.542	0.450	-0.013
	EoU04	0.128	0.679	0.576	**0.935**	0.097	-0.201	-0.149	-0.232	0.458	0.517	0.556	0.443	0.438	0.385	-0.062
Sanction	SA01	0.039	0.047	0.043	0.068	**0.855**	0.154	0.110	0.183	0.030	0.063	0.112	0.110	0.114	-0.003	-0.010
	SA02	0.109	0.135	0.060	0.087	**0.941**	0.148	0.116	0.166	0.079	0.126	0.213	0.161	0.166	0.048	-0.030
	SA03	0.079	0.139	0.105	0.083	**0.951**	0.165	0.154	0.162	0.096	0.188	0.217	0.206	0.108	-0.026	-0.078
Private Information Privacy Concerns	PIC01	-0.162	-0.270	-0.319	-0.169	0.093	**0.888**	**0.945**	0.759	-0.433	-0.317	-0.214	-0.263	-0.352	-0.247	-0.072
	PIC02	-0.178	-0.253	-0.289	-0.167	0.151	**0.881**	**0.943**	0.749	-0.398	-0.299	-0.182	-0.231	-0.313	-0.224	-0.091
	PIC03	-0.212	-0.151	-0.216	-0.106	0.150	**0.872**	**0.877**	0.781	-0.340	-0.260	-0.093	-0.185	-0.282	-0.227	-0.129

Business Information Privacy Concerns	BIC01	-0.206	-0.344	-0.377	-0.236	0.184	**0.922**	0.804	**0.956**	-0.469	-0.386	-0.307	-0.299	-0.331	-0.283	-0.048
	BIC02	-0.249	-0.358	-0.376	-0.256	0.172	**0.924**	0.815	**0.950**	-0.493	-0.409	-0.313	-0.309	-0.343	-0.279	-0.062
	BIC03	-0.234	-0.325	-0.338	-0.249	0.156	**0.893**	0.761	**0.945**	-0.391	-0.339	-0.269	-0.297	-0.259	-0.254	-0.083
Attitude	AT01	0.304	0.525	0.644	0.498	0.067	-0.445	-0.417	-0.433	**0.963**	0.664	0.562	0.567	0.562	0.407	-0.064
	AT02	0.303	0.537	0.666	0.522	0.134	-0.425	-0.382	-0.429	**0.961**	0.672	0.599	0.575	0.555	0.407	-0.066
	AT03	0.303	0.525	0.657	0.491	0.067	-0.458	-0.407	-0.467	**0.965**	0.656	0.536	0.544	0.557	0.419	-0.026
	AT04	0.378	0.554	0.693	0.531	0.023	-0.445	-0.392	-0.457	**0.951**	0.667	0.539	0.547	0.617	0.448	0.031
	AT05	0.334	0.538	0.661	0.510	0.083	-0.466	-0.427	-0.464	**0.960**	0.682	0.599	0.582	0.553	0.408	-0.020
	AT06	0.331	0.575	0.642	0.549	0.104	-0.459	-0.403	-0.474	**0.933**	0.699	0.609	0.574	0.601	0.406	-0.002
Habit	HA01	0.291	0.702	0.737	0.584	0.038	-0.391	-0.345	-0.401	0.678	**0.905**	0.612	0.620	0.588	0.514	-0.061
	HA02	0.285	0.611	0.614	0.537	0.212	-0.280	-0.214	-0.319	0.600	**0.906**	0.662	0.675	0.429	0.335	-0.155
	HA03	0.296	0.621	0.629	0.492	0.175	-0.348	-0.298	-0.366	0.650	**0.930**	0.656	0.646	0.459	0.377	-0.196
Social Influence	SI01	0.285	0.603	0.573	0.563	0.215	-0.252	-0.191	-0.289	0.585	0.672	**0.955**	0.588	0.476	0.326	-0.061
	SI02	0.236	0.587	0.552	0.551	0.203	-0.286	-0.226	-0.319	0.582	0.680	**0.972**	0.568	0.421	0.279	-0.156
	SI03	0.200	0.600	0.553	0.565	0.197	-0.250	-0.178	-0.297	0.578	0.689	**0.976**	0.590	0.403	0.284	-0.200
Hedonic Motivation	HM01	0.241	0.547	0.531	0.448	0.173	-0.306	-0.274	-0.310	0.555	0.672	0.568	**0.957**	0.430	0.399	-0.188
	HM02	0.297	0.558	0.548	0.480	0.155	-0.276	-0.236	-0.291	0.562	0.664	0.555	**0.944**	0.451	0.441	-0.139
	HM03	0.242	0.574	0.530	0.478	0.201	-0.284	-0.234	-0.308	0.578	0.689	0.598	**0.964**	0.418	0.403	-0.199
Facilitating Conditions	FC01	0.335	0.437	0.412	0.405	0.114	-0.320	-0.332	-0.282	0.479	0.401	0.337	0.335	**0.875**	0.597	0.229
	FC02	0.362	0.384	0.372	0.425	0.137	-0.241	-0.261	-0.202	0.441	0.369	0.280	0.279	**0.855**	0.591	0.266
	FC03	0.343	0.481	0.481	0.469	0.095	-0.330	-0.328	-0.305	0.532	0.498	0.385	0.413	**0.892**	0.613	0.127
	FC04	0.309	0.546	0.565	0.477	0.144	-0.322	-0.294	-0.321	0.592	0.551	0.490	0.486	**0.852**	0.507	0.055
Price Value	PV01	0.341	0.459	0.439	0.417	-0.008	-0.268	-0.253	-0.261	0.398	0.425	0.289	0.399	0.634	**0.960**	0.170
	PV02	0.335	0.481	0.454	0.445	-0.003	-0.288	-0.273	-0.279	0.423	0.420	0.273	0.412	0.619	**0.964**	0.137
	PV03	0.345	0.486	0.452	0.430	0.029	-0.285	-0.258	-0.286	0.435	0.452	0.319	0.441	0.648	**0.965**	0.146
Computer Self-Efficacy	CSE01	0.433	-0.006	0.006	0.036	-0.030	-0.078	-0.054	-0.094	0.076	-0.049	-0.079	-0.080	0.249	0.224	**0.792**
	CSE02	0.389	-0.153	-0.088	-0.111	-0.066	-0.057	-0.069	-0.042	-0.108	-0.213	-0.196	-0.251	0.071	0.059	**0.927**
	CSE03	0.447	-0.010	-0.007	-0.022	0.000	-0.067	-0.073	-0.057	0.035	-0.066	-0.079	-0.065	0.161	0.177	**0.759**
	CSE04	0.551	-0.009	0.034	0.010	-0.022	-0.092	-0.113	-0.065	0.077	-0.023	-0.005	-0.038	0.264	0.226	**0.828**

Note: ITM = IT Mindfulness, BF = Better Functionalities, UF = Usefulness, EoU = Ease of Use, SA = Sanction, IC = Information Privacy Concerns, PIC = Private Information Privacy Concerns, BIC = Business Information Privacy Concerns, AT = Attitude, HA = Habit, SI = Social Influence, HM = Hedonic Motivation, FC = Facilitating Conditions, PV = Price Value, CSE = Computer Self-Efficacy

Inter-Factor-Correlations for Consumerization of Instant Messaging (square root of AVE in the diagonal)

	ITM	BF	UF	EoU	SA	IC	PIC	BIC	AT	HA	SI	HM	FC	PV	CSE
IT Mindfulness	0.820														
Better Functionalities	0.218	0.892													
Usefulness	0.303	0.613	0.905												
Ease of Use	0.114	0.674	0.616	0.910											
Sanction	0.079	0.087	0.008	-0.040	0.917										
Information Privacy Concerns	-0.212	-0.205	-0.337	-0.155	0.174	0.883									
Private Information Privacy Concerns	-0.188	-0.157	-0.271	-0.107	0.140	0.944	0.917								
Business Information Privacy Concerns	-0.214	-0.229	-0.364	-0.184	0.188	0.952	0.797	0.946							
Attitude	0.305	0.477	0.624	0.485	0.093	-0.421	-0.380	-0.417	0.947						
Habit	0.342	0.613	0.697	0.559	0.141	-0.318	-0.274	-0.328	0.726	0.889					
Social Influence	0.232	0.547	0.559	0.502	0.198	-0.157	-0.096	-0.198	0.641	0.694	0.951				
Hedonic Motivation	0.248	0.475	0.519	0.436	0.193	-0.232	-0.189	-0.249	0.566	0.672	0.546	0.951			
Facilitating Conditions	0.394	0.436	0.465	0.358	0.000	-0.330	-0.316	-0.309	0.514	0.433	0.371	0.356	0.808		
Price Value	0.401	0.405	0.407	0.323	-0.055	-0.233	-0.212	-0.229	0.377	0.366	0.230	0.362	0.635	0.937	
Computer-Self-Efficacy	0.540	-0.030	0.038	-0.037	-0.053	-0.169	-0.157	-0.162	-0.050	-0.108	-0.118	-0.140	0.293	0.208	0.819

Note: ITM = IT Mindfulness, BF = Better Functionalities, UF = Usefulness, EoU = Ease of Use, SA = Sanction, IC = Information Privacy Concerns, PIC = Private Information Privacy Concerns, BIC = Business Information Privacy Concerns, AT = Attitude, HA = Habit, SI = Social Influence, HM = Hedonic Motivation, FC = Facilitating Conditions, PV = Price Value, CSE = Computer Self-Efficacy

Inter-Factor-Correlations for Consumerization of File Sharing (square root of AVE in the diagonal)

	ITM	BF	UF	EoU	SA	IC	PIC	BIC	AT	HA	SI	HM	FC	PV	CSE
IT Mindfulness	0.818														
Better Functionalities	0.220	0.919													
Usefulness	0.307	0.676	0.930												
Ease of Use	0.169	0.740	0.649	0.937											
Sanction	0.090	0.130	0.083	0.088	0.916										
Information Privacy Concerns	-0.229	-0.333	-0.365	-0.233	0.168	0.899									
Private Information Privacy Concerns	-0.195	-0.275	-0.314	-0.186	0.141	0.955	0.926								
Business Information Privacy Concerns	-0.242	-0.360	-0.383	-0.259	0.180	0.960	0.835	0.951							
Attitude	0.341	0.568	0.691	0.541	0.083	-0.471	-0.424	-0.475	0.955						
Habit	0.318	0.706	0.724	0.588	0.153	-0.374	-0.315	-0.398	0.705	0.914					
Social Influence	0.247	0.616	0.577	0.578	0.211	-0.272	-0.205	-0.312	0.601	0.703	0.968				
Hedonic Motivation	0.272	0.586	0.562	0.490	0.185	-0.302	-0.259	-0.317	0.591	0.707	0.601	0.955			
Facilitating Conditions	0.385	0.545	0.544	0.517	0.142	-0.354	-0.351	-0.328	0.601	0.540	0.447	0.453	0.869		
Price Value	0.353	0.494	0.466	0.447	0.007	-0.291	-0.271	-0.286	0.435	0.449	0.305	0.434	0.658	0.963	
Computer-Self-Efficacy	0.501	-0.095	-0.045	-0.057	-0.051	-0.079	-0.086	-0.067	-0.025	-0.150	-0.146	-0.184	0.176	0.156	0.829

Note: ITM = IT Mindfulness, BF = Better Functionalities, UF = Usefulness, EoU = Ease of Use, SA = Sanction, IC = Information Privacy Concerns, PIC = Private Information Privacy Concerns, BIC = Business Information Privacy Concerns, AT = Attitude, HA = Habit, SI = Social Influence, HM = Hedonic Motivation, FC = Facilitating Conditions, PV = Price Value, CSE = Computer Self-Efficacy

Heterotrait-Monotrait Ratios for Consumerization of Instant Messaging

	ITM	BF	UF	EoU	SA	IC	PIC	BIC	AT	HA	SI	HM	FC	PV	CSE
IT Mindfulness															
Better Functionalities	0.223														
Usefulness	0.320	0.663													
Ease of Use	0.115	0.711	0.675												
Sanction	0.092	0.082	0.052	0.059											
Information Privacy Concerns	0.222	0.215	0.367	0.165	0.183										
Private Information Privacy Concerns	0.204	0.169	0.302	0.116	0.148	1.024									
Business Information Privacy Concerns	0.221	0.241	0.398	0.198	0.202	1.007	0.863								
Attitude	0.307	0.492	0.668	0.506	0.089	0.438	0.404	0.434							
Habit	0.227	0.465	0.554	0.473	0.025	0.320	0.301	0.313	0.715						
Social Influence	0.365	0.670	0.786	0.621	0.158	0.346	0.303	0.358	0.785	0.725					
Hedonic Motivation	0.233	0.575	0.608	0.534	0.196	0.166	0.104	0.211	0.666	0.554	0.767				
Facilitating Conditions	0.253	0.499	0.565	0.464	0.196	0.245	0.204	0.263	0.588	0.433	0.743	0.577			
Price Value	0.455	0.478	0.524	0.398	0.069	0.369	0.365	0.343	0.555	0.422	0.481	0.396	0.380		
Computer-Self-Efficacy	0.423	0.429	0.446	0.345	0.063	0.250	0.233	0.245	0.394	0.291	0.398	0.243	0.384	0.733	

Note: ITM = IT Mindfulness, BF = Better Functionalities, UF = Usefulness, EoU = Ease of Use, SA = Sanction, IC = Information Privacy Concerns, PIC = Private Information Privacy Concerns, BIC = Business Information Privacy Concerns, AT = Attitude, HA = Habit, SI = Social Influence, HM = Hedonic Motivation, FC = Facilitating Conditions, PV = Price Value, CSE = Computer Self-Efficacy

Heterotrait-Monotrait Ratios for Consumerization of File Sharing

	ITM	BF	UF	EoU	SA	IC	PIC	BIC	AT	HA	SI	HM	FC	PV	CSE
IT Mindfulness															
Better Functionalities	0.209														
Usefulness	0.306	0.714													
Ease of Use	0.159	0.769	0.691												
Sanction	0.092	0.124	0.084	0.092											
Information Privacy Concerns	0.232	0.346	0.388	0.243	0.181										
Private Information Privacy Concerns	0.208	0.292	0.341	0.197	0.151	1.024									
Business Information Privacy Concerns	0.241	0.376	0.409	0.272	0.199	1.010	0.896								
Attitude	0.335	0.582	0.726	0.558	0.079	0.486	0.447	0.492							
Habit	0.196	0.560	0.632	0.525	0.076	0.283	0.273	0.274	0.701						
Social Influence	0.312	0.755	0.793	0.633	0.155	0.400	0.344	0.429	0.748	0.740					
Hedonic Motivation	0.232	0.637	0.612	0.603	0.209	0.282	0.218	0.326	0.617	0.534	0.755				
Facilitating Conditions	0.258	0.610	0.600	0.514	0.186	0.317	0.278	0.334	0.612	0.562	0.764	0.627			
Price Value	0.414	0.569	0.579	0.550	0.156	0.377	0.385	0.345	0.626	0.447	0.579	0.462	0.470		
Computer-Self-Efficacy	0.366	0.511	0.495	0.466	0.033	0.304	0.289	0.299	0.448	0.329	0.480	0.317	0.453	0.714	

Note: ITM = IT Mindfulness, BF = Better Functionalities, UF = Usefulness, EoU = Ease of Use, SA = Sanction, IC = Information Privacy Concerns, PIC = Private Information Privacy Concerns, BIC = Business Information Privacy Concerns, AT = Attitude, HA = Habit, SI = Social Influence, HM = Hedonic Motivation, FC = Facilitating Conditions, PV = Price Value, CSE = Computer Self-Efficacy

Appendix 2.2/D – Test for Common Method Variance

We tested for CMV by applying the correlational marker technique as post hoc detection method (Lindell and Whitney 2001; Richardson et al. 2009). First, we partialled out the smallest shared variance in bivariate correlations among substantive exogenous latent variables. This did not affect significance of any bivariate correlation among the variables. Second, we implemented the correlational marker technique with a theoretically unrelated marker variable (Lindell and Whitney 2001; Richardson et al. 2009). The correlation observed between the marker variable and the theoretically unrelated variable is interpreted as an estimate of CMV (Lindell and Whitney 2001). The maximum shared variance of the marker variable with other latent variables is only 10.9% for the instant messaging model and 16.3% for the file sharing model. Again, partialling out the smallest shared variance between the marker and the substantive exogenous variables resulted in no substantial changes in significance of bivariate correlations. In summary, we do not find hints towards an issue with CMV and, thus, assume that CMV is less of a concern in this study.

Appendix 2.2/E – Empirical Results for Control Variables

	Instant Messaging	**File Sharing**
Habit → Use	0.405 ***	0.424 ***
Social Influence → Use	0.039	-0.040
Hedonic Motivation → Use	-0.120	0.028
Facilitating Conditions → Use	0.059	0.031
Price Value → Use	-0.031	-0.038
Computer-Self-Efficacy → Use	-0.057	-0.105

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Appendix 2.2/F – Explained Variance in the Structural Equation Models

	Instant Messaging		**File Sharing**	
	R^2	R^2 Adj.	R^2	R^2 Adj.
Better Functionalities of Private IT Service	0.047	0.043	0.048	0.044
Relative Usefulness of IT Service Cons.	0.451	0.446	0.506	0.501
Relative Ease of Use of IT Service Cons.	0.454	0.452	0.548	0.546
Attitude towards IT Service Cons.	0.481	0.472	0.553	0.545
IT Service Cons. Use Behavior	0.583	0.565	0.594	0.576

3. Use Processes of Communication and Collaboration Technology for Work Purposes

3.1. Emergent User Roles of a Digital Workplace: A Network Analysis Based on Trace Data

Abstract

Communication and collaboration software for knowledge workers are introduced with high expectations, especially in knowledge-intense industries. While advantages of such tools are well documented in theory, many initiatives have yet to achieve the desired outcomes in practice. Research has dealt with roles in the digital workplace and found that one-size-fits-all solutions are not suitable. However, for a lack of real-world data the matter is still not sufficiently understood. To close this gap, we conduct a sequential mixed-method study. We perform an exploratory analysis based on trace data within a service organization and reconstruct its social structure. Through a cluster analysis, eight distinct emergent user roles are identified. Additionally, we analyze covariates of cluster membership, such as organizational hierarchy, through statistical testing. Lastly, semi-structured interviews help to explain our findings qualitatively. We contribute to research and practice by deepening the understanding of heterogeneous user behavior in a digital workplace.

Keywords: digital workplace, social software, digital trace data, social structure, social network analysis, emergent user roles, communication channel, collaboration platform

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3.1.1. Introduction

The tertiary and quaternary (knowledge-intense) sectors of the economy have long been on the rise and with it, the number of knowledge-intense jobs (Kenessey 1987). Many jobs in modern organizations, especially in the western world, require extensive amounts of knowledge work (Kane et al. 2012). In recent years, digitalization has brought forward many software tools to support communication and collaboration between knowledge workers. This development has lead the digital workplace to grow continuously, particularly with new additions such as social collaboration platforms, enterprise social networks (ESN), or new communication tools like instant messaging (Gotta et al. 2015). Consequently, these market trends have prompted the development of new comprehensive software solutions (Gotta et al. 2015; Pawlowski et al. 2014). These tools have introduced many new functionalities to the digital workplace with goals such as increasing knowledge distribution beyond formal communication lines (Alavi and Leidner 2001), mediating communication and collaboration in distributed work environments (Seebach et al. 2011), helping blur organizational boundaries (Pawlowski et al. 2014), and ultimately increasing the productivity of knowledge workers (Kane et al. 2012; Köffer 2015). While companies are implementing these software solutions with great expectations, researchers and practitioners often report that adoption, usage, and impact are not yet fully understood (e.g., Berger et al. 2014; Herzog et al. 2015; Kiron et al. 2013; Kügler et al. 2012). Existing academic literature found that *one size fits* all solutions are inappropriate to address the heterogeneous job requirements and user behaviors of the digital workplace (Köffer 2015; Maruping and Magni 2015). Therefore, there is growing interest in evaluating social software initiatives in order to understand (1) why some users are adopting communication and collaboration tools and others are not, (2) which features are used by different user groups, and (3) which users create and distribute information within the organization. As a first step to better understand this heterogeneous usage behavior of knowledge workers within the digital workplace, an integrated analysis of both communication and collaboration technology is vital. While several studies exist which have brought forward first contributions regarding this issue, researchers frequently note that for privacy reasons, findings based on real-world data are scarce (e.g., Pawlowski et al. 2014; Wang and Noe 2010).

Therefore, the aim of this paper is to derive a user typology from the informal social structure of a digital communication and collaboration environment in an organization,

in order to understand the heterogeneous user behavior as well as the emergent roles that knowledge workers take on, and to investigate why they do so. The latter is necessary to draw specific inferences regarding theory and practice. To approach this goal, we conduct a mixed-method study (Venkatesh et al. 2013): We start by deriving the social structure of an organization that provides knowledge-intense services from a digital trace data set, i.e., data on user activity recorded by an information system (Howison et al. 2011). We do so with the tools of social network analysis (SNA) which serves as the basis of all further analyses. Subsequently, we use a cluster analysis to explore various interaction types regarding the heterogeneous behavior of users. We then evaluate explanatory variables from metadata about the users through statistical testing in order to detect covariates of cluster membership. Lastly, we conduct semi-structured interviews with a theoretical sample of users informed by our previous findings to verify and better interpret our empirical results.

This study provides the following contributions: First, we identify eight distinct user roles of the digital workplace for knowledge workers from our real-world data set and explain their characteristics. Second, we find that several of the identified user roles show a strong relationship with the organizational hierarchy. Third, we categorize multiple other user roles as task-specific and report insights about them derived from the user interviews. This suggests that knowledge-sharing can be an in-role behavior for certain types of employees (Wang and Noe 2010). Fourth, we discuss how the identified user roles relate to the existing scientific body of knowledge, such as the organizational knowledge creation theory (Nonaka et al. 2006). Fifth, we discuss practical implications for the digital workplace that have previously been derived from the literature and discuss how our approach can help with addressing them.

The remainder of this paper is structured as follows: Section 2 gives an overview of the elements of a digital workplace for knowledge workers and reviews the existing literature regarding user roles of knowledge workers. Section 3 explains our mixed-method approach and its components. Section 4 contains the results of the study. We then proceed to discuss the contributions derived from these results in Section 5. Lastly, Section 6 assesses our study critically regarding its limitations and concludes the paper.

3.1.2. Problem Context and Literature Review

3.1.2.1. Knowledge Creation and Social Structures

According to the knowledge-based theory of the firm, knowledge is the primary resource of an organization (Grant 1996) and a superior knowledge base increases the value of an organization and its performance (Kogut 2000). Yet, despite the importance of knowledge, organizations often do not know what they know, because their body of knowledge is comprised of the knowledge of individual employees as well as shared knowledge resulting from social interactions within the organization (Alavi and Leidner 2001). The fact that knowledge is mostly owned by employees places great emphasis on knowledge application and the role of the individual (Grant 1996). For knowledge workers, it is critical to know how and from whom to obtain the valuable information required to do their jobs (Cross et al. 2002). Congruent with that, a trend towards networked organizations and an emphasis on social networks of employees is noticeable. The social interactions inherent in such networks are a manifestation of the structural dimension of social capital and are related to the extent of resource exchange within an organization (Tsai and Ghoshal 1998). It is well studied that social contacts help the members of intrafirm networks to maintain and extend their social capital within the organization (Steinfield et al. 2008). Communication and collaboration tools of the digital workplace can foster interactions, in particular between employees who are on different hierarchical levels (Behrendt et al. 2015), or who have no formal social relations between one another (Faraj et al. 2011; Kane et al. 2014). This in turn helps employees to increase their access to the network and to gain social capital. Therefore, and to study organizational networks, an investigation of the implicit social structure that emerges from those interactions between the users of the digital workplace seems promising. While this is an important step towards understanding an organization's knowledge capability, little empirical research exists in that area (Richter et al. 2010). In relation to the implicit social structure, the existence of emergent roles is a particularly interesting topic in order to improve the understanding of user behavior. Emergent roles are roles that users take on implicitly and as a result of their interactions with others. In self-organizing collaboration communities such as Wikipedia, emergent roles are a cornerstone of the knowledge-creation process (Arazy et al. 2016). However, it remains unclear whether these emergent roles can also be observed for organizational settings.

3.1.2.2. The Digital Workplace for Knowledge Workers

Many jobs in modern organizations require extensive amounts of knowledge work (Kane et al. 2012). Thus, we are particularly interested in the digital workplace of the so-called knowledge workers. Knowledge workers are characterized as employees who "think for a living" (Davenport 2005) and turn "complex information […] into knowledge" (Davenport 2005). Davenport (2005) further sharpens the definition of knowledge workers, as people that "have 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). Köffer (2015, p2) introduced the digital workplace based on C. Tubb as "the collection of all digital tools provided by an organization to allow employees to do their jobs". As a first step to investigating the digital workplace for knowledge workers, it is important to understand and define the different software tools available to them. Generally speaking, there are software tools which are driven by structured and reproducible business processes rather than human interactions (van der Aalst et al. 2011), and those which foster open digital interactions between employees (Wang and Noe 2010). Examples for process-driven tools are enterprise resource planning or workflow management systems. These systems are not well-suited for the identification of an implicit social structure between employees because they follow pre-defined processes and often do not leave room for spontaneous personal interactions. Without the set perimeters of pre-defined business processes, however, an implicit social structure can emerge freely. We classify such software tools congruently with McAfee (2006) as communication channels and collaboration platforms. Communication channels include peer to peer communication tools, such as email or instant messaging, and cannot be accessed or searched by others (McAfee 2006). Collaboration platforms, such as content management systems, wikis, and blogs, by comparison, are accessible to many or all employees within the organization and the knowledge stored in them is persistent (McAfee 2006). Both of those systems foster digital interactions between employees, and therefore represent how people go about their daily business and who they interact with digitally.

3.1.2.3. Related Work on User Roles

Recently, the existence and formation of emergent roles of knowledge workers has caught the interest of researchers. Multiple current studies have identified communication and

collaboration use cases including *Broadcasting, Dialog, Collaboration, Knowledge Management,* and *Sociability* (Schlagwein and Hu 2016; Schubert and Glitsch 2016). While these use cases provide a detailed outline of the functionality and capabilities of such a software environment, the authors do not attribute the use cases to specific user roles. Regarding email communication, there are a number of studies that have looked into network structures (e.g. Bird et al. 2006; Kane et al. 2012; van Alstyne and Zhang 2003), but surprisingly little research has addressed user roles. Among the notable exceptions are Alavi and Leidner (2001), who defined that in a digital environment, knowledge flows from a *Provider* to a *Seeker,* and that balancing the two is desirable. Muller et al. (2010) used real-world data to investigate the consuming behaviors of *Uploaders, Contributors,* and *Lurkers* within an enterprise file-sharing system. Reinhardt et al. (2011) created a general typology of knowledge worker roles based on a literature review. Subsequently, they verified the existence of *Controllers, Helpers, Learners, Linkers, Networkers, Organizers, Retrievers, Sharers, Solvers,* and *Trackers* through a laboratory task execution study. Their paper provides a comprehensive overview of knowledge worker roles and their behaviors, but lacks a validation based on real-world data. In contrast to that, other authors have looked at real-world data of ESN to investigate the influence of formal hierarchy on user behavior (Behrendt et al. 2015; Riemer et al. 2015). Behrendt et al. (2015) found that in ESN, the hierarchy seems to have an influence on user behavior. Riemer et al. (2015), on the other hand, found that while hierarchy has a low influence on the likelihood of responses from the network, the users' own contributions are far more important. Those findings further substantiate the relevance of informal social structures in the context of ESN. However, it remains unclear how significant the influence of formal hierarchy on emergent roles is. A study by Arazy et al. (2016) employed a SNA to identify seven emergent roles within the self-organizing collaboration platform Wikipedia. In their study, they found *All-round Contributors, Quick-and-Dirty Editors, Copy Editors, Content Shapers, Layout Shapers, Watchdogs,* and *Vandals.* A similar exploratory study by Füller et al. (2014) investigates the heterogeneous user behavior and the social structure of a collaborative open-innovation-contest community based on real-world data. In their study, they found six distinct user roles*: Socializers, (active and passive) Idea-Generators, Masters, Efficient Contributors,* and *Passive Commentators.* While their research approach is conducive to our goal of identifying user roles in a digital workplace, it is questionable whether their results can be directly transferred to the organizational context.

In summation, several researchers have previously dealt with user roles in the context of digital communication or collaboration, both within and outside of organizations. Their approaches cover a number of different software systems and reveal a number of domain-specific emergent roles. However, those studies have yet to combine both the communication and collaboration structures of a digital workplace. Additionally, to the best of our knowledge, an area that has yet to be addressed is the investigation into user behaviors in conjunction with reasons explaining why users behave the way they do or perform a certain informal role – especially in the presence of formal roles.

3.1.3. Empirical Study

To address the identified research gap, we use a mixed-method approach (Venkatesh et al. 2013), which combines aspects of previous studies by identifying user roles in an exploratory fashion, analyzing potential influencing factors quantitatively, and interviewing users qualitatively to better understand the reasons for why employees act the way they do.

3.1.3.1. Research Setting and Data Set

Our exploratory study is based on digital trace data from a service organization that provides knowledge-intense services to corporate and individual customers. This organization is well-suited for this study for multiple reasons. First, it has two different locations with distributed teams consisting of employees from both locations. Therefore, it relies heavily on a distributed and digitally enabled work environment. Second, the organization uses the standard software Microsoft Office 365 with its social collaboration component SharePoint and the communication system Exchange. In that regard, the platform resembles a significant part of the communication and collaboration technology used in many companies today (Gotta et al. 2015). Third, the organization almost exclusively employs knowledge workers. While this organization is well-suited for our research goal, we do acknowledge that studying a single organization bears limitations on the inferences that can be drawn from our study. Further, we acknowledge the limitation of only analyzing the most dominant digital collaboration and communication system in the organization, while for example omitting interactions through phone calls or personal contact for a lack of trace data.

The organization has multiple specialized departments which are responsible for the provision of the organization's external service offerings, and support functions that provide

internal shared services, such as Finance or Human Resources (HR) to all departments. Each full-time employee is a member of exactly one department and one or multiple support functions. For the purpose of our research, we were provided with digital trace data for a period of six weeks across the months of March to May 2016. At the time, the organization had a total of 146 registered employees who are users of the digital workplace. Amongst the 146 users were 6 Heads of Departments, 6 Heads of Support Functions, 8 Assistants to the Heads of Departments, 35 Full-time Employees and 91 Part-time Employees. Part-time employees have variable working hours, generally with about 10 hours per week. Almost all users can be counted towards the knowledge worker category, as they mainly have high degrees of education and work experience in professions like management, business and financial services, or computer sciences (Davenport 2005).

For our study, the digital trace data was pseudonymized by the organization's system administrator to address privacy concerns (Herzog et al. 2015; Köffer 2015; Pawlowski et al. 2014; Wang and Noe 2010). This ensures the identification of communication and collaboration patterns but prevents the researchers from knowing about the content, or from identifying individual employees (van Alstyne and Zhang 2003). Both the Exchange and SharePoint logs contain only internal communication and collaboration, but do not include recipients or users outside of the organization. To identify characteristics of users, who perform a certain role, we were provided with the user-specific binary attributes *gender, site* (differentiating between the company's two sites), and *length of employment* (split into "long" and "short" according to the median), as well as the *position in the organizational hierarchy* (distinguishing between five hierarchical levels). The selection of the attributes and their granularity was chosen in such a way, that each combination of attributes matched multiple (or no) employees of the organization, but never a single one.

3.1.3.2. Social Network Analysis and Interaction Patterns

We use the tools of SNA as a basis to study the heterogeneous user behaviors and derive different user roles from the resulting social structure. SNA is ideally suited to study the actors of a given social system (Wasserman and Faust 1994) and has been used in social sciences for many decades (Borgatti et al. 2009). With metrics drawn from the social structure, actors can be distinguished, potentially resulting in new insights into user roles (Arazy et al. 2016; Füller et al. 2014). The foundation of many SNA concepts, such as

centrality and other actor-related measures, is graph theory (e.g., Füller et al. 2014; Wasserman and Faust 1994). The relational structure of a social system consists of patterns of relationships among the actors of the system. Network data is fundamentally dyadic, meaning that ties are observed for a set of two actors at a time (Borgatti and Foster 2003). The sum of those actors and the ties amongst them form a social network (Wasserman and Faust 1994). Such an approach focuses on the patterns of interconnection but tends to neglect the content of the network ties between the actors (Borgatti et al. 2009). It is based on the idea that an actor's position in a network influences their opportunities and constraints (Kane et al. 2014). This approach is conducive to our pseudonymized data set which contains communication and collaboration patterns but not their contents.

SNA typically considers one or more of the following basic tie types: proximity (co-membership in groups, such as departments), relations (social relationships, such as friendship), interactions (discrete exchanges between nodes, such as a conversation), and flows (tangible or intangible material that moves from one node to another, such as information) (Borgatti et al. 2009; Kane et al. 2014). While flows are important, because "information flows drive knowledge transfer in organizations" (Alavi and Leidner 2001), they are often difficult to measure. Consequently, and congruent with previous IS research regarding IT platforms and channels, we focus primarily on interactions (Kane et al. 2014). To understand the differences between our two IT systems, it is important to differentiate between the channel, which "pushes" information, and the platform, which requires users to "pull" information. For the push-medium email communication (i.e., Exchange), the sender initiates an interaction by sending an email. For the pull-medium content collaboration (i.e., SharePoint), however, the sender provides content to the IT system and the retriever accesses this content, resulting in an interaction.

The application of SNA in IS has long focused on single links, which contrasts multiplex approaches common in the social sciences (Howison et al. 2011). In our case, interactions can cover several distinct forms of communication or collaboration between two users. We define the following four possible dyadic interaction patterns that can be observed within the given data set, as presented in Figure 3.1-1:

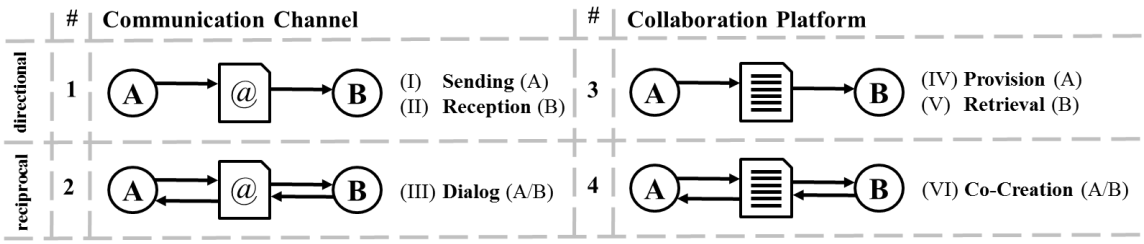

Figure 3.1-1: Interaction Patterns

Content co-creation and email dialog, as defined in this work, are by definition reciprocal and thus do not have a direction. The other two interaction types are directional, however. The strength of a tie is determined by the frequency or depth of a connection, which can be determined by interaction data (Kane et al. 2014). In our study, the strength of an interaction tie is defined by the number of different files and email subjects that two actors interact on.

In order for the observed interaction types to be transferred into input parameters for our cluster analysis, measures of contribution for the individual users need to be defined. There are several actor-based (egocentric) structural features that can be measured for a network which are commonly referred to as centrality of an actor (Füller et al. 2014; Kane et al. 2014; Wasserman and Faust 1994). Those concepts are related to the importance, prominence, and visibility of an actor within a network. For the purpose of our study, we focus on degree centrality as a measure of activity (Wasserman and Faust 1994) and for greater access to network flows, such as information disseminated through interactions (Kane et al. 2014).

3.1.4. Analysis and Results

3.1.4.1. User Typology

To construct a social network from the log files, the defined interaction patterns were first mined from our digital trace data set. We find that the average number of colleagues a user is connected to through content collaboration is substantially lower than via email communication (10.6 and 8.9 for collaboration vs. 55.7 and 78.3 for communication). A deeper examination of the ties' intensity, which refers to the number of files or email subjects they have interacted on, reveals that users, who are connected, have on average approximately four bilateral and five unilateral communication ties (i.e., communicate on four email subjects in a discussion and on five subjects one-sidedly), but only three collaboration ties (i.e., collaborate on three files). In the social network, the overall number

of interactions (weighted with their intensity) for the two directions of unilateral network ties (email sending/reception and content provision/retrieval, respectively) is identical, and therefore, the means are too. Median and standard deviation can differ depending on the directionality. For example, a single user can send emails to multiple recipients, which results in a more even distribution for email reception than for email sending. The mean number of sending and reception ties, however, stays the same. The descriptive statistics on the frequency of interactions (Table 3.1-1) show that more users are connected through communication ties (means of 271 and 297.4) than through collaboration ties (means of 33.2 and 23.2). The heterogeneous standard deviations substantiate the assumption that users behave differently from one another. A large standard deviation for the email sending measure (327.5 compared to 185.2 for email reception), for example, suggests that a limited number of users are responsible for the majority of the unilateral communication. However, due to the skewness of some of the data, the standard deviation has to be taken with a grain of salt.

	Variable	Mean	Median	SD	Skewness
I	Email Sending	271.0	170.0	327.5	3.70
II	Email Reception	271.0	212.0	185.2	1.35
III	Email Dialog	297.4	226.5	238.2	1.87
IV	Content Provision	33.2	18.5	47.3	3.41
V	Content Retrieval	33.2	22.5	43.2	4.17
VI	Content Co-Creation	23.2	11.0	29.3	2.27

Observations: n = 146 , SD = standard deviation

Table 3.1-1: Descriptive Statistics on the Frequency of Interactions

We used the interaction types to capture each user's communication and collaboration behavior as input variables for an exploratory cluster analysis aimed at identifying the distinct user types inherent in the social structure of our network. To do that, we first checked if both the measures for the unweighted graph, which records whether or not any tie exists between two users as a binary measure, and the weighted graph, which includes the strength of every tie, present a potential source of heterogeneity. We found that the spearman rank correlation coefficients between the unweighted and weighted means resides between 0.88 and 0.98, depending on the type of interaction. Therefore, we decided to only use the weighted graphs, because they contain more information and their interpretation regarding the usage patterns is more straight-forward, as it represents the extent to which the users use the interactions and not just the number of colleagues they are connected to.

For our cluster analysis, we used an agglomerative hierarchical procedure with the Ward.D2 minimum variance method and the Euclidian distance. Hierarchical clustering usually works well (Füller et al. 2014), is reproducible, and does not need the desired number of clusters, or their size, as an input parameter, which is conducive to our exploratory approach. Also, users that have been added to one cluster will remain in that cluster even if the cluster solution is changed, which helps with the process of determining the appropriate number of clusters. To eliminate outliers, we censored all values above the respective 98% quantiles.

"There is no universal definition for a good clustering size, [rather] the evaluation remains mostly in the eye of the beholder" (Bonner 1964; Rokach and Maimon 2005, p. 326). Several different stopping rules (Milligan and Cooper 1985) were employed, but yielded inconclusive results. We found that for eight clusters, the results are well interpretable. A lower cluster size joined multiple clearly distinct user groups, whereas more clusters resulted in very small cluster sizes with clusters that may be regarded as outliers rather than distinct user groups.

From our cluster analysis, we conclude the following typology: of the eight distinct user types, there are three that use both the communication channel and the collaboration platform roughly to the same extent. These clusters are labeled All-rounders with low, mid, and high activity. Four of the clusters are labeled according to a peak in one or more of six clustering dimensions. Two user types with peaks in communication interactions (Email heavy-users and broadcasters) were observed and two user types with peaks in collaboration interactions (Content co-creators and providers). Lastly, a user group that remains largely passive on both systems was identified. An overview of all clusters is provided in

		Interaction Types											
		Communication Channel						Collaboration Platform					
		Reception		**Sending**		**Dialog**		**Retrieval**		**Provision**		**Co-Creation**	
User Role	#	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD	**Mean**	SD
All-rounder High-A.	9	**0.67**	0.11	**0.58**	0.14	**0.78**	0.20	**0.61**	0.23	**0.44**	0.21	**0.52**	0.13
All-rounder Mid-A.	16	**0.55**	0.16	**0.36**	0.13	**0.42**	0.13	**0.26**	0.10	**0.22**	0.10	**0.35**	0.12
All-rounder Low-A.	33	**0.30**	0.13	**0.20**	0.10	**0.28**	0.12	**0.19**	0.16	**0.13**	0.09	**0.14**	0.10
Email Heavy-User	8	**0.86**	0.13	**0.75**	0.15	**0.75**	0.15	**0.20**	0.07	**0.12**	0.07	**0.32**	0.27
Email Broadcaster	7	**0.31**	0.15	**0.89**	0.12	**0.53**	0.17	**0.11**	0.08	**0.15**	0.11	**0.07**	0.06
Content Co-Creator	11	**0.56**	0.16	**0.50**	0.15	**0.44**	0.11	**0.55**	0.14	**0.51**	0.21	**0.80**	0.20
Content Provider	8	**0.29**	0.07	**0.20**	0.07	**0.25**	0.07	**0.47**	0.35	**0.77**	0.24	**0.32**	0.13
Passive User	54	**0.17**	0.07	**0.08**	0.07	**0.13**	0.05	**0.06**	0.05	**0.03**	0.04	**0.04**	0.04

Table 3.1-2: User Typology with Corresponding Means and Standard Deviations (SD) of the Different Interaction Types

A nine cluster solution would have split Content Providers into two, creating a user group of two individuals that not only provide content, but also heavily retrieve content. As mentioned above, this group was omitted for its small size and because the characteristic attributes of Content Providers are still present in this ninth cluster. This is apparent in the data as part of the relatively high standard deviation of 0.35 in Content Retrieval of the Content Providers. A seven cluster solution, on the other hand, would have joined Content Co-Creators and All-rounders High-Activity that considerably differ in content co-creation and email dialog.

The *All-rounder High-Activity* (6.16% of 146 users) is characterized by fairly high email interactions, which suggests that this user type communicates heavily in a digital way, especially through email dialogs. A mean of 0.78 for email dialogs states that, on average, this user type has 78% of the interactions of the most active user in the network. This user type is also fairly active on the collaboration platform (1st to 3rd highest, depending on the interaction type), where they provide and retrieve content, in addition to co-creating content with their colleagues.

The *All-rounder Mid-Activity* (10.96%) is less active than its high-activity equivalent. While their number of received emails is comparable to those of an All-rounder High-Activity, they engage significantly less in reciprocal communication, as measured by the number of email dialogs.

The *All-rounder Low-Activity* (22.60%) forms the second largest cluster. This user type is considerably less active (2nd to 3rd last in all interaction types) than the formerly mentioned All-rounder types.

The *Email Heavy-User* (5.48%) engages much more heavily in email communication than in any collaborative activities. The peak in received emails is also substantial, which according to Wasserman and Faust (1994) is an indicator for a prestigious user. If this user type engages in any collaboration activity, it's mainly through co-creation of content with other users. Very rarely does this user type provide content that other users access.

The *Email Broadcaster* (4.79%) has a strong peak in outgoing email communication (most) but receives comparably little amounts of emails. However, this user type also has a fairly large amount of email dialog interactions (3rd most), likely as a result of the high number of sent emails.

The *Content Co-Creator* (7.53%) uses the collaboration platform and the communication channel fairly heavily but has a substantial peak in content co-creation (most). This indicates that the user type collaborates heavily with other users in order to create tangible content.

The *Content Provider* (5.48%) is fairly active with regards to collaboration interactions and has a significant peak in content provision. This indicates that this user type creates tangible content that other users access frequently. The communication interactions, however, are sparse (2nd lowest) for this user type.

Finally, the *Passive User* group makes up for the majority of the users (36.99%). This user type has the lowest values across all interaction types and therefore does not participate particularly actively through digital communication or collaboration within the organization.

3.1.4.2. Covariates of Role Membership

To investigate the association between our categorical explanatory variables and the eight user types, we first examine the contingency tables illustrating the relative frequency distributions (Agresti 2007). We then apply a chi-squared-test for independence to determine whether there is a significant difference between the expected and observed frequencies. To deal with small cell values for rare user types, we simulate the associated p-values through a Monte Carlo Simulation (Adery 1968). First, we study the relationship of the identified user roles and the organizational hierarchy. Organizational hierarchy is a factor that has been mentioned frequently in literature regarding user behavior in the context of digital communication (Behrendt et al. 2015; Riemer et al. 2015). We observe a strong relation between the identified user roles and the position in the organizational hierarchy (Table 3.1-3). The association between the two variables is highly significant ($p<0.01$) with a chi-squared test statistic of $X^2 = 184.81$. We find that Heads of Departments and Heads of Support Functions tend to be heavy email-users, as observed in 50% of the cases. These users communicate heavily via email but tend to use the collaboration platform to a substantially lesser extent. Assistants to a Head of the Department, conversely, mainly belong to the *All-rounder High-Activity* category. This user type is similarly involved in email communication than heavy email-users, but also engages heavily in collaborative activity, resulting in a more balanced usage of the collaboration platform and the communication channel. The full-time employees who don't hold a leadership role,

are widely spread across the different user types, with a peak at *Content Co-Creators* and A*ll-rounders of Low- and Mid-Activity*. This shows that in our study regular full-time employees are generally less involved in email communication than their superiors. However, about one third of the full-time employees are heavily involved in collaborative activities, in particular content co-creation with other colleagues. This is an observation that will be subject to further qualitative investigation in the following section. Part-time employees are mostly *Passive Users*. This user type receives more emails than it sends and has a very low engagement on the collaboration platform. The rest of the part-time employees are mainly *All-rounders of Low-Activity*.

	Organizational Hierarchy					
User Role	**Head of Department**	**Head of Support F.**	**Assistant to H. of Dept.**	**Full-time Employee**	**Part-time Employee**	# of people
All-rounder High-Activity		17%	**63%**	9%		9
All-rounder Mid-Activity	17%	33%	25%	23%	3%	16
All-rounder Low-Activity	17%			17%	29%	33
Email Heavy-User	**50%**	**50%**	13%	3%		8
Email Broadcaster	17%			9%	3%	7
Content Co-Creator				**31%**		11
Content Provider				3%	8%	8
Passive User				6%	**57%**	54
# of people	6 (100%)	6 (100%)	8 (100%)	35 (100%)	91 (100%)	146

Table 3.1-3: Contingency Table for User Role and Organizational Hierarchy

In general, the organizational hierarchy does not fully explain all user types, but the different hierarchical levels show (more or less) clear tendencies towards a specific user type. To get a better picture of the factors related to the cluster membership, we proceed to analyze three additional potential covariates. First, regarding the organization's two different *sites*, we find a significant difference to the expected frequencies across all roles ($p<0.10$). According to a column-wise chi-squared test for goodness-of-fit, this is mainly due to the clusters All-rounder High and Mid-Activity, as well as due to the Email Broadcaster and Content Provider. For All-rounders High-Activity, the cause may be a higher number of Assistants to Head of Departments that are located at site A - the organization's oldest branch. Broadcasting and Content Provision activities might possibly be related to a high number of shared services, which are located at site A. Second, we examine the association between *gender* and emergent roles and do not find significant differences

across our clusters (p=0.58). Previous studies regarding knowledge management have found significant influence of gender diversity on knowledge sharing (Wang and Noe 2010). Third, regarding the *length of employment* we find a highly significant association (p<0.01). We observe that Email Heavy-Users and All-rounders of High and Mid-Activity are more likely to have been with the company for a long time, while passive users have been with the company for only a short time significantly more often. However, both of those observations are correlated with the organizational hierarchy, as superiors tend to have been a part of the organization for a longer period of time than part-time employees in this organization.

3.1.4.3. User Interviews

We follow up on the quantitative results through qualitative user interviews as part of our mixed-method approach to qualitatively confirm the quantitative results (Venkatesh et al. 2013). To do so, we conduct *semi-structured face-to-face interviews* with members of the organization (Myers and Newman 2007). The nine interviewees are selected based on *theoretical sampling* informed by the insights gained from our previous findings (Anderson 2010; Glaser and Strauss 2009). Because of the pseudonymized data, it is not possible to select interviewees based on their emergent role. However, due to the strong correlation between the organizational hierarchy and the identified user types, we are able to use the users' organizational positions to determine appropriate interview partners. Therefore, we select three part-time employees (A, B, C), three full-time employees (D, E, F), an Assistant to a Head of Department (G), a Head of Support Function (H), and a Head of Department (I). Similar to Behrendt et al. (2015), who used a mixed-methods approach to investigate an ESN in a medical context, we defined the following two stages for the qualitative part of our study: Intended behavior and use cases of interaction types (Interview Stage 1), and addressing the findings of the quantitative section to allow for confirmation, rejection, and explanation (Interview Stage 2). All interviews were conducted, recorded, and transcribed by the authors of this paper. The transcripts were then coded iteratively to identify categories of repeated answers that address the overarching questions of the two interview stages mentioned above.

Intended Behavior and Use Cases

In the first stage, we intend to learn more about why the interviewees use the communication channel and collaboration platform respectively, and why they engage in the respective identified interaction types. In general, email communication is used for coordination, information sharing, or to document decisions in written form particularly with other employees who are not physically available. Email dialog is mainly used for coordination and status updates, while unanswered emails are for announcements, triggers or simply to inform somebody about something – for example through a copy of an email.

The collaboration platform, on the other hand, is used to co-create and archive knowledge, to make content accessible to a larger audience, and to look for and find information. For content co-creation, people frequently mentioned use-cases, which require intensive teamwork. In addition to co-creating content, they also mentioned receiving input or detailed in-text feedback through that kind of interaction. It was frequently mentioned that content stored on the platform is persistent, durable, and save. Additionally, administrative tasks such as shared lists, instructions and tutorials were mentioned. Content retrieval is used to access (or provide) input for knowledge creation, informational lists, meeting minutes, and other protocols. Overall, this shows that users are making conscious decisions about when they use which software. It also confirms that our defined interaction types are indeed recording heterogeneous behavior and that the patterns capture distinct information.

When asked about the most important influencing factors for why somebody would use communication channels or collaboration platforms more or less intensely, the interviewees almost unanimously confirmed the position in the hierarchy to be of relevance, and also mentioned the nature of the individual tasks. Interviewee H stated: “You have to view it in the context of the task. [A part-time employee] has vastly different communication requirements than an Assistant to the Head of Department, who has to coordinate important strategic issues with multiple stakeholders”. Experience with the software systems, as well as personal preference and IT skills were also mentioned in this context.

Addressing the Quantitative Findings

In the second stage, we asked the interviewees to address our quantitative findings and to provide explanations as to why the observed patterns may exist. For that, they were shown

versions of Figure 3.1-1, Table 3.1-2 and Table 3.1-3 before being asked questions such as: "We observed that Assistants to a Head of Department are more heavily involved in content collaboration than other employees. Judging from your experience and interaction with them, is this a plausible observation and if so, why do you think they are?"

All but two *Passive Users* are part-time employees. Per our interviewees, part-time employees communicate and collaborate significantly less because they work less hours and have fewer tasks: "They have fewer duties that they need to communicate and collaborate on. Things like delegating, controlling, and guiding are mainly done through communication – and that's not typically part of a part-time employee's job description", Interviewee H.

We identified three levels of *All-rounders*, who use the two systems with rather similar intensity. Thus, we conclude that Mid-Activity All-rounders represent the average usage amongst employees who work full hours, while Low-Activity All-rounders use both systems to a lesser degree. High-Activity All-rounders are occupied by middle managers who depend on documenting decisions in a structured way: "Depending on the size of their department, they have to maintain a lot of lists to keep an overview of all the topics that they deal with. They also gather a lot of information from the entire organization and transform or condense it for their bosses", Interviewee G. They also often organize meetings and bring decisions made by the participants into practice, which requires extensive amounts of communication: "It has got to do with our responsibilities. Management assistants are the binding element between their superiors and the other employees. They have to gather a lot of information, condense it, and pass it on. That happens mainly via email, as many employees are working on external projects during the week", Interviewee H.

According to our interviewees, *Email Broadcasters* are (1) organizers of certain expert group meetings and other regular events, who ask for input from the participants, send agendas, and schedule meetings, or (2) the main secretary's office, which often sends emails to multiple recipients to inform them about changes regarding meetings, updates about decisions, or forward emails that they receive centrally but for which they are not responsible, or (3) single-point-of-contacts: "I receive emails with some brief information from my boss, based on which I write a proper email and communicate the matter to everybody else in the department", Interviewee B.

Email Heavy-Users communicate more than they collaborate with others. The high number of incoming emails indicates that these users are particularly prestigious (Wasserman and Faust 1994). First, managers "have exponentially more tasks" than employees on lower hierarchy levels. "It's a cascading effect. For every task you receive status updates which accumulate accordingly", Interviewee E. They give input, set goals, and monitor progress, but do not necessarily get involved operationally. Secondly, the reason why this communication is done via email, was explained by a lack of in-person availability. "That's why they depend heavily on emails. Usually, they answer a bulk of emails in the evening", Interviewee G. Interviewee I added that he uses emails frequently because he "travels a lot and the integration of the email client works flawlessly on the smartphone".

Content providers are all located at site A where most shared services are situated. We therefore suggest that this user behavior is task-specific. According to our interviewees, there are employees who are responsible for creating and updating tutorials, descriptions, FAQs, or templates. Frequently mentioned were the IT, Public Relations, and Finance departments. Given the fact that most Content Providers are part-time employees, and that the information stored in the mentioned documents is rather broad, we conclude that Content Providers are employees who gather and document information, rather than necessarily creating it themselves in the first place. Another interesting finding from the self-assessment was that content provision was rated low across the board, which suggests that providers of content are often unaware of others using their work.

For *Content Co-Creators***,** extensive teamwork is an important factor. Interviewee F said: "that's again task-related. More time for projects, proposals, or evaluation reports means more collaboration with others." Some interviewees mentioned that teams which work in distributed environments, such as different internal locations or external projects, might engage more in content co-creation.

3.1.4.4. Meta-findings

To sum up our insights from the three parts of this study, we provide the following meta-inferences from integrating the qualitative and quantitative findings (Venkatesh et al. 2013). The results of the different parts of our study are presented in Table 3.1-4.

We found that part-time employees use the communication channel and the collaboration platform less frequently than full-time employees. However, task-specific exceptions, such as Content Providers, or Email Broadcasters are possible. In the user role Content

Provider, part-time employees do not necessarily create new knowledge, but document existing tacit knowledge or merge dispersed knowledge to make it tangible. Full-time employees occupy many different user roles. The majority of them use both systems with relatively equal intensity and tend to be All-rounders of Low- or Mid-Activity. However, for task-specific reasons, about one third of them are engaged in tacit knowledge creation with their co-workers and are therefore Content Co-Creators. All of the user roles observed for full-time employees communicate significantly less than the roles most frequently observed for top managers (Head of Support Function, Head of Department) and middle managers (Assistant to Head of Department). Assistants to the Heads of Departments are highly active on both systems, and are thus High-Activity All-rounders. They have a broad portfolio of tasks where they are required to obtain information from employees and restructure or condense them to suit the needs of their superiors. In addition to that, they frequently organize meetings and take minutes to document decisions made by their superiors. Heads of Departments, just like Heads of Support Functions, are mainly using the communication channel, and not the collaboration platform. Their job profile requires extensive amounts of coordination and communication, because they are ultimately responsible for all tasks within their departments and are required to keep up with all developments, as well as to give high level input or feedback where necessary. Due to their limited in-person availability the communication is often asynchronous and therefore digital.

Several outliers that do not follow the observed correlations between user roles and organizational positions, are also apparent. For users who communicate or collaborate less than the rest of their co-workers on the same hierarchical level, this could be for personal factors such as vacation time, which we did not include into the quantitative part of our study for privacy reasons. Particularly interesting, however, are users who communicate and collaborate more than their peers. For example, part-time employees who are Mid-Activity All-rounders, or full-time employees who are High-Activity All-rounders. We suggest and our interviews support, that these users might be so called *hidden leaders*. Such employees use relationships and interactions with others to manifest their leadership, and do not rely on a hierarchical position to influence others (Edinger and Sain 2015).

User Role	Profile	Most Common Hierarchical Positions	Other Important Attributes	Qualitative Insights
All-rounder High-Activity	Frequent email communication, especially dialog. Frequent content collaboration	Assistant to Head of Dept.	Long employment & Site A	Middle management; broad portfolio of tasks; structured documentation; efficiency of coordinative tasks.
All-rounder Mid-Activity	Moderate email communication. Moderate to low content collaboration	All levels	Long employment	Average usage of channel and platform.
All-rounder Low-Activity	Moderate to low email communication. Low content collaboration.	Part- & Full-time Employee	-	Below average usage of channel and platform.
Email Heavy-User	Frequent email communication, especially reception. Low content collaboration.	Head of Support Function & Head of Department	Long employment	Limited in-person availability; lots of coordination, input, and feedback through cascading effects of responsibilities.
Email Broadcaster	Moderate email communication, but very frequent email sending. Low content collaboration.	Part- & Full-time Employee	Site A	Task-specific: scheduling of meetings; newsletters; single-point-of-contact in certain shared services, e.g., IT department, secretary's office.
Content Co-Creator	Moderate email communication. Frequent content collaboration, especially content co-creation.	Full-time Employee	-	Task-specific: when extensive team work is required and in distributed teams: e.g., research, written proposals, internal and external projects.
Content Provider	Low email communication. Frequent content collaboration, especially content provision.	Part-time Employee	Site A	Shared services and administrative tasks: e.g., instructions, tutorials, and templates in Finance, IT, HR departments.
Passive User	Very low email communication. Very low content collaboration.	Part-time Employee	Short employment	Fewer tasks & work hours; mainly operational tasks; more in-person contact through open-plan office, less meetings.

Table 3.1-4: Meta-Findings – User Roles with Quantitative and Qualitative Factors

3.1.5. Discussion

3.1.5.1. Theoretical Implications

Several researchers have previously dealt with roles of knowledge workers, different use cases of communication and collaboration software, and hierarchical differences in social software usage. However, the previous findings leave room for further contributions. This is due to several reasons: First, little research relies on real-world data. Second, the rare exceptions do not combine both collaboration and communication systems in an integrated way. Third, the mentioned studies rarely investigate exogenous covariates for a specific user behavior. Our paper identifies and analyzes eight heterogeneous user roles to address this gap.

Previous research regarding ESN has found relationships between the organizational hierarchy, on the one hand, and communication and knowledge sharing, on the other hand (Behrendt et al. 2015). Others, however, call for deemphasizing the role of hierarchy in knowledge sharing (Wang and Noe 2010). In our study, we find strong associations to the organizational structures for many user roles. However, for other roles, specific tasks that the users perform seem to be the distinguishing factor. For example, the user group identified as Content Providers has frequently been described in the literature as Providers or Sharers (Alavi and Leidner 2001; Reinhardt et al. 2011). According to several statements of the software environment's users in the qualitative part of our study, Content Providers are people whose jobs require them to gather information and create content that is frequently accessed by other users. This is congruent with Wang and Noe (2010) who state that knowledge sharing can be an in-role behavior for certain employees. The same applies to Email Broadcasters. Schlagwein and Hu (2016) observed broadcasting behavior in the context of ESN, and directly compare it to email broadcasting. According to the authors, broadcast in general is primarily aimed at reaching many users with a preconceived message. Such messages usually contain formal rather than informal information, when transmitted via email (Schlagwein and Hu 2016). Based on our user interviews, the respective user group is indeed tasked with broadcasting of information, e.g., in the form of internal newsletters. In addition to that, we learn from our interviews that the group might also be involved in the planning and scheduling of meetings, which according to Reinhardt et al. (2011) is the task of an Organizer. Due to the pseudonymized data set, we cannot conclusively say whether organizing is a relevant factor for the emergence of Email Broadcasters. For instance, according to our interviews Assistants to the

Heads of Departments are also frequently involved in such activities, but in addition to that they also heavily participate in other interactions. Therefore, while we find users who perform tasks attributed to an Organizer, we cannot say with certainty whether some of them would form their own user group if the content of their interactions were considered.

A large part of the users in our study are all-rounders, which is congruent with a study by Arazy et al. (2016), who investigated emergent user roles in the open collaboration platform Wikipedia. For example, in our study, the majority of Assistants to the Heads of Departments – who are middle managers – are High-Activity All-rounders characterized by high levels of communication and collaboration activities. The organizational knowledge creation theory (Nonaka et al. 2006) can provide an explanation for this observation. It has, amongst other things, dealt with the role of leadership in knowledge management. According to Nonaka et al. (2006), top level managers communicate and coordinate visions about knowledge throughout the organization. Congruent with that, we find that Heads of Departments and Support Functions – who are top managers – are heavily involved in email communication and not so much in collaborative activities such as content provision or co-creation. For reasons of cost and time, not all knowledge can be shared (Nonaka et al. 2006). This is particularly the case for people high up in the hierarchy whose time is particularly precious. According to our interviews, this might be a reason for why Heads of Departments and Support Functions tend to create less tangible content through the collaboration platform and use asynchronous and verbal communication more frequently. Middle managers, on the other hand, bring the visions of top managers into concepts and facilitate organizational knowledge creation by synthesizing knowledge of front line employees as well as of their top managers and help make it explicit (Nonaka et al. 2006). These users are described in our user interviews as employees who gather information and reshape it to suit the needs of their superiors. In that sense, their behavior also resembles that of Linkers who "mash up information from different sources to generate new information", as found in a study by Reinhardt et al. (2011).

Contrary to previous studies which hypothesized and found Retrievers, Learners or Seekers (Alavi and Leidner 2001; Reinhardt et al. 2011), we do not find a user group that has peaks in content retrieval in our real-world data set. While many of the identified user types rely heavily on content retrieval, they also convert that information into tangible content to a similar extent. Because our study is based on social network data, we only consider content that was modified within the six-week observation period. It remains

unclear whether the absence of Retrievers might be influenced by that restriction. However, it seems reasonable that employees do not look for information simply for the sake of knowing it, but that they do something with the obtained information. This then results in more balanced user types, which according to Alavi and Leidner (2001) is desirable, at least on an aggregated organizational level.

Several previous studies regarding digital social structures report about a dense network core and a large periphery of rather passive users (e.g., Füller et al. 2014; Muller et al. 2010). We too found a passive user type, however, we are uncertain whether this is due to the uncommon organizational structure with many part-time employees or if it is a phenomenon that can generally be observed for employees with operative tasks. Congruent with our observation, and within a different organization, Behrendt et al. (2015) found that lower hierarchical levels are less active in ESN. In their study, the lowest hierarchical levels barely participate in ESN at all, average hierarchical levels have the most social relationships, middle managers communicate actively, and top managers reach many users at once. In our study, some part-time employees pointed out, that their lack of digital communication and collaboration might be due to a higher level of personal interactions in their open-plan offices. However, the effect of such personal interactions on digital interactions are not considered in our quantitative analysis.

Lastly, we find several employees who do not fall into task specific roles, but also are not in the same cluster as their colleagues on the same hierarchical level. We consider these to be outliers that communicate and collaborate more than their peers. According to social capital theory, users can gain social capital on an individual and relationship level from such informational exchanges with their colleagues (Steinfield et al. 2008). Our interviewees state that being well-connected in the digital workplace can be one aspect of several important aspects for a promotion. Congruent with that, they also state that there are a number of colleagues who are particularly involved in communication and collaboration, for example because they are experts in a particular field. Therefore, it might be possible that some of these users are hidden leaders or experts of some sort.

3.1.5.2. Managerial Implications

Our contributions, can be used to help practitioners with addressing *six* of the practical challenges for collaborative work in the digital workplace, which Köffer (2015) extracted through a literature review. First and most generally, we show a way to *monitor general*

work behaviors (1) through digital trace data with our study. While privacy issues might limit the usefulness of such an analysis in an organizational context, our approach does provide a way to investigate how communication and collaboration systems are being used on an organizational level. This might help organizations to assess the overall adoption rates and identify areas for improvement. It could also be interesting for platform owners, who can study which features – if defined as interaction types – are being used by which user groups. Second, Maruping and Magni (2015) report that with the diversity of work practices, no *one size fits all* strategy regarding the incorporation of collaboration technology can be pursued. With our typology of user roles, we provide guidance for practitioners to *segment employees (2)*, not only regarding their collaboration behavior, but also regarding their communication requirements (Cameron and Webster 2013). Third, through identifying different user types in our study, we also help organizations to better understand user needs based on which they can *provide support and training (3)*, tailored to the individual needs of their employees. As mentioned in Section 3, for data privacy reasons it would be challenging for organizations to recreate this analysis in order to identify individual employees, however, in our analysis of covariates of cluster membership, as well as our qualitative interviews, we described the user types and their characteristics in depth. This might help organizations to target entire homogeneous groups of knowledge workers with their support or training efforts, rather than individual users. Fourth, and connected to the previous point, through the identification of Passive Users, employees with a small number of ties can be encouraged to interact with others (Zhang and Venkatesh 2013), which in turn helps to *enable social interactions (4)*. Fifth, by getting a better idea of the communication and collaboration requirements of each hierarchical level, practitioners are also supported to more adequately *consider individual characteristics (5)*, such as digital skills and experience in their hiring or promotion decisions. For example, the 9% of full-time employees that reside in the High-activity All-rounder cluster and the Email Heavy-Users cluster might be candidates for a more communication-heavy job in management. Last, top management support is often cited as a critical success factor for the adoption of new software tools and for a positive knowledge sharing culture (e.g., Wang and Noe 2010). We found that middle managers are particularly engaged in communication and collaboration as per their job requirements, which might make them better advocates to *demonstrate leadership* (6) on novel (social) collaboration platforms or ESN.

3.1.6. Limitations and Future Research

Our study has a number of limitations and leaves room for further research. While our data set is taken from an organization that is well-suited to study knowledge workers in the digital workplace, it only represents a small sample of knowledge workers. Additionally, we only capture white-collar knowledge workers with our study, therefore our results cannot necessarily be generalized to other knowledge workers, such as healthcare practitioners or engineers. Also, while many of the user types found in this study overlap with those identified in previous studies in other settings, we cannot say with certainty that these user types are also inherent in the social structure of other organizations. Therefore, further research based on different data sets is necessary to validate the generalizability of our findings. Likewise, we follow an "eye of the beholder" clustering approach, which leans heavily on the interpretation of the identified clusters. While we provided extensive qualitative details to support our selected clustering solution, this remains an explorative approach which, again, needs to be validated in future research contributions. The maturity of the software usage within the organizations and personal IT skills could be considered to draw comparisons between organizations. A problem that is frequently mentioned in the context of SNA based on digital trace data is that by definition it only considers social interactions within the software environment. For example, it neglects undocumented face-to-face interactions and interactions through other software tools (Wang and Noe 2010). Howison et al. (2011) caution not to over-interpret the number of digital events between employees, because the intensity and content of the interactions is unknown. Yet, researchers could define more distinct interaction patterns for future work, to distinguish further between user types. For example, Gleave et al. (2009) present different ego-networks and hypothesize that their shapes can give hints about the roles of actors. Additionally, for privacy reasons our analysis neglects the content of the interactions and the actual information flows transmitted through them. *Hashing* and *speech acts* have been used in the past to allow for an automatic analysis while maintaining the anonymity of the data (Carvalho and Cohen 2006; van Alstyne and Zhang 2003) and could be applied to this context as well. Another interesting question for further research is whether the employees keep or change their user roles over time. And if they change, what external factors cause those role changes. Researchers in the context of Wikipedia have found a turbulent stability of emergent roles, which describes the phenomenon that

individual user roles may change, but the overall composition remains the same (Arazy et al. 2016).

3.1.7. Conclusion

In this study, we addressed the need to gain a better understanding of the heterogeneous behaviors of knowledge workers within their digital workplace in an organization. The importance of this question is rooted in the understanding that one size fits all solutions regarding the incorporation of such software into the diverse work practices are not adequate. Therefore, and to improve our knowledge of how these work practices differ, we set out to identify emergent user roles of a communication and collaboration environment. This endeavor is rooted in the knowledge-based theory of the firm and social capital theory, as well as in a fragmented body of research on the digital workplace and user roles in digital communication and collaboration environments. As a result of a cluster analysis, we found eight distinct user roles. In contrast to other studies in different contexts, we found that the presence of organizational roles can help explain many behavioral differences through factors such as the organizational hierarchy and the individual job requirements of the users. Those findings are routed in a quantitative analysis of influencing factors and qualitative user interviews. We observe that, congruent with the organizational knowledge creation theory, top managers are heavily involved in communication, while middle managers bridge the gap between top managers and employees by turning visions into tangible content. For user types that distribute information and provide content, we observed usage patterns that can be explained through an in-role understanding of knowledge sharing. Similarly, for employees who are heavily involved in tasks that require teamwork, a tendency towards co-creation of content with colleagues was observed. Lastly, and congruent with the positive effects of social connections on social capital, we argue that outliers can potentially be hidden leaders and candidates for promotions. With our approach, we contribute to the scientific progress in the field and support practical implications of communication and collaboration in the digital workplace. Future research should refine our interaction types and validate our findings with different data sets, particularly through but not limited to longitudinal designs.

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3.2. From Broken Habits to New Intentions: How COVID-19 Expands our Knowledge on Post-adoptive Use Behavior of Digital Communication and Collaboration

Abstract

The COVID-19 pandemic has caused an unprecedented surge in digital communication and collaboration. While a rich body of knowledge exists on IS use, our understanding of post-adoptive use behavior regarding communication and collaboration is comparatively limited. Existing models assume decreasing growth rates over time and are not designed to capture spikes in use behavior such as the one observed during the pandemic. In this mixed-method study, we propose a model that explains drivers of post-adoptive behavior and outline the influence of COVID-19. Based on real-world data from MS Teams, we show that individual feature use varies within and between subjects over time with an increasing growth rate during COVID-19. To understand drivers for post-adoptive behaviors, we further conduct qualitative interviews. We find established influencing factors to be relevant regarding intentional use. Yet, constructs from the realm of communication and collaboration research play an important role as exogenous factors. Additionally, habits were deliberately altered during COVID-19 and replaced with new intentions. Based on our model, we propose a perspective on the new normal in post-epidemic times. Extended knowledge of post-adoptive behavior and its triggers assists practitioners in adjusting to the new normal or to react to new situations beyond COVID-19.

Keywords: post-adoption, sensemaking, IS use, communication and collaboration, novel situations

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3.2.1. Introduction

Around the world, the COVID-19 pandemic has urged companies to have their employees work from home. Studies found that more than 25% of the German workforce worked from home during the height of the pandemic in March 2020 (Möhring et al. 2020). This fast-tracked the rapid boom of digital collaboration and communication tools, such as Microsoft (MS) Teams or Zoom. MS Teams meetings surged at an exponential rate with 2.7 billion minutes of meetings as of 31st March compared to 900 million on 16th March 2020 (Spataro 2020). Such tools have been widely used before, to support globally distributed teams, mobile work, and flexible working hours. Yet, their relevance is likely to increase as a greater number of employees working from home will become the new normal in post-epidemic times (e.g., Kelly 2020). This is exemplified by the German technology company Siemens who recently announced to enable 140,000 employees to work from home after the pandemic (Handelsblatt 2020) and political debates around a right to work from home (Süddeutsche Zeitung 2020).

Efficient digital communication and collaboration will most likely become one of the key priorities and success factors for companies in such a work environment. Even though many commercially available tools provide a large and easy to use set of communication and collaboration features, companies depend on the willingness of the employees to use them. While organizations can promote the provision and installation of such tools, for example through inclusive change management, the initial adoption does not predetermine the long-term use of the tool and its different features (Bagayogo et al. 2014). Jasperson et al. (2005) state that "users employ quite narrow feature breadths, operate at low levels of feature use, and rarely initiate technology- or task-related extensions of the available features" (p. 525). For companies, however, it is important to foster an intense use of the provided tools to enhance efficient communication. This will become particularly important since remote work is likely to stay relevant in the new normal after COVID-19. However, managers can only steer and promote use if they understand the reasons for post-adoptive user behavior.

In the information systems (IS) discipline, technology acceptance and use has been a highly researched topic resulting in various models and theories which aim to predict technology adoption and acceptance (e.g., Davis 1989; Moore and Benbasat 1991; Venkatesh et al. 2003). Despite IS use being a central topic in IS research with a large body

of research examining these topics, the collective understanding of post-adoptive behavior is comparatively less mature (Jasperson et al. 2005). For example, researchers have long called for insights based on real-world data, longitudinal insights, and for detailed post-adoption studies on a fine-grained feature level (Bagayogo et al. 2014; Jasperson et al. 2005).

So far, IS researchers argue that feature use varies based on the task and changes over time (Benlian 2015; Kim and Malhotra 2005). Specifically, Benlian (2015) finds that feature use increases over time but growth rates diminish. Evidently, in the case of COVID-19 growth rates for communication and collaboration use have spiked due to the exogenous shock, however, a detailed understanding of how this happened is still evolving.

The unique opportunity provided by COVID-19 with a major share of the work force working from home and using digital rather than physical means of communication enables us to study post-adoption of communication and collaboration tools. In the wake of this development, this study focuses on individual post-adoptive behaviors on a feature-level by analyzing real-world data based on MS Teams before and after COVID-19. This enables us to answer the following research question:

How and why do changes in post-adoptive digital communication and collaboration use behavior occur, and what can we learn from the times of COVID-19 about it?

To address the question, we use a mixed-methods approach combining quantitative data analysis and qualitative interviews to provide a comprehensive understanding of post-adoptive behaviors. We use real-world data consisting of feature use counts of a communication and collaboration tool over the period of 9 months. We identify seven distinct use patterns in the data and analyze them based on a rich conceptualization covering system, task, and user (Burton-Jones and Straub 2006). Our results indicate that individual post-adoptive use varies between individuals and within individuals over time with users switching from one behavior to another. Thus, post-adoptive use is highly individual and heterogenous. In times of COVID-19 many users changed their behaviors while others did not. We first trace this back to different hierarchical positions in our quantitative strand. Through our qualitative strand, we identify factors affecting such heterogenous post-adoptive use behavior while combining several insights from research streams on IS use, and communication and collaboration. We confirm the influence of UTAUT factors and derive additional exogenous factors. Such factors include task, group, and organizational environment. Further, we find habit-breaking technology sensemaking due to novel

situations as well as network externalities to be important factors for changing growth rates in post-adoption. Proposing a model based on these findings, we offer an explanation to post-adoptive communication and collaboration behavior from a theoretical lens. Based on this we outline a perspective on the new normal after COVID-19.

3.2.2. Theoretical Background

3.2.2.1. Research on IS Use

The field of IS use is the most mature and well-researched amid the IS-community (Venkatesh et al. 2003, Hu et al. 1999). Use is described as one of the most important success factors regarding the implementation of an IS (Sabherwal et al. 2006; Venkatesh et al. 2008). Burton-Jones and Gallivan (2007) define technology use as "a user's employment of a system to perform a task". For a holistic view and rich understanding of IS use, the user, the system, and the task need to be taken into account (Burton-Jones and Straub 2006). Several contributions have explained use behavior in a detailed way (Davis 1989; Venkatesh et al. 2003; Venkatesh et al. 2016b).

Technology use can be divided into three phases: adoption, initial use, and post-adoptive use (Jasperson et al. 2005, Venkatesh et al. 2016a). Adoption "refers to the stage before and right after a target technology implementation/introduction", whereas "initial use refers to the stage when users begin to apply the technology to accomplish their work/life tasks" (Venkatesh et al. 2016b, p. 345) (p. 345). The post-adoptive use refers to the time "after the application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities" (Jasperson et al. 2005) (p. 531). All three phases have been researched independently. Following our research question, we proceed to elaborate on the post-adoption phase.

3.2.2.2. Post-adoptive Use Behavior

Research on post-adoptive IS use generally concerned with multiple aspects. It investigates why people continue to use IS, the role of automatic IS use in the form of habits, and a better understanding on how IS are actually used (Bagayogo et al. 2014). While there is an ongoing debate on how to categorize post-adoptive use, Jasperson et al. (2005, p. 531) differentiate between "feature adoption decisions, feature use behaviors, and fea-

ture extension behaviors" (p. 531). Such features of a technology are defined as the building blocks or components of the technology (Griffith 1999; Griffith and Northcraft 1994; Jasperson et al. 2005).

Previous research has shown that feature use is not constant and changes over time (DeSanctis and Poole 1994; Goodhue 1995; Goodhue and Thompson 1995; Griffith 1999). However, research has also shown that growth rate diminishes over time (Benlian 2015). In the post-adoptive phase, habitual rather than intentional use becomes important. Users start to form habits based on their previous use behavior which they do not necessarily change unless they reflect on their use (Jasperson et al. 2005). The theory thus suggests that technology sensemaking events have to take place for users to re-evaluate and change their use behavior in the post-adoptive phase (Jasperson et al. 2005).

However, according to Jasperson et al. (2005) due to a lack of research on post-adoptive behavior, the knowledge of the technology sensemaking processes is limited, lacking insights on questions like what triggers technology sensemaking in the post-adoptive phase.

3.2.2.3. Related Work on Post-adoptive Use of Communication and Collaboration Tools

The emergence of sophisticated information and communication technology enables teams to communicate and collaborate digitally and, thus, brings the subject of teamwork to the IS research agenda (Dennis et al. 2008). Several research contributions at the overlap between IS use in general and communication and collaboration technology offer technology-specific antecedents (Brown et al. 2010; Lou et al. 2000; van Slyke et al. 2007). For example, Brown et al. (2010) combine highly impactful models from the realm of collaboration research (i.e., social presence theory, channel expansion theory and the task closure model) with IS use research (UTAUT). In their study, they show how collaboration-related constructs, mediated through UTAUT, influence intentional use of collaboration tools. While this study is highly relevant to our research endeavor, it does not explicitly focus on post-adoptive use or stark changes in use behavior, such as the ones that could be observed during COVID-19. Lou et al. (2000) and van Slyke et al. (2007) analyze the use of collaboration tools. They introduce critical mass as an additional explanatory factor for the intention to use collaboration systems. However, they too do not account for changes in use behavior. Additionally, Sykes and Venkatesh (2017) show

how different social network ties influence use of a collaboration tool. While they do use longitudinal data, their focus is not on explaining changes in use behavior.

We thus refer to the body of knowledge on post-adoptive behavior of IS use in general. Jasperson et al. (2005) investigate how and why individuals use different features of an IS in post-adoption. Benlian (2015) uses a longitudinal design to determine that post-adoptive use increases in a non-linear way with diminishing growth rates. Sun (2012) explores how and why individuals revise their system use at the feature level. His findings suggest that triggering conditions like novel situations, discrepancies between expectancies and reality, and deliberate initiatives influence the changes in the post-adoptive feature use. Sorgenfrei et al. (2014) describe adoption as well as post-adoption as a dynamic process in their classification of existing IS use models. According to their research, use of technology features changes over time due to changing beliefs and motivations of the individual users.

We summarize that a comprehensive and detailed picture of the adoption and use behavior of an IS exists. The mature body of knowledge includes insights regarding acceptance and adoption decisions of communication and collaboration tools, and several contributions on the general IS usage behavior in post-adoption phases. This paper aims to extend the existing knowledge by investigating the effects of an exogenous shock such as the one brought about by COVID-19. Understanding the use of communication and collaboration technology is particularly relevant in the wake of COVID-19. Yet, existing research models and contributions on IS communication and collaboration behavior appear to be limited regarding the explanation of radical changes. We shed light on the post-adoption behavior of communication and collaboration tools using a longitudinal design. Those insights can help us understand which use behaviors might become the new normal.

3.2.3. Research Approach

3.2.3.1. Mixed-Methods

We conduct a mixed-methods study combining quantitative and qualitative research methods in the same research inquiry to get rich insights into the phenomenon of interest (Venkatesh et al. 2013; Venkatesh et al. 2016a). We follow a sequential mixed-methods design to reach complementarity, which is one out of seven purposes suggested by Ven-

katesh et al (2013). We combine a quantitative exploration of user behaviors with a qualitative analysis of drivers based on interviews with the users to understand and explain the quantitative findings.

3.2.3.2. Research Setting

Our study is based on trace data from a German organization that has implemented the communication and collaboration tool MS Teams. The organization provides knowledge-intensive services in an educational and consulting context to corporate, public, and individual customers. It has multiple specialized departments which are responsible for the provision of the organization's external service offerings, and support functions that provide internal shared services across departments, such as Finance or Human Resources. Each Full-time Employee is a member of exactly one department and one or multiple support functions. The organization has two locations and many teams consist of members from both locations. Over the period of our analysis (9 months), the organization had between 158 (first phase of our investigation) and 182 active employees (last phase). This change is due to strategic and long-term growth of the organization and includes normal fluctuation. The organizational hierarchy comprises different positions, which are: Heads of Departments, Heads of Support Functions, Assistants to the Heads of Departments, Full-time Employees, Administrative Employees, and Part-time Employees. Part-time employees have variable working hours (in many cases 10 hours per week).

The existing IT landscape is rather mature and supports knowledge-intense digital work in distributed teams. Regarding devices, the organization offers desktop PCs and laptops to many of its employees. Also, employees are provided with non-digital communication devices, such as landline telephones. Smartphones are only provided to employees upon request. The organization encourages and supports a bring-your-own-device policy. It further uses multiple applications from the MS Office 365 suite. This includes the service MS Exchange, providing email capabilities, and MS SharePoint, for document management, file sharing and knowledge management. In addition, MS Teams was introduced in June 2019 and provides four major communication features: Team Chat, Private Chat, Calls, and Meetings.

3.2.3.3. Quantitative Strand

Data Set

Data were collected for a period of 9 months from July 2019 to April 2020. It is separated into three different phases which each cover a 90-day period. It captures post-adoptive use (T1 from 23rd July to 21st October 2019), continued post-adoptive use (T2 until 19th January 2020), as well as the influence of COVID-19 (T3 until 18th April 2020) which imposed work from home. The COVID-19 pandemic rapidly reached Germany in February of 2020 and started impacting daily work. The organization strongly recommended work from home on 7th March. All employees were ordered to work from home on 16th March.

We were provided with use counts of the four MS Teams features for each employee during the respective periods. DeSanctis and Poole (1994) suggest that a not too detailed feature list should be considered in the analysis. Rather, features should be viewed in parsimonious bundles to achieve consistent and meaningful empirical results. To capture deep structure use (Sykes and Venkatesh 2017; Wang and Butler 2006) we used data regarding the breadth (Burton-Jones and Straub 2006; Saga and Zmud 1993) and depth (Lucas and Spitler 1999) of use. Breadth measures the number of features used and depth the intensity of use. In our study, use counts represent: sending a message in an MS Teams channel (Team Chat), sending a message in a private conversation with one or many persons (Private Chat), peer-to-peer audio or video call (Calls) and audio or video meetings with more than two participants or prior scheduled meetings (Meetings). The data was pseudonymized by the organization's system administrator to address privacy concerns (e.g., Herzog et al. 2015; Pawlowski et al. 2014). This ensures the identification of user behaviors but prevents the researchers from knowing the content of the messages or from identifying individual employees (van Alstyne and Zhang 2003). Additionally, we were provided with user-specific meta-data regarding the organizational hierarchy (distinguishing between the seven positions). Each position has at least six employees, so anonymity is not an issue.

Data Preparation and Clustering

To capture different types of user behaviors across all features, we used clustering. We normalized our data concerning the maximum and minimum of usage counts for each feature and time period individually. This made feature counts comparable and turned

weighted them equally. The data was winsorized (98% quantile) and logarithmized to eliminate outliers. We used agglomerative hierarchical clustering with the Ward.D2 minimum variance criterion and Euclidian distances. Hierarchical clustering has been used in such contexts (Füller et al. 2014), is reproducible, and does not need the desired number of clusters as an input parameter. Also, users added to one cluster remain in that cluster unless the cluster is split into two, which helps with the determination of adequate cluster size. Cluster size was determined subjectively based on the interpretability of split clusters (e.g., Frank et al. 2017). We took solutions into account where the breadth and depth of feature use differed substantially between clusters. The 7-cluster solution showed the best split regarding the breadth and depth. The results indicated that similar clusters exist independently of the period. Based on this observation, we additionally computed a k-means clustering for the 7-cluster solution. We used the means of our hierarchical clustering solution from T1 as initial centroids for the k-means in all three periods (Füller et al. 2014). This assures the comparability of the clusters across periods. We report the results of this k-means clustering in the following.

3.2.3.4. Qualitative Strand

We aim to elaborate on our quantitative results with a qualitative analysis (Venkatesh et al. 2013). To do that, we conducted semi-structured (virtual) interviews with employees of the organization. Interviewees were selected according to theoretical sampling informed by our prior findings (Anderson 2010; Glaser and Strauss 2009). For privacy reasons, no inferences from a cluster to the users it contains are possible. However, as we found some hierarchical positions to predominantly occupy a certain cluster, we selected appropriate interview partners based on this information. In total, we conducted ten interviews with one Head of Department, three Heads of Support Functions, one Assistant to Head of Department, one Full-time Employee, one Administrative Employee, and three Part-time Employees.

In each interview, we first introduced the research project and explained that the recordings and data are treated anonymously and securely. To ensure that interviewees are familiar with MS Teams, we provided a short description. We used a semi-structured protocol allowing interviewees to narrate based on their experiences with MS Teams while ensuring that our questions are addressed (Myers and Newman 2007). We followed an ethnographic style (Leech 2002). We started by asking the interviewees about their

use of individual features to identify the breadth and depth of their use behavior and to allocate them to the cluster they occupy. We refrained from showing them the clustering results to prevent biases. Our protocol included questions regarding reasons that influence post-adoptive behavior for the time horizons before and during COVID-19.

The interviews were conducted in German, the native language of the employees. The authors of this paper transcribed the interviews and two authors independently coded the data before discussing and consolidating the codes to identify the relevant drivers and recurring factors that influence individual post-adoptive use behavior. We followed the coding guidelines of Grounded Theory and started with inductive open codes that were then aggregated to categories through axial coding (Strauss and Corbin 1990) After the first iterations of our coding process, results were discussed within the entire group of authors. We found multiple similarities between our inductive coding categories to existing constructs from different established models of IS use literature. Thus, we were guided by these existing categories in the later iterations of the coding process, which resembles more of a deductive coding approach. The complementary mix of inductive and deductive coding allowed us to combine multiple aspects of existing research into a wholistic view. Selected direct quotes were translated into English by the authors for the reporting in this paper.

3.2.4. Quantitative Results

3.2.4.1. Descriptive Statistics

First, we provide descriptive statistics of the feature counts over the three periods. We report the mean, median and maximum of messages sent for Team Chat and Private Chat, of Calls, and of Meetings participated in per employee over each time period (Minimum omitted as it is always zero). The results presented in Table 3.2-1 show that on an organizational level, MS Teams use has increased drastically during COVID-19 for three features.

	T1 (post-adoptive use)				T2 (continued post-adoptive use)				T3 (use during COVID-19)			
	Team Chat	Private Chat	Calls	Meet-ings	Team Chat	Private Chat	Calls	Meet-ings	Team Chat	Private Chat	Calls	Meet-ings
Mean	6.2	254.9	3.8	8.1	11.9	359.2	5.9	13.9	10.8	735.7	19.0	49.6
Me-dian	0.0	70.5	1.5	4.0	2.0	151.5	3.0	10.5	2.0	353.5	11.0	39.0
SD	14.0	427.3	5.3	9.7	25.9	420.4	8.1	14.0	20.9	926.0	22.3	40.4
Max	92.0	2779.0	25.0	47.0	231.0	2404.0	35.0	76.0	162.0	7141.0	116.0	205.0

Table 3.2-1: Descriptive Statistics of MS Teams Feature Use

In particular, the data shows a disproportionally large increase in mean use from T2 to T3 for three out of four features (+105% for Private Chat, +222% for Calls, +256% for Meetings) when compared to T1 and T2 (+41% for Private Chat, +55% for Calls, +71% for Meetings). This drastic surge in T3 during COVID-19 is likely a result of the increased need for digital communication triggered by remote work during the crisis. For Team Chat, however, use decreased (-9% from T2 to T3). These observations show a general organizational trend regarding the use of the individual features of the tool. Lastly, the standard deviations substantiate the assumption that use behavior differs between users, supporting the necessity to investigate feature use behavior on an individual level.

3.2.4.2. Individual Behavior and Changes over Time

Based on prior literature and the descriptive statistics, we investigate two assumptions within our quantitative analysis regarding individual feature use: 1) individual feature use varies between individuals and 2) individual feature use varies within individuals over time. Our clustering results are presented in Table 3.2-2. The clusters are sorted by increasing use across the four features. A cluster is considered “superior” if either more features are used or one or multiple features are used at a higher intensity.

Seven distinct clusters are found showing different levels of feature use, which are consistent over time. When considering that normalized data was used for the clustering, the results further underline that the clusters follow the previously outlined organizational trend and actual use intensity has increased, while the clusters remain comparatively stable relative to one another. Yet, the data shows some within-cluster changes, like among low-intensity clusters (particularly C1). There, the data indicates that users that use MS Teams in a very limited way have increased their use of Meetings during COVID-19 (T3).

Our longitudinal design allows us to analyze changes over time. We find changes in cluster size between the time periods. Our results show that C1 (27 users in T1, 10 users in T3) and C2 (23 users in T1, 7 users in T3) decrease in size whereas C5 (10 in T1, 21 in T3), C6 (21 in T1, 29 in T3), and C7 (25 in T1, 51 in T3) increase. Further, especially in T3, high-intensity clusters like C7 increased substantially in size (30 in T2 to 51 in T3). Particularly the clusters that only use individual features, such as C1 and C2 are decreasing in size, which indicates a broader feature usage over time. It is important to note that a change in clusters means that users vary their behavior relative to the organizational trend by either showing stronger increases or using different features (data was normalized within each time period).

We additionally detect movements within individuals between time periods (see Appendix 3.2/A). Results confirm that even within users, the movements are mainly in an upward direction with stronger movements during COVID-19 as more users show intensive use of all features in T3 – both in absolute terms as well as relative to the rest of the organization.

The outlined results show that feature use is highly individual and changes over time. While some users just follow an organizational trend, others change their feature use in breadth and depth over time. We thus support that feature use varies (1) between individuals and (2) within individuals over time. Especially during COVID-19 we find that users tend to adopt more features of MS Teams and use those at higher intensity. Use has also substantial increased during COVID-19. We proceed with further analysis regarding the explanation of this heterogeneity.

Cluster	Description	T	Team Chat	Private Chat	Calls	Meetings	Cluster Size
C1	Largely passive, little use	1	.01	.04	.05	.07	**27**
		2	.01	.08	.02	.16	22
		3	.00	.18	.06	.33	10
C2	Occasional use of Private Chat	1	.05	.38	.03	.06	**23**
		2	.13	.54	.13	.10	20
		3	.16	.35	.14	.13	7
C3	Low or medium use of Private Chat and Meetings	1	.12	.49	.13	.47	**29**
		2	.09	.55	.15	.58	28
		3	.06	.51	.15	.52	24
C4	Medium use of all Features but Team Chat	1	.15	.68	.57	.45	23
		2	.14	.75	.51	.62	25
		3	.04	.67	.44	.71	**40**
C5	High use of all features but Calls	1	.91	.78	.32	.67	10
		2	.62	.77	.35	.60	**33**
		3	.64	.70	.33	.65	21
C6	High use of all features but Team Chat	1	.19	.77	.61	.85	21
		2	.15	.92	.77	.83	16
		3	.16	.83	.77	.82	**29**
C7	High use of all features	1	.74	.87	.79	.80	25
		2	.74	.91	.76	.84	30
		3	.70	.90	.78	.89	**51**

Table 3.2-2: Normalized Clustering Results[2]

3.2.4.3. Analysis of Hierarchical Position

One potential reason explaining differences between individuals may be organizational hierarchy. Task has long been known to influence user choice in the context of communication and collaboration (Daft and Lengel 1983; Goodhue and Thompson 1995; Trevino et al. 1987). The position in the organizational hierarchy can be regarded as a proxy for the task, as every position encompasses specific tasks – particularly regarding communication. For example, Brown et al. (2010) show the influence of task characteristics to collaboration technology use and base their argument on Dennis et al. (2008) who explain managers' choice of media for communication purposes with their media synchronicity theory. Other studies find an impact of organizational hierarchy on IS use behavior in the context of collaboration platforms (Behrendt et al. 2015; Frank et al. 2017; Riemer

[2] Largest Cluster Size Across all Time Periods in Bold

et al. 2015). Hence, we hypothesize that organizational roles influence post-adoptive feature use behavior and perform an analysis of the relationship between clusters and hierarchical positions.

Indeed, we observe that some of the hierarchical positions are predominantly present in specific clusters (see Table 3.2-3). Particularly in the later periods, the three organizational positions Full-time Employees, Assistant to Head of Department, and Head of Support Function mostly occupy higher clusters (C6 or C7), meaning they belong to the high-intensity users. This tendency solidifies over time for all three, indicating a general increase in use. For Head of Departments this picture is less clear: the data shows some to be in C1 whereas others occupy C3 to C7. This suggests different use styles within the hierarchical level, but a general tendency to use digital media less frequently than the other positions. Further, the increase in use in times of COVID-19 seems to affect Heads of Departments to a lesser degree than their Assistants, Heads of Support Functions or Full-time Employees. Administrative Employees (primarily secretaries) mostly belong to C1 for the first two periods with most of them switching to C2 in T3. For Part-time Employees use varies strongly, (mostly between C1-5). This may be because they have variable work hours and tasks with a rather high variance between individuals.

Our analysis suggests relative clear tendencies between use behavior and hierarchical positions, supporting the previously stated hypothesis. Yet, for some positions we observe a larger spread than for others. This heterogeneity is subject to further analysis in our qualitative strand.

C	Full-time Employee			Assistant to HD			Head of Support Function			Head of Department			Administrative Employee			Part-time Employee		
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
1	.02									**.33**	**.33**	.11	**.71**	**.86**	.29	.21	.13	.07
2	.02												.14		**.43**	**.25**	.20	.04
3	.12	.11					.33			.11	.22	.11			.14	**.25**	.21	.21
4	.26	.18	.04	.11	.22					.11	.11	**.44**				.12	.14	**.33**
5	.07	.11	.06		.22					.11	.11					.07	**.25**	.17
6	**.29**	.20	.34	**.44**	**.56**					.22	.11	.11	.14			.02	.01	.11
7	.21	**.39**	**.55**	**.44**		**1.00**	**.67**	**1.00**	**1.00**	.11	.11	.22		.14	.14	.13	.05	.07

Table 3.2-3: Percentage of Users in Clusters for each Hierarchical Position and Period[3]

[3] Highest Numbers for Each Period and Position in Bold

In summary, our quantitative analysis shows strong support for the assumption of varying feature use (1) between individuals and (2) within individuals over time. Further, we find a surge in MS Teams feature use for three out of four features during COVID-19. This indicates that users strongly changed their feature use behavior over time. Additionally, we find hierarchical positions and their tasks as a potential factor explaining differences between individuals. To explain why these particular use behaviors are observed, we proceed to the qualitative results.

3.2.5. Qualitative Results

3.2.5.1. Reasons for Feature Use Before and During COVID-19

Because of the extraordinary situation presented by COVID-19 and the limitations of our anonymized data set, we conduct user interviews to get a deeper understanding of the circumstances that drove user behavior. We aim to identify rationales for different user behavior found in our quantitative strand and how COVID-19 affected them. In our interviews, we were able to identify and confirm multiple well-established IS use constructs from UTAUT. These are included in our model but not explained in detail. Rather, we focus on exogenous mechanisms specific to communication and collaboration technology. Appendix 3.2/B provides a comprehensive overview with interview quotes describing all factors.

Task Technology Fit

Interviewees described that task influences the way MS Teams was used in post-adoption. Individuals select different features for the various communication and collaboration tasks within their work. “For knowledge-intensive tasks you cannot chat, you must use the Call function. For coordination tasks you can chat or call” (Interview 7). This is echoed by multiple other interviewees as well. At the same time, they see the technology itself as decisive factor.

First, social presence describes “a technology’s ability to transmit nonword cues (e.g., voice inflection) and nonverbal cues (e.g., gestures, facial expressions)” (Brown et al. 2010 p. 19). Interviewees explain that they choose MS Teams Meetings rather than leaner features (e.g., Team Chat) because “you still see each other”, which was important during COVID-19 for a lack of personal interaction (Interview 5). Yet, interviewee 8 relates: “Communication is also about personal interaction, which can hardly be replaced by a

video conference and is also very important from a social aspect" explaining the choice of face-to-face interactions over MS Teams use before COVID-19.

Second, one employee reported: "I try to avoid MS Teams Chat as there is already so much traffic with various email accounts" (Interview 8). Interviewee 8 is a Head of Departments whose self-assessed usage pattern fits C1. We attribute this to information overload caused by immediacy of feedback of chats, which describes the extent to which a user can quickly communicate with others (Brown et al. 2010).

Third, reprocessability was found to be important. Interviewee 5 reports that "due to the task, [the team] communicates mainly via email since everyone […] can see prior messages". Hence, the task demands creating records of communication. This is congruent with media synchronicity theory which suggests reprocessability determines choice and describes "the extent to which the medium enables a message to be reexamined or processed again" (Dennis et al. 2008 p. 587).

The importance of individual communication tasks regarding use becomes especially apparent during COVID-19. Passive users (C1) still exist in times of this external shock (T3). For some of these users the task does not demand an increased use of MS Teams features. For example, interviewee 8 states he has many planned meetings in his regular workday: "as Head of Department I am barely involved in ad-hoc topics. Rather, I have many regular meetings during my workday". Therefore, COVID-19 only influenced his use of one feature, Meetings. Interviewee 5, who reported the necessity to reprocess records of communication, does not see the "need to change anything from using email at the moment" due to the nature of the task. This shows that individuals evaluated their options for digital communication and made deliberate use decisions based on task-technology fit.

Based on our results, we argue that task and technology need to be considered together. It is the adequate interplay between task and technology that determines which feature is used. Task-technology-fit is the "degree to which a technology assists an individual in performing his or her portfolio of tasks" (Goodhue and Thompson 1995 p. 216). Hence, this is a highly individual assessment that depends on individual tasks and personal judgement and influences use decisions.

Individual

Particularly with administrative employees, we find a lack of computer self-efficacy to negatively influence MS Teams use. Interviewee 5 whose self-reported usage behavior matches C1, says that the low use of MS Teams is "probably also due to my [lack of] technical know-how." Computer self-efficacy is the belief in one's ability to use computer technology (McDonald and Siegall 1992; Venkatesh and Davis 1996; Yi and Hwang 2003).

Further, geographic proximity affects MS Teams use, which refers to the geographic distribution of the members of a group (Massey and Montoya-Weiss 2006). With different geographic locations of the team members, meetings cannot be held in person and must be moved to Teams: "MS Teams [Meeting] was used for all meetings where it was clear from the outset that you were not in the same location" (Interview 3), which was echoed by multiple interviewees. This was the case for distributed teams before COVID-19. But during COVID-19, we naturally find the drastically reduced geographic proximity due to work from home to be a major driver of feature use.

Group

Also, we find team norms to influence the feature use, because "ultimately, it is a team decision through which feature to communicate" (Interview 7). This is echoed by multiple interviewees. "The use of Team Chat depends on the team. Some teams use the feature and some teams do not. So, my use changes also with the teams I'm in" (Interview 4). It was reported that several teams in the organization started developing new norms on how to communicate and interact with a majority working from home in T3. These new team norms have likely influenced post-adoptive MS Teams use during COVID-19. Similarly, we find evidence for social influence by individual superiors and peers. This is defined as the "degree to which an individual perceives that important others believe that he or she should use the [new] system" (Venkatesh et al. 2003 p. 451). Regarding peer influence, interviewee 2, a Head of Support Function, states: "When I still got messages in Skype for Business, I always answered to write in MS Teams [Chat]" (Interview 2). Interviewee 2 indicated that he considers himself one of the most active MS Teams users of the organization. A Head of Department, who is likely a passive user of the Chat function, for example relates: "Sometimes young employees wrote to me via MS Teams, so I pointed out bilaterally that they should write me an email instead" (Interview 8). The

results indicate that preferences of other individual team members as well as the emergent team norms exhibit substantial influence on the individual users' behavior.

Network Externalities

Particularly in the early phases of a new collaboration and communication tool, network externalities have been found to play an important role in the literature. Network externalities refers to "the positive external consumption benefits as a result of technology use. That is, a user will benefit more from a technology as the total number of users for this technology increases" (Lou et al. 2000 p. 94). This is echoed in our interviews, particularly for the Chat function, were employees report that "in the long run, MS Teams [Chat] has also become more used by everyone and therefore more useful" (Interview 6). This seems to be consistent among employees who appreciate the fact that many colleagues can be reliably reached through MS Teams. This seems to be a personal preference, where "some people are available basically until they go to bed" and others are not. "If I don't expect to get an immediate response from someone via Teams Chat, I rather use email to contact them", reports interviewee 3. Better reachability became especially evident in T3, when more people started actively using MS Teams and could be reliably reached: "I started to use the Call function with the video functionality to start interacting with people. Before that time, I would have probably used the Chat" (Interview 10). "I now assume that the other person is sitting in front of the computer and I just try to call [via MS Teams]" (Interview 3). We conclude that with an increased use by the organization and reaching a perceived critical mass (Lou et al. 2000), a feature for communication and collaboration gains value for the individual, as colleagues can be reached more quickly and reliably.

Organization

Some interviewees mention that they were not able to use all MS Teams features: "because we were the last to be upgraded to Windows 10" (Interview 5). This represents a lack of technology-facilitating conditions, which refer to technical compatibility issues (Brown et al. 2010). The same interviewee reported that the team "[has] no microphone and no headset here at work". Yet, during COVID-19 it technical support helped them overcome barriers for use: "I have the incredible luxury of having the IT department at my side, explaining it to me and setting it up over hours" (Interview 5). Thus, we identify resource-facilitating conditions as a second influencing factor regarding the organization, that relate to the availability of time, money, and infrastructure (Brown et al. 2010).

Habit

Lastly, we identify habit as a factor influencing use. Habit plays an important role in post-adoption literature (e.g., Benlian 2015; Jasperson et al. 2005) and is "the extent to which people tend to perform behaviors automatically because of learning" (Limayem et al. 2007 p.705). In our interviews, habitual use of other tools is mentioned as a factor preventing the use of single features of MS Teams. One interviewee for example states: "Among part-time employees, it is often the case that people simply send text messages via WhatsApp. [...] Why should I get used to [MS Teams Chat] if I am already used to WhatsApp?" (Interview 6). Thus, we find evidence that habitual use of other tools prevents the post-adoptive use of MS Teams features.

3.2.5.2. Novel Situations as a Stimulus for Post-Adoptive Use

Habit is identified as a factor influencing feature use in post-adoption. This is congruent with previous literature: "During periods of non-reflective, post-adoptive behavior, use history as habit becomes the dominant predictor of an individual's post-adoptive behavior" (Jasperson et al. (2005). Thus, and in line with Venkatesh et al. (2012) and Jasperson et al. (2005), we distinguish between intentional and habitual use behavior in the following. However, as we observe users switching between clusters, we argue that such habits can be broken and lead to a change in behavior. Changes happen when individuals deliberately think about their use, change their cognition and turn to new behaviors. Asking interviewees about changes in their feature use, we found that users change their post-adoptive behaviors if one or more communication and collaboration characteristic changes substantially, causing a novel situation.

Impact of COVID-19

Interviewees report that COVID-19 led them to reassess their current use of digital communication and collaboration tools. "Every exchange in person is now done with [MS Teams] Chat, every telephone call is now done with [MS Teams] Call" (Interview 3). We find evidence that the circumstances surrounding COVID-19 have led to the disruption of habitualized behavior by triggering cognitive processes and technology sensemaking. This was reflected in some interviews: "With the start of the work from home period, I thought about the opportunities MS Teams provides for my digital work environment" (Interview 10). We proceed to analyze to outline the novel situations caused by COVID-19 in more detail.

Congruent with quantitative findings, most respondents reply that they used MS Teams features more intensely once the lockdown due to COVID-19 caused them to work from home. This is because the social-distancing measures made in-person communication unavailable. Interviewees state that they meet the increased need for digital communication with increased MS Teams use, preferring MS Teams and its features over other alternatives such as email, WhatsApp, Skype for Business, or Zoom. Especially Meetings were found to increase substantially during COVID-19, even for passive user. We attribute this to the fact that Video is the second richest medium if in-person meetings are unavailable.

Further, during COVID-19 new team norms regarding the digital communication and collaboration evolved that changed the way teams interact and which features they used and thus, reinforced post-adoption of MS Teams.

Also, a substantial increase in network externalities seems to have amplified the development during COVID-19. Multiple employees report that they started to use features differently because more people were better reachable with MS Teams when they worked from home. This not only holds for employees working from home themselves, but even when they are in the office and a large share of their colleagues work from home.

Also, we found increased organizational support and investments in digital infrastructure to influence post-adoption of MS Teams during COVID-19. Technical staff provided help for employees to cope with the new technical challenges. Yet, even though the need for digital communication was pressing and all other features increased in use counts, Team Chat did not increase during COVID-19. A lack of facilitating conditions in the home office during COVID-19, for example technical infrastructure, was an inhibitor of use in those cases.

Changing Use Behavior Prior to COVID-19

Within our interviews, we identify that such novel situations can be the result of other changes too. For example, a change in task (which is most often brought upon by a change of hierarchical position) leads to a different feature use: “With the change in position, I obtained new tasks and so, I changed the way I communicated” (Interview 3). Also, with the change of team, the feature use reportedly frequently changes: “Recently I have changed the team and since then I also use the Team Chat function, because the new team uses it to communicate” (Interview 9). Similarly, a change in facilitating conditions is found as a factor changing post-adoptive behavior. Interviewee 4 report that he “had to

wait for the next update [on his computer] to be able to install MS Teams". Until then, he reports: "I used it online in the browser, but not very active because I didn't find it very user-friendly. But as soon as the software was on my computer, I started to use MS Teams chats very quickly".

Conscious processing leading to the reflection of use behavior is technology sensemaking and generally occurs as a result of a stimulus (Jasperson et al. 2005). Interviewee 10 relates to this deliberate process: "I also evaluated which kind of communication I will use MS Teams for and for which communication I will stay with the old tools". We consider our results evidence that changes in the exogenous variables represent novel situations and result in altered use behavior and broken habits.

3.2.5.3. Model Synthesis

Summarizing our findings, we conclude that many established constructs of technology use are relevant drivers influencing post-adoptive use of collaboration and communication tools on a feature-level. Constructs identified within our coding process could be mainly summarized under the main drivers proposed by UTAUT: performance expectancy, effort expectancy, facilitating conditions and social influence (Venkatesh et al. 2003). Other factors have been brought forward in collaboration-specific work on IS use (Brown et al. 2010). Additionally, we identified habit which is an important factor in post-adoption literature (Jasperson et al. 2005) and network externalities to extend upon it (Lou et al. 2000). Further, we investigated drivers for changes in feature use and found that a change in the exogenous factors can create novel situation which induce technology sensemaking. In accordance with Jasperson et al. (2005), this leads to a reassessment of habitual use and a potential change in use. Based on our findings, we propose the following model (Figure 3.2-1).

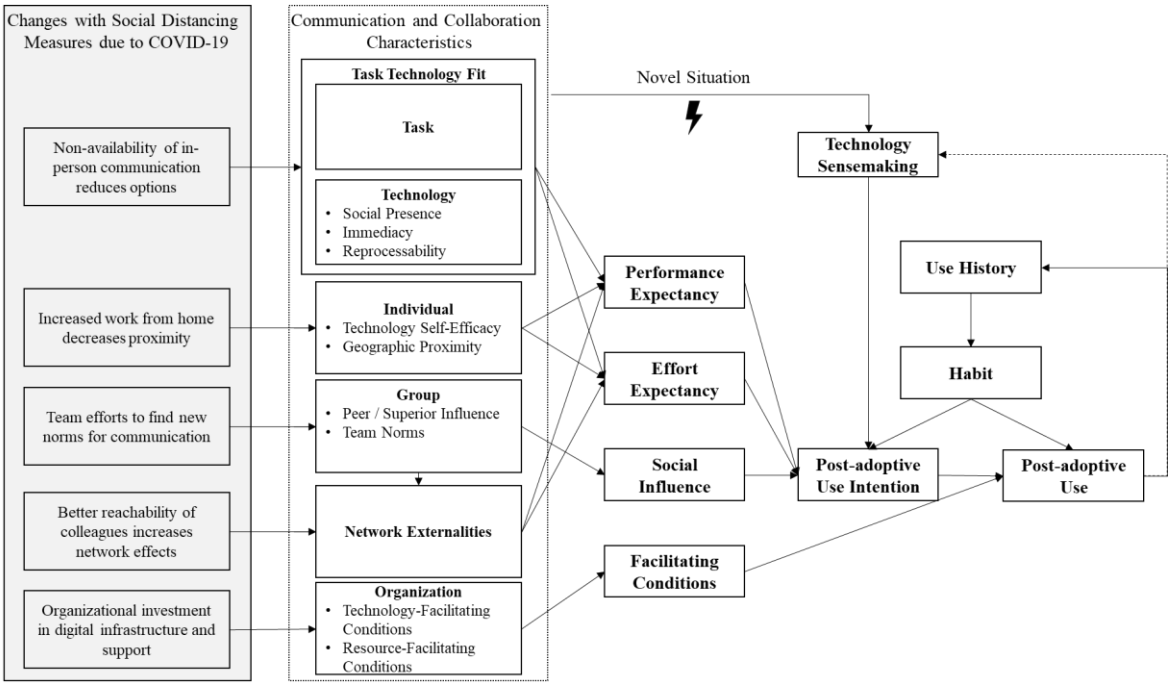

Figure 3.2-1: Proposed Model for Post-Adoptive Use of Communication and Collaboration Technology[4]

3.2.6. Discussion

This paper examines post-adoptive feature use behavior in communication and collaboration tools and the influence of COVID-19. In doing so, it addresses the need to gain a better understanding of post-adoptive use (Bagayogo et al. 2014; Benlian 2015). We aim to learn from the external shock of COVID-19, understand its effects, and derive insights regarding what post-adoptive use of communication and collaboration tools will translate to the new normal. In the following, we discuss our findings and integrate the qualitative and quantitative results by providing meta-inferences (Venkatesh et al. 2013; Venkatesh et al. 2016a).

3.2.6.1. Empirical Contributions

The results of our quantitative analysis challenge the existing presumption that post-adoptive use growth rates decrease over time (Benlian 2015), at least with external shocks. Our findings suggest that feature use behavior varies across individuals and within individuals over time. Between individuals the differences can be attributed in part to different hierarchical positions and, thus, different communication and collaboration tasks.

[4] Some relationships between constructs are only superficially based on user interviews. We rely on previous research to derive them (e.g., Brown et al.2010; Jasperson et al.2005; Lou et al.2000)

Furthermore, we find that feature use behavior varies over time within users. This supports prior findings (e.g., Bagayogo et al. 2014; Jasperson et al. 2005; Kim and Malhotra 2005).

Putting together both strands of analysis, we generate a deeper understanding of determinants for post-adoptive feature use. We identified several factors influencing the breadth and depth of individual feature use. Congruent with previous literature that accepts viewing post-adoption - where additional information about a technology exists - in the larger context of IS use, UTAUT factors remain relevant (Jasperson et al. 2005).

Yet, congruent with previous research we find additional exogenous variables to drive use decisions. Factors like task, group, and the organizational environment are the cornerstone for determining communication and collaboration behavior between users. Communication-intense tasks include coordination activities, quick decisions, and gathering of information. Different tasks require different kinds of communication and therefore, the use of different digital media to best solve the task at hand (Goodhue and Thompson 1995). This is congruent with our quantitative findings where we observe a strong relationship between the hierarchical position and use behavior. These observations are congruent with work on media choice (Daft and Lengel 1986), media synchronicity theory (Daft and Lengel 1986; Dennis and Kinney 1998; Dennis and Valacich 1999) and Task-Technology-Fit (Goodhue and Thompson 1995).

Potentially even more interesting from a research perspective are the deliberate decisions against the use during COVID-19. We find that several hierarchical positions did not change their behavior substantially. These are mainly Administrative Employees and Heads of Departments. Firstly, for Administrative Employees, this is often because their work does not require extensive amounts of coordination, but rather record and documentation of their communication (e.g., for scheduling appointments). They predominantly use email for those purposes. Secondly, Heads of Departments often deliberately refrain from using Private Chat, because of the immediacy of the feature that they do not desire as they are in (digital) meetings for most of the day. Thus, the immediacy of feedback inherent in the feature overwhelms them. They rather push towards the use of asynchronous media, such as email. This is also congruent with media synchronicity theory by Dennis et al. (2008) who stated that managers tend to use email for conveying information.

Prior studies on IS use, particularly regarding communication and collaboration, often only investigated the influence of static factors on static technology use. Yet, to the best of our knowledge, the reasons and effects of drastic changes in use have not been considered so far. Thus, our results add to the scientific body of knowledge by showing that circumstances altering influencing factors of IS use can lead to technology sensemaking and induce a major change in use behavior. Without this cognitive re-evaluation, the resulting changes in one factor would influence user behavior only marginally. However, in our study, they are reported to be triggering conditions for an extensive re-evaluation of the use behavior that goes far beyond such marginal changes. This is underscored by the observation that the changes in use behavior go beyond the organizational upward trends in the different phases of IS use. The strongest evidence exists regarding changes in task, team, and geographic proximity. We consider this an empirical contribution that challenges existing views (Ågerfalk 2014).

In line with research on post-adoption, we find habitual use to play an important role in determining use behavior (e.g., Venkatesh et al. 2012). Changes in habitual use can be deliberately altered as a result of technology sensemaking (Jasperson et al. 2005). Technology sensemaking is a re-evaluation of current use behavior (Jasperson et al. 2005). Our interviews revealed that changes in use behavior can be induced by novel situations. This is in line with Griffith (1999), who finds that a novel situation presents triggering conditions for individual sensemaking. For example, we find that new tasks, new teams, or a change in proximity often lead to a change in use. Building on existing literature, we argue that the cognitive processes following technology sensemaking are induced by the change in the exogenous factors identified in this study. This means that changes in those factors do not only marginally influence post-adoptive use but can also trigger sensemaking.

3.2.6.2. Theoretical Contributions

Based closely on our empirical contributions, we derive the following theoretical contributions. Through the combination of quantitative and qualitative data, we are able to derive rich insights on the reasons for use of communication and collaboration technology. We build a model that is able to explain the drastic changes in use behavior due to COVID-19. This model combines previous literature streams regarding communication and collaboration technology, IS acceptance and use, and post-adoptive use.

This model consists of three elements: First, congruent with the work of Brown et al. (2010), we find communication and collaboration characteristics to have a strong influence on use decisions. We extend those characteristics through network externalities (Sykes and Venkatesh 2017) and a highly individual judgement of the fit between task and technology (Goodhue and Thompson 1995). Secondly, classical factors of technology acceptance (like the ones known from UTAUT) mediate the relationships between these characteristics and the use intention through well-known variables from the IS use context (Brown et al. 2010). Thirdly, we find that non-reflective habitual use based on prior use history is a strong determinant of use (Jasperson et al. 2005). Yet, deliberate changes in use behavior through technology sensemaking can be triggered as a result of novel situations. Such situations can occur from a change in one or more of the communication and collaboration characteristics.

Our model's implications regarding our research question are fourfold: First, it helps us understand how changes in heterogenous individual COVID-19 user behavior came to be. In the scenario under investigation in this study, it helps us to explain why some user groups did not use communication and collaborations features, while others did. It could potentially also explain differences between organizations, for example where tasks and available technology are different, or where the critical mass of a tool was not reached.

Second, COVID-19 will most likely not have been the last external shock. Other epidemics or catastrophes, as well as organization-specific shocks such as mergers and acquisitions, or an expansion resulting in distributed locations could create similar situations. The model will help analyze and potentially predict user behavior in such situations.

Third, even without external shocks, the model helps to understand the interplay of existing theories in post-adoptive communication and collaboration use. For example, we find evidence that changes in teams and positions create similar situations, where employees re-evaluate and potentially change their use behavior.

Fourth, the model helps us anticipate the use behavior in what has been called a "new normal" after the pandemic (Kelly 2020). It provides a structure on how to assess the new normal based on different expectations on how the variables will change. We proceed to present a perspective of the new normal as one estimation based on our model while recognizing that other perspectives are valid as well.

3.2.6.3. Perspective on the New Normal

It will be interesting to see whether the observed changes in user behavior stick after obligatory work from home, or if users fall back into previous routines. Building on our proposed model, we provide a perspective on the new normal which we discuss along its constructs. Based on our findings during COVID-19, we are convinced that there will be a new normal that manifests itself in altered post-adoptive feature use.

Regarding habit, the new normal after COVID-19 will be a new situation that leads employees to technology sensemaking and a deliberate decision about how to use communication and collaboration technology. If our assessment is correct, users will again re-evaluate their behavior in the wake of the new situation and break with the habits formed during COVID-19 to some extent. New technology sensemaking will be based on the full range of available ways to communicate and collaborate, which includes face-to-face interactions. New intention will likely differ both from the old normal as well as from the current COVID-19 situation.

In terms of intentional use, we first assume that tasks will not change substantially in the new normal. However, COVID-19 brought major investments and changes regarding technology, and the availability of those systems will prevail. For example, MS is constantly adding functionalities to Teams that foster collaboration, such as break-out rooms and noise reduction, and announced functionalities that will help employees maintain productivity and well-being while working from home, such as scheduling of breaks and virtual commutes (Schafer 2020). Furthermore, in-person communication will become increasingly available again, which extends the options to choose from. Based on our interviews, users of the organization under investigation will continue their use of Private Chat for coordinative tasks, to gather information, and to make quick decisions. For more creative tasks that require more richness, users are likely to revert to in-person meetings. For tasks that require asynchronous communication and documentation more formal digital tools, such as email, will be used. Lastly, it is less clear if Teams Calls will continue to substitute phone calls despite the increased ease of use, should reachability decrease with more people working in the office.

Technology self-efficacy increased for many employees who were increasingly dependent on using digital communication and collaboration technologies. Thus, we predict that self-efficacy will remain higher than before COVID-19 or increase further.

Geographical proximity was drastically reduced due to social distancing measures. In the new normal, we are convinced that there will be a balance somewhere in between the two extremes with working remotely remaining more common than prior to the pandemic. As the use of digital tools for communication and collaboration has proven to work well and people are increasingly getting used to the tools, travelling for internal business meetings is likely to reduce.

Regarding peer influence, the new normal may be driven by more pressure to use specific tools or features when peers are working remotely compared to the old normal. However, based on anecdotal evidence we assume that superiors will be more open towards working remotely and using digital communication and collaboration tool with less physical presence required. Many team norms have changed during COVID-19, with best practices being discussed and the emergence of new norms regarding working and communicating virtually. We thus think that these new team norms will still be relevant in the new normal and support the use of digital communication and collaboration tools.

Regarding network externalities, the critical mass has likely been superseded during COVID-19. Hence, in that regard we are already observing the new normal.

Facilitating conditions have improved. Many organizations have rapidly created infrastructures and technical support to help employees cope with the challenges of remote work. We think that this will be somewhat scaled back in the new normal but remain better compared to the old normal.

Thus, in summary we expect that a changed habitual post-adoptive use as well as an increased use intention will lead to a new normal which is characterized by a substantial increase in digital communication and collaboration, even when the effects of COVID-19 are lessened in the long run.

3.2.6.4. Managerial Implications

The managerial implications derived from our research are threefold and go hand in hand with our theoretical contributions.

First, our model assists practitioners to be prepared and react quickly if shocks occur. It provides a guideline how companies can leverage novel situations to break habits and trigger new use behaviors driven by a stimulus, which do not have to be pandemics but can also be mergers or the opening of a new location for example. Certainly, we do not

suggest creating such situations artificially, but to take advantage of them, by stimulating and supporting the technology sensemaking processes that take place as a result of the change of situation. As our model indicates, organizations can act on an individual, group, and organizational level. They can for example foster individual technology self-efficacy by offering trainings, foster the development of new team norms regarding communication and collaboration, or provide necessary personal and monetary resources as well as compatible technology equipment to assist in the transformation. An example for the applicability of those recommendations is that MS has announced the introduction of a functionality that will allow managers to see after-hours collaboration norms for their teams (Schafer 2020).

Second, even if there is no such external shock, companies can use the model to identify potential factors that can induce technology sensemaking and lead to altered post-adoptive behaviors. Aiming to influence post-adoptive communication and collaboration behavior, companies should be aware that a change in the portfolio of tasks, a change of the role in the organization, the relocation of employees, or change of geographical proximity through work from home, or by setting up distributed teams will induce novel situations. It is essential to support employees in these circumstances and help them in their transition as they question old habits and form new intentions.

Third, our analysis provides underlying factors that help to understand new post-adoptive behaviors and its triggers. This will help organizations cope with the new normal, in a currently insecure and dynamic environment regarding digital communication and collaboration. It will be necessary for organizations to adjust technologically and organizationally to cope with this new normal. Our model provides a perspective on how the new normal may be different after COVID-19. We believe it shows that the drastic changes in use behavior during COVID-19 can be explained rationally in many cases, which alleviates some of the uncertainty surrounding the new normal.

Following our perspective on the new normal, organizations should evaluate the tool portfolio to meet employees' demands and may in some settings decrease redundancy of tools to avoid complexity. Additionally, they should consider providing the necessary organizational support to facilitate adjustments to the new normal and supporting the creation of new team norms by being open to new team set-ups and provide flexibility. Even if

this perspective and measures proves inaccurate for specific organizations, our model offers a structure on how to assess the new normal and consider measures to foster adequate post-adoptive use.

3.2.7. Limitations and Further Research

This work comes with some limitations which concur with alleys for future research. Regarding limitations, our study is firstly based on only one organization and, thus, on a limited sample size. The organization under investigation is rather tech savvy and operates in a knowledge-intense domain, which speaks for a high usefulness of the tools under investigation. Hence, our data may be limited in terms of generalizability to other organizational contexts. Further research may include other cases and different types of organizations as well to account for organization-specific differences.

Secondly, the data available to us has some limitations. This is because only use counts for four features were available. Thus, the study falls short of considering other main features offered in MS Teams, such as MS Planner. Further, the features considered in this paper aggregate quite broad sets of functions. While the literature suggests that parsimonious operationalization creates consistent empirical results, a more fine-grained conceptualization of features could enrich our understanding of feature use in the future.

Thirdly, the time span of our analysis only includes data until April 2020. Thus, we encourage further research to regard post-adoptive user behavior after the peak of COVID-19 as well to identify long-term changes in user behavior. Such insights will further be helpful to validate our view on the new normal.

It will be interesting to see what habits will remain and which ones will again be broken after the forced work from home due to COVID-19. Further, we attribute to further research to empirically test our proposed model and challenge the relationships and factors deduced from our analysis.

3.2.8. Conclusion

COVID-19 drastically changed the way organizations communicate and collaborate coming with a sudden surge in digital communication and collaboration tools. As researchers and practitioners predict remote working will likely become the new normal in organizations, a detailed understanding on user behavior and its drivers in post-adoption is needed. We address this need by investigating the heterogeneous post-adoptive user behavior

within an organization. We were able to explain the heterogeneity through several established factors from technology acceptance models. Additionally, we identify several exogenous factors from the realm of communication and collaboration, which determine user behavior. Task-technology-fit, team, and network externalities are such factors. Changes in behavior during COVID-19 are caused by a change in these influencing factors but are amplified through deliberate technology sensemaking induced by the novel situation. Thus, the work from home policy due to COVID-19 broke habits, created new intentions, and changed use behavior. With our research, we alleviate some of the uncertainty surrounding the new normal by outlining that the increases in use behavior during COVID-19 can be rationally explained. While the gathered experience will surely translate to the new normal, technology sensemaking will likely take place once more when the situation changes again. Based on our model, we developed a perspective on what the new normal of use behavior regarding communication and collaboration tools will look like and suggest avenues for organizations to cope with it.

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Appendix 3.2/A – Movements Between Clusters Over Time

		T2						
	C	**1**	**2**	**3**	**4**	**5**	**6**	**7**
T1	**1**	**14**	3	8	2	0	0	0
	2	3	**8**	4	3	5	0	0
	3	2	3	**6**	6	7	0	5
	4	1	1	2	**6**	5	5	3
	5	0	0	0	1	**7**	0	2
	6	0	1	4	4	2	**6**	4
	7	0	0	0	0	6	4	**15**

		T3						
	C	**1**	**2**	**3**	**4**	**5**	**6**	**7**
T2	**1**	**6**	4	4	5	3	0	0
	2	0	**1**	7	3	5	3	1
	3	1	0	**5**	12	3	7	0
	4	1	0	2	**9**	1	4	7
	5	2	2	5	5	**5**	2	12
	6	0	0	0	2	0	**8**	6
	7	0	0	1	1	3	2	**23**

Appendix 3.2/B – Constructs Driving Feature Use Behavior and Exemplary Interview Quotes

Factor	Example Quotes	Hierarchical Position	Interview
Social Presence (-)	"MS Teams is no adequate substitute for walking by the office."	Assistant to Head of Department	4
	"Communication is also about personal interaction, which can hardly be replaced by a video conference and is also very important from a social aspect".	Head of Department	8
	“With Teams calls in comparison to the telephone you have your hands free and at the same time you still see each other.”	Administrative Employee	5
Immediacy (-)	"I try to avoid MS Teams Chat as there is already so much traffic with various email accounts."	Head of Department	8
Reprocessability (-)	“Due to the task, [the team] communicates mainly via mail since everyone has access and […] can see prior messages.”	Administrative Employee	5
Computer Self-Efficacy (+)	"For me, the first week with MS Teams was chaos, but that's probably also due to my technical know-how. [...] If you don't have to deal with it, then you don't do it. For us [older people], there is a greater entry barrier than for the young people.”	Administrative Employee	5
Geographic Proximity (-)	“Even if there was no COVID-19 and remote work, cross-location collaboration would have been done via MS Teams.”	Full-time employee	7
	“MS Teams was used for all meetings where it was clear from the outset that they were not in the same location.”	Head of Support Function	3
Peer Influence (+)	“Often, I am the one that initially writes to people via MS Teams.”	Assistant to Head of Department	4
	“When I still got messages in Skype for Business, I always answered to write in MS Teams [Chat].”	Head of Support Function	2
Superior Influence (+)	“I would never write an informal message to a Head of Department. Therefore, MS Teams is also less used for this interaction".	Head of Support Function	2
	"Sometimes young employees wrote to me via MS Teams, so I pointed out bilaterally that they should write me an email instead"	Head of Department	8
	“My boss did not like to communicate via WhatsApp, therefore, we quickly moved our communication to MS Teams.”	Assistant to Head of Department	4

Team Norms (+)	**"Ultimately, it is a team decision through which feature to communicate."**	**Full-time employee**	**7**
	“It is obvious that different teams use MS Teams differently”	Part-time employee	10
	"It depends a lot on which team you're on, and how you communicate within that team."	Part-time employee	6
	"The use of Team Chat depends on the team. Some teams use the feature and some teams do not. So, my use changes also with the teams I’m in.”	Assistant to Head of Department	4
	"The use of different features depends heavily on the team. [...] The more intensively it is used in the team, the faster you can get used to the tool."	Part-time employee	9
Network Externalities (+)	“In the long run, MS Teams [Chat] has become more used by everyone and therefore, more useful.”	Part-time employee	6
	"Skype for Business was not used so intensively because you couldn't be sure that the messages would be read by the person or that they would be online. With MS Teams [Chat], I can rely on the messages being and received and read".	Assistant to Head of Department	4
	“Additionally, it was very important to get to know how many people of the organization move together with me to MS Teams. I will use the communication platform which is used by most of the employees”	Part-time employee	10
	“Some people are available basically until they go to bed”. If I don’t expect to get an immediate response from someone via Teams Chat, I rather use email to contact them”	Head of Support Function	3
Task-Technology-Fit (+)	"For knowledge-intensive tasks you cannot chat, you must use the Call function. For coordination tasks you can chat or call."	Full-time employee	7
	“The Chat is very well suited to gather information for an informal question [and] for making quick decisions in the Chat” (Interview 2).	Head of Support function	2
	"Collecting information works very well via Chat in MS Teams" [...] MS Teams is also very well suited for information exchange, where no record is needed "	Assistant to Head of Department	4
	"If several people interact through a Private Chat, it usually becomes confusing, which is why Team Chat is much better suited for this".	Part-time employee	9
	"MS Teams is also great for making quick decisions via Chat. Chat messages replace a phone call or a knock at the door much more than an email. The chat is also very well suited for gathering information through informal questions."	Head of Support Function	2

Performance Expectancy (+)	**"MS Teams [Chat] is simply a much faster medium than email."**	**Full-time employee**	**7**
	“MS Teams does not create direct push notifications in Team Chat”	Full-time employee	7
	“The sort function and findability of emails is completely missing in MS Teams [Chat] and a search function to find things in a structured way. These functions are very important for my work."	Head of Department	8
	“By using emails we can store and sort them and are able to look at what we have written. This is not possible with MS Teams in such a way.”	Administrative Employee	5
	"With the app of MS Teams you are almost always reachable."	Head of Support Function	3
	“The benefit of Chat messages is very large. In Teams, you can work together with more than one person in a meaningful way".	Head of Support Function	2
Effort Expectancy (-)	"In case I need to look up the phone number in the address book, I rather use MS Teams Calls"	Head of Department	8
	“It is very practical that the MS Teams Meetings interact directly with Outlook and you can see the appointments in Outlook immediately"	Head of Support Function	3
	“For everything where the phone was previously used, Teams Calls are now used. This is very practical because I no longer have to look up the phone number”	Head of Support Function	3
	“Team Channels need to be set up by the technical support, which is rather annoying. It is faster to just use Private Chat.”	Head of Support Function	1
Technology-Facilitating Conditions (+)	"Because we have no microphone and no headset here at work and we were the last to be upgraded to Windows 10."	Administrative employee	5
	“Only after we were able to change Team Chat privacy, we started to use this functionality.”	Head of Support Function	2
Resource-Facilitating Conditions (+)	“I have the incredible luxury of having the IT department at my side, explaining it to me and setting it up over hours”	Administrative Employee	5
Habit (-)	"Which tool is ultimately used is based on habit. The Head of Departments are used to simply writing emails"	Full-time employee	7
	"Among part-time employees, it is often the case that people simply send text messages via WhatsApp. [...] Why should I get used to [MS Teams Chat] if I'm already used to WhatsApp?"	Part-time employee	6
	"Among part-time employees, people were better reached via WhatsApp.”	Part-time employee	6
	“Initially I still sent Meeting invites via Skype – simply out of habit”	Head of Support Function	3

4. Outcomes of the Use of Communication and Collaboration Technology

4.1. The Interplay of Appraisal and Self-Efficacy: Technostress and Remote Working Performance During COVID-19

Abstract

The countermeasures to contain the COVID-19 pandemic have caused employees to work from home. A novel situation in which individuals use information systems (IS) more intensively to stay in touch with co-workers emerged. This provides opportunities to investigate individual differences in the appraisal of IS use situations and coincides with recent calls for research aiming for conceptual clarification in technostress research and the investigation of the positive side of technostress. Among the overlapping constructs are self-efficacy and IS use appraisal. We conduct an empirical study with 1,553 German employees to investigate these relationships and the positive and negative outcomes during the COVID-19 pandemic. We find that IS use appraisal and remote working self-efficacy are interconnected, yet different constructs that may be affected differently. We find that self-efficacy is related to challenge IS use appraisal, rather than hindrance IS use appraisal. Further, challenge IS use appraisal is a driver for performance in a remote working environment. We conclude that there are stressful aspects of IS use which are not influenced the individual's believe in his or her own abilities appraisal. Our study emphasizes the important role of remote working self-efficacy and IS use appraisal to mitigate techno-distress and increase performance during remote work.

Keywords: IS use, cognitive appraisal, COVID-19, self-efficacy, remote work

Authors: Manfred Schoch, M.Sc.

Status: Working paper

4.1.1. Introduction

To contain the COVID-19 pandemic, many organizations have advised their employees to work from home. Studies surveying the German workforce indicate that more than 25% worked from home during the height of the first wave of the pandemic in March 2020 (Möhring et al. 2020). This number was likely higher for knowledge-intense industries. In an effort to maintain communication and collaboration between employees in this physically distanced work environment, many organizations and employees reverted to digital communication and collaboration tools, such as Microsoft Teams or Zoom. As a result, both sales and usage time of such tools grew exponentially (Spataro 2020).

The physical distancing measures came with many potential sources for psychological stress and strain, such as reduced social contacts, and increased family demands from a lack of childcare options. The use of digital technologies was both a blessing and a curse for many in this time. While it enabled individuals to stay in touch with co-workers, family, and friends, it also confronted many with new IT issues. Such issues include erecting and maintaining remote working infrastructure, using new technologies, or using existing technologies for new purposes. Such novel circumstances are a potential source of stress for some (Ellsworth and Scherer 2003). Early scientific contributions have investigated the effect of both the physical distancing measures themselves and the increased IS use on psychological health (e.g. Vaziri et al. 2020). Yet, individual differences in the perception of such stressful situations and ways to mitigate the adverse consequences are important avenues for further research.

COVID-19 came at a time, at which researchers have begun to recognize that technostress research has been primarily concerned with the negative side of stress (Tarafdar et al. 2019). Few contributions have already investigated the positive side of technostress. These studies have advanced our knowledge on technostress through models that differentiate between challenge stressors and hindrance stressors (Benlian 2020; Califf et al. 2020). This is congruent with stress research from the realm of occupational psychology. There, many studies have similarly differentiated between challenge and hindrance stressors (Cavanaugh et al. 2000). Yet, organizational psychologists have recently suggested that analyses that recognize individual differences in the appraisal of such situations may be fruitful. This puts an emphasis on diversity and the analysis of whether different individuals react differently to stress. Underlying is an individual assessment of the situations that explains different individual responses in objectively equal environments (Krohne 2001). In the context of IS use, appraisal may include the evaluation of IS as a

challenging or motivating factor on the one hand, or a threat and disturbing factor on the other hand (Tarafdar et al. 2019).

A recent call for research inquiries has proposed that low technology self-efficacy could be a driver of threat appraisals in the context of IS use (Tarafdar et al. 2019). Congruently, seminal work from psychology has found that self-efficacy and appraisal are different phenomena that affect each other (Jerusalem and Schwarzer 2010). While self-efficacy is a characteristic of the individual that is built through prior personal accomplishments and experiences, appraisal may vary between situations and within situations over time. This is because appraisal is a cognition that may change continuously as an individual interacts with the environment (Jerusalem and Schwarzer 2010).

In this study, we investigate the impact that the individual IS use appraisal has on the remote working situation during the COVID-19 pandemic and the increased use of digital communication technology that came with it. We further analyze how such appraisals may be influenced and draw conclusions on how further research on IS can profit from these findings. Thus, the paper at hand investigates the following research question:

What relationship do individual appraisal and self-efficacy have with techno-distress and performance in times of remote work?

The theoretical implications of this work are threefold: First, we advance the current knowledge regarding the relationship between self-efficacy and IS use appraisal. We show that self-efficacy affects challenge IS use appraisal rather than hindrance IS use appraisal. This suggests that hindrance IS use appraisal is not related to the individuals' resources and, thus, has a different root that warrants further research. Second, we show that there is a positive relationship between each of the two antecedents low remote working self-efficacy and hindrance IS use appraisal with technostress experienced during remote work brought about by the COVID-19 pandemic. Third, we portrait remote working self-efficacy and challenge IS use appraisal as important antecedents of performance during remote work.

4.1.2. Theoretical Background

Stress due to digital technologies has a long history. It was first described as a failure of employees to adapt to modern office technology. A more recent definition of technostress is: "stress that users experience as a result of their use of IS in the organizational context" (Tarafdar et al. 2015, p. 103). As such, technostress is a dark side phenomenon that has focused on characteristics of technology that its users consider to be a threat (Tarafdar et al. 2019). Further,

technostress is "a process that involves a transaction between the individual and the environment" (Tarafdar et al. 2019, p. 8). We depict a conceptual model of this process in Figure 4.1-1. There may be other conceptualizations, for example, focusing on addiction (Hu et al. 2021), but this work on remote work during COVID-19 focuses on organizational IS use.

According to theory, the root of technostress is considered to be IS use (Ayyagari et al. 2011). Therefore, IS use variables have been included directly into some models of technostress studies. For example, Ayyagari et al. (2011) include IS use as a control variable, Stich et al. (2019) investigate email use as a driver of stress, and Maier et al. (2015a) find an effect of social network usage on stress. Similarly, events that happen during IS use, such as technology-induced interruptions, have been assessed as potential sources of stress (Galluch et al. 2015).

An important question in technostress research is how different individuals experience IS use differently and what individual factors drive the relationship (Tarafdar et al. 2019). Thus, it has been recognized that not all users are similarly affected by the use of IS. What stresses one individual might easily be handled by another. This view emphasizes the role of the individual and allows for differences in how situations are perceived. The cognitive process that explains different individual responses in objectively equal situations is called appraisal (Krohne 2001). Such appraisals can differ between individuals regarding the same stimulus (Smith and Kirby 2011). Relevant appraisal conditions in a work context are considered to be challenge appraisal and hindrance appraisal (LePine et al. 2016; Maier et al. 2021). Lazarus and Launier (1978) describe challenges as situations that provide opportunities to overcome hardship and for growth. This is congruent with the definition of LePine et al. (2016), who consider challenging work conditions to promote personal growth and the fulfillment of work tasks, and hindering work conditions to thwart them.

Depending on the individual appraisal, IS use situations and conditions may be appraised as threatening or hindering. Research has identified such conditions that create stress and summarized them as, for example, invasion, overload, complexity, uncertainty and insecurity (Ragu-Nathan et al. 2008). Their conceptualization and operationalization have an inherent threat or hindrance appraisal and thus measure the negative side of stress (Tarafdar et al. 2019). Thus, the corresponding items measure a misfit between individual resources and situational conditions (Ayyagari et al. 2011). For example, techno-overload occurs when IS forces the individual to work faster and longer than they want. A given number of emails is considered too many when the number exceeds the amount of emails an individual feels confident dealing with (Stich et al. 2019). The exact number of emails that are necessary to create the perception of techno-

overload is highly individual and related to individual factors, such as skills, preferences, or self-efficacy. Technostress-creators as measured by Ragu-Nathan et al. (2008) thus represent a condition after the individual appraisal (cf. Tarafdar et al. 2019).

Individual factors that moderate the relationship between IS use and different appraisals have been investigated regarding technostress. Tarafdar et al. (2019) have summarized existent research on the matter and report that such individual factors include, for example, technology self-efficacy, technology competence, or personality traits (e.g., neuroticism, agreeableness, and extraversion).

The appraisal concept was adapted by occupational psychologists regarding the conditions of work through the Challenge-Hindrance-Framework (Cavanaugh et al. 2000). The appraisal process is implicit in this conceptualization, which recognizes differences on a stimulus level not the individual level (Benlian 2020). Several meta-studies on the Challenge-Hindrance-Framework have been published since and have underscored its relevance to research and practice (Mazzola and Disselhorst 2019; Podsakoff et al. 2007). According to the studies, challenging situations are generally associated with positive outcomes, such as performance, and hindering situations with negative outcomes, such as psychological strain.

More recently, occupational psychologists have started to recognize the importance of a more nuanced differentiation of individual cognitive appraisal (e.g. Searle and Auton 2015), emphasizing the role of the individual within the stress process. Research on technostress has also shifted its focus to a view on technostress that accounts for its positive and negative side. In doing so, it has (explicitly and implicitly) recognized the role of appraisal. For example, different appraisals have been used in studies stating that technology-driven challenge stressors lead to challenge appraisal of certain IS events and thus may result in positive outcomes (e.g., Benlian 2020). In a study concerning healthcare IT, Califf et al. (2020) have categorized positive characteristics of IS use (usefulness) and aspects that facilitate IS use (technology support and facilitating conditions) as challenge stressors – thus these situations were predominantly appraised as challenging between subjects. Congruent with their operationalization, the established technostress-creators have been categorized as hindrance stressors by the study.

Recent conceptual work on technostress has differentiated between techno-distress and techno-eustress on this basis. Techno-distress "embodies the negative stress that individuals face in their use of IS" (Tarafdar et al. 2019, p. 20). It thus involves the individual appraisal of IS use as negative – hindering, threatening, or damaging – and is associated with negative outcomes (Tarafdar et al. 2019). As pointed out, the operationalization of technostress-creators already

involves parts of this techno-distress process, as they have an inherent threat appraisal. Techno-eustress refers to the positive side of stress and involves challenge IS use appraisals and positive outcomes (Tarafdar et al. 2019). The authors further suggest that there may be a relationship between hindrance appraisal with positive outcomes under some circumstances (Tarafdar et al. 2019).

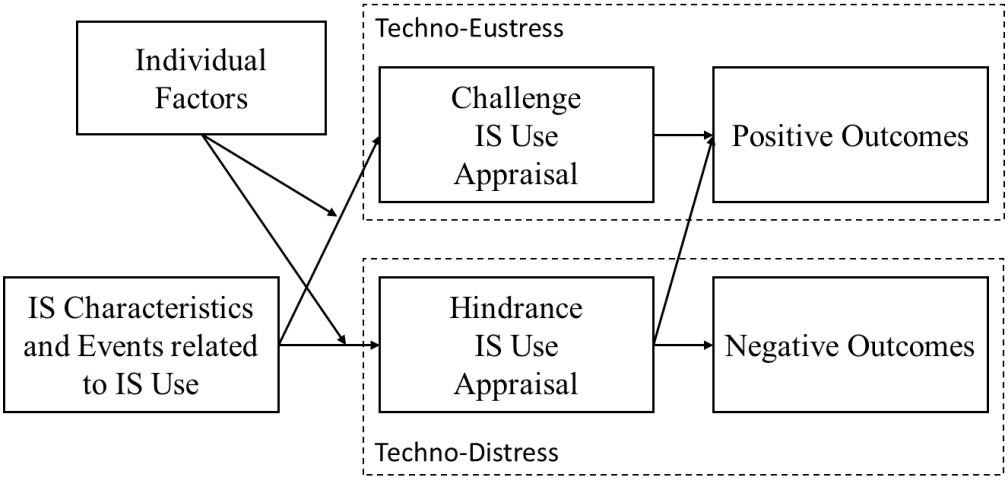


Figure 4.1-1: Conceptual Model, Based on Tarafdar et al. (2019), Maier et al. (2021)

We summarize the current findings and the existing research gap as follows: there have been many studies that have theoretically established and empirically investigated the relationship between IS use and technostress. Research on technostress has investigated several individual aspects that influence the relationship between IS use and the negative side of technostress. Yet, individual differences in IS use appraisal have been suggested as an avenue to advance theoretical knowledge on technostress. In addition, research has acknowledged that there are conceptual issues and overlaps in technostress research that require clarification. Particularly the individual factors that influence IS use appraisals and their relationship with known technostress-creators that have an inherent negative connotation, have seen little attention. In this work, we aim to address these issues. The COVID-19 pandemic has brought many individuals into a novel use situation that they may not have chosen themselves and did not envision before the pandemic. This has led to a novel use situation that provides excellent opportunities for research regarding the perception of technostress and its outcomes.

4.1.3. Hypothesis Development

We propose a research model based on hypotheses derived from the literature. Following the conceptual model from left to right, the research model of this paper comprises IS use for re-

mote work during COVID-19, individual remote working self-efficacy, the role of IS use appraisal, and their influence on techno-distress[5] and performance. A graphical representation of the research model is shown in Figure 4.1-2. In the following, we derive the corresponding hypotheses in detail.

The Influence of Remote Working Self-efficacy

Techno-distress has been characterized as a misfit between situations related to IS use and an individual's personal resources (Ayyagari et al. 2011). It is important to note that this is a construct that captures IS use appraised by the individual user as threatening or damaging (Tarafdar et al. 2019). The conceptualization puts an emphasis on the individuals' ability to deal with the demands imposed by IS use. Thus, and congruent with Tarafdar et al. (2019), individual factors play an important role for technostress. Previous literature has mostly included personal resources, such as general IS problem-solving competences described as digital literacy (Tarafdar et al. 2019) or technology competence (Tarafdar et al. 2015) in work on the perception of techno-distress. Yet, the resources required for remote work have been separately studied in previous works (e.g. Wang and Haggerty 2011). Such resources are broader and include the provision of adequate information by the employer and ways to receive help regarding remote work. To the best of our knowledge, no studies regarding techno-distress have yet included such context-specific measures.

We suggest that remote working self-efficacy affects techno-distress in times of remote work situations such as the ones experienced during the COVID-19 pandemic. Further, the employer can contribute to this sense of self-efficacy through the provision of adequate support and information. This is because individuals who are self-efficacious with IT will know how to operate IS in a healthy manner and are able to prevent or circumvent techno-distress by themselves or with the help of their organization. For example, users can deactivate notifications of their work communication tools to reduce techno-invasion. This is particularly important when close in-person contact with co-workers, and thus social support, is unavailable. Thus, we bring forward the following hypothesis:

H1: Remote working self-efficacy negatively effects techno-distress.

[5] As Hu et al. (2021) point out, it may be problematic to use the word technostress or techno-distress to refer to an outcome and that technostrain may be a better term. Yet, we stay within known terminology in IS research (e.g., Shu et al., 2011) and use techno-distress to refer to the underlying state that users experience as a result of the techno-distress process.

Self-efficacy is a central construct in behavioral research and has been identified as a major driver of performance in occupational psychology and management science. This is because individuals with high self-efficacy compared to individuals with low self-efficacy may be more persistent in problem-solving even if they initially experience hindrances and setbacks (Tims et al. 2014). Analyses in the workplace related to the use of computer hardware and software have confirmed this proposition empirically (Harrison et al. 1997). Thus, we transfer this concept to the context of remote work. For example, if individuals with high remote working self-efficacy encounter a technical issue during videoconferences, they may work persistently to find a workaround or fix the problem, which increases their effectiveness and efficiency in completing the meeting. In turn, this may increase performance. Thus, we hypothesize:

H2: Remote working self-efficacy has a positive effect on performance.

In this paper we extend this existing view on the role of self-efficacy to the context of individual appraisal of IS use. Smith and Kirby (2011) refer to Lazarus and Folkman (1984) and point out that challenge appraisals are more likely when the individual has control over a situation. In other words, the person perceives that it "has the potential to change the circumstances to bring them more in line with his or her desires" (Smith and Kirby 2011, p. 8). This suggests that individual resources, such as remote working self-efficacy, are important antecedents of IS use appraisal. Apart from this theoretical plane, empirical research has shown that there is such a connection between self-efficacy and challenge appraisal but that it is not the same. For example, Jerusalem and Schwarzer (2010) show that over time, individuals with low self-efficacy show different appraisal patterns than individuals with high self-efficacy. They find that individuals with high self-efficacy maintain higher levels of challenge appraisal throughout a task. This exemplifies that while self-efficacy is a characteristic of the individual, appraisal can vary from situation to situation and within situations. Similar indications have been found in technostress literature, where Salo et al. (2018) suggest that a confidence to overcome smartphone failures is essential to positive views on stress. It thus seems intuitive that a high self-efficacy influences challenging IS use appraisal. Jerusalem and Schwarzer (2010) find that the opposite is also true: low self-efficacy is associated with an increase in threat and hindrance appraisals over time. This is congruent with the conceptual work of Tarafdar et al. (2019) who specifically propose that low self-efficacy may be associated with increased threat appraisal (which resembles hindrance appraisal in the work context, as pointed out). We thus conclude that there are several indications for the role of remote working self-efficacy in determining a challenge or hindrance IS use appraisal in times of remote work and hypothesize:

H3a: Remote working self-efficacy has a positive effect on challenge IS use appraisal.

H3b: Remote working self-efficacy has a negative effect on hindrance IS use appraisal.

The Influence of Challenge and Hindrance Appraisal

Several technostress studies have already incorporated challenge and hindrance situations into their models. Califf et al. (2020) categorized technostress-creators and technostress-inhibitors as either challenging or hindering in a mixed methods study in the health care sector. In their study, technostress-creators, such as unreliability, complexity, uncertainty, insecurity, and overload were categorized as hindering. Similarly, Benlian (2020) developed technology-driven challenge and hindrance stressors and found them to confer with challenge and hindrance appraisal. Congruent with these previous results of IS literature, we thus propose that hindrance IS use appraisal will be positively associated with techno-distress (Califf et al. 2020). This is also in line with Tarafdar et al. (2019) who state that known technostress creators have an inherent negative connotation. It thus captures the "technology environment as threatening and the outcomes [as] adverse consequences" (Tarafdar et al. 2019, p. 12). We thus hypothesize:

H5: Hindrance IS use appraisal has a positive effect on techno-distress.

Contrarily, hindrance stressors and hindrance appraisal may hamper performance. This is because such situations provide no opportunity for personal growth or gains, but rather thwart them (Cavanaugh et al. 2000). Research from the realm of occupational psychology has thus found negative relationships between hindrance appraisal and task performance (LePine et al. 2016). Recent meta-studies have confirmed this relationship for the realm of occupational psychology (Mazzola and Disselhorst 2019). Previous work on technostress has suggested that there is a connection between techno-distress and performance (Tarafdar et al. 2015). It is important to note that techno-distress implies a threat or hindrance appraisal (Tarafdar et al. 2019). Other studies have pointed out that the relationship between hindrance appraisal and performance has not been fully understood yet and that different empirical results exist (LePine et al. 2016). We conclude from theoretical conceptualization and empirical results that it is the hindrance appraisal that is causal for effects on performance. Thus, we hypothesize:

H6: Hindrance IS use appraisal has a negative effect on performance.

In contrast, challenge stress provides opportunities for growth and personal gains (LePine et al. 2016). This is because challenge stress may generally be associated with higher motivation and the ability to overcome hurdles (Mazzola and Disselhorst 2019). Recent work on the positive side of technostress has found that characteristics of IS which make them more useful can be

appraised as challenging (Califf et al. 2020). Similarly, Benlian (2020) emphasizes the role of IS for learning and mastering skills in his characterization of technology-driven challenge stressors. In addition, recent work suggests that challenge IS use appraisal leads to innovative use behavior (Maier et al. 2021). In turn, advanced and innovative use behavior has been associated with increased performance (Burton-Jones and Straub 2006). Thus, theory and empirical findings imply that challenge IS use appraisal may be associated with an increase in performance. Hence, we hypothesize:

H7: Challenge IS use appraisal has a positive effect on performance.

Control Variables

The dependent variables in this model may certainly be influenced by other factors, too. Thus, we include IS-related variables and variables related to job stress into the model that have been shown to influence the outcomes. First, higher IS use has been shown to influence technostress. Technostress has been theorized as a consequence of IS use (Ayyagari et al. 2011). Thus, various variables relating to IS use have been included both as explanatory variables (e.g., Maier et al. 2015b; Stich et al. 2019) and control variables (e.g., Ayyagari et al. 2011) in previous studies. Second, a higher workload may increase both technostress (Ayyagari et al. 2011; Stich et al. 2019) and performance (e.g., Lepine et al. 2005).

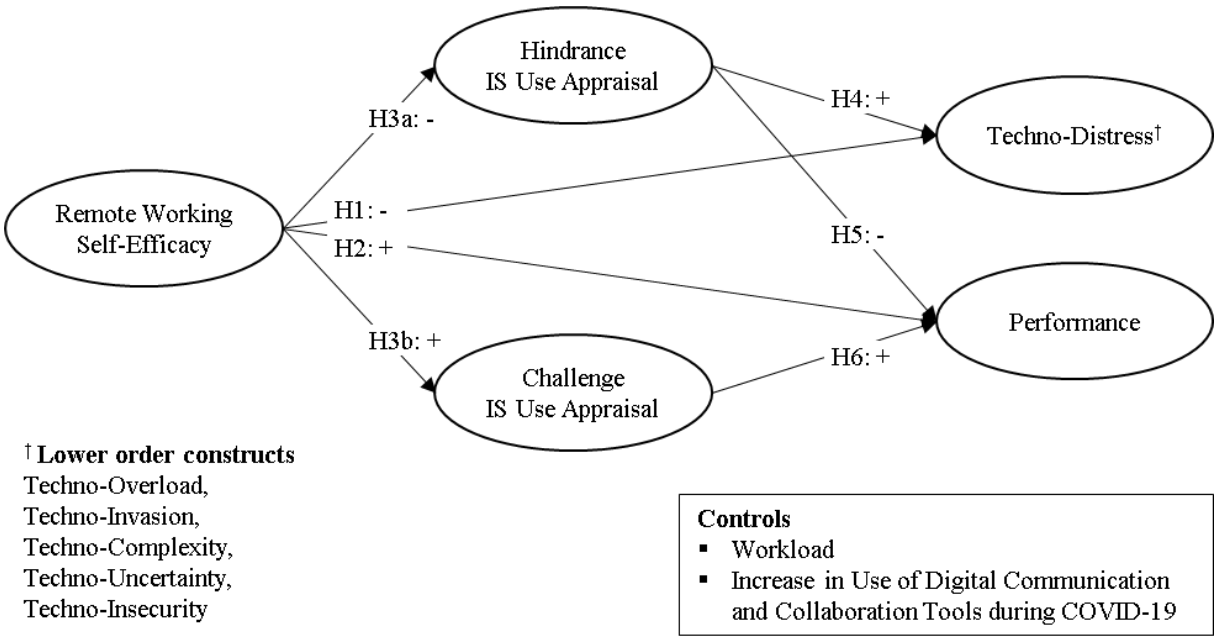


Figure 4.1-2: Research Model of Paper 5

4.1.4. Quantitative Empirical Analysis

4.1.4.1. Survey Design and Procedures

To test the model empirically, we design an online survey. The survey collects data concerning IS use and its consequences during COVID-19. We acquired participants via an external research panel focusing on the German workforce. For their participation, respondents were paid a small incentive. The survey was administered in in May 2020 during the initial COVID-19 lockdown in Germany. Data quality was ensured by evaluating open questions and excluding questionnaires that were completed unrealistically fast. As a result, we collected 1,553 valid responses. We consider this sample largely representative of the German workforce.

We used existing evaluated item scales for our questionnaire, which focused on individual resources regarding the digital workplace, IS use, appraisal, technostress, and performance. For measuring remote working self-efficacy, we use the scale of Wang and Haggerty (2011). For techno-distress, recent literature acknowledges that there are little adequate measures (Hu et al. 2021). We thus use the items from Ragu-Nathan et al. (2008) that measure "stressors appraised by the individual as damaging" (Tarafdar et al. 2019, p. 9) which "create technostress[6] in the organization " (Ragu-Nathan et al. 2008, p. 421) as lower order constructs (LOC). We combine them to a reflective higher order construct (HOC) to capture the underlying construct of techno-distress. For reflective measurement models, the underlying construct is assumed to cause changes in the indicators (e.g., Jarvis et al. 2003). Thus, in the paper at hand, the reflective HOC is assumed to cause changes in the LOCs, which is consistent with Ragu-Nathan et al. (2008). This approach further helps ensure a parsimonious model (Polites et al. 2012). For appraisal, we ask participants to report their appraisal of IS use in general as either challenging or hindering. Congruent with Benlian (2020), we do so using the scales of LePine et al. (2016) adapted to the context of IS. Regarding performance, we use the scale of Frone et al. (1997). For the control variable of workload, we used a COPSOQ III subscale (Burr et al. 2019). All of these measurements are reflective and measured on five-point Likert scales. Regarding the control variable of IS use, we adapted a scale by Venkatesh et al. (2012) to reflect a relative change in use during COVID-19 for email, instant messaging, audio and video communication. This construct is formative and measured on a three-point Likert scale. Appendix A provides an overview of the items.

[6] This important early contribution to technostress uses the term to refer to the negative side of technostress – techno-distress.

4.1.4.2. Results

1,553 participants completed our survey, of which 41.9% are female and 58.1% male. Regarding age, 1.5% were below 25, 15.1% were 25-34, 27.4% were 35-44, 31.2% were 45-54, 24.4% were 55-64, and below 0,5% were 65 and older. We assess the model through structural equation modeling (PLS-SEM) using SmartPLS 3.2. We start with the evaluation of the measurement model before assessing the structural model and testing our hypotheses.

Evaluation of the Measurement Model

Regarding the reflective measurement model, we tested the internal consistency reliability using composite reliability (CR) and Cronbach's Alpha (Alpha). All scales are above 0.7 and below 0.95, which can be regarded satisfactory. For convergent validity, we examine outer loadings and average variance extracted (AVE). Outer loadings are satisfactory because the they all exceed the common threshold of 0.708 (Hair et al. 2017). AVE is above 0.5 in all cases. This indicates convergent validity.

For discriminant validity, we examine each indicator's cross-loadings with all other constructs and find that they are indeed lower than the indicator's outer loadings. Further, we evaluate the heterotrait-monotrait (HTMT) ratios. These are consistently below the threshold of 0.90 (Henseler et al. 2015) for all first-order constructs with a maximum of 0.73 (Techno-Invasion and Techno-Insecurity). Thus, discriminant validity is supported. Table 4.1-1 shows the respective values as well as the means and standard deviations (SD) of the reflective constructs.

	# of Ind.	Mean	SD	Out. Load.	Alpha	CR	AVE
Hindrance IS Use Appraisal	3	2.602	1.182	0.909-0.934	0.910	0.944	0.848
Challenge IS Use Appraisal	3	3.270	1.015	0.864-0.901	0.864	0.917	0.786
Remote Working Self-Efficacy	4	3.582	0.996	0.853-0.918	0.919	0.943	0.805
Performance	4	3.485	1.036	0.854-0.884	0.893	0.925	0.756
Techno-Overload (LOC)	4	2.464	1.221	0.823-0.905	0.899	0.930	0.769
Techno-Invasion (LOC)	3	2.161	1.217	0.809-0.900	0.833	0.900	0.751
Techno-Complexity (LOC)	5	2.177	1.159	0.826-0.901	0.918	0.938	0.753
Techno-Uncertainty (LOC)	4	2.510	1.173	0.860-0.890	0.894	0.926	0.758
Techno-Insecurity (LOC)	5	2.058	1.151	0.812-0.881	0.900	0.926	0.714
Techno-Distress (HOC)	21	2.264	1.180	0.740-0.876	0.907	0.907	0.661

Table 4.1-1: Descriptive Statistics Reflective Constructs, Outer Loadings, Internal Consistency, and Average Variance Extracted[7]

[7] Ind. = indicators

Evaluation of the Structural Model and Hypotheses Testing

Collinearity is also not a major issue in the structural model since all inner variance inflation factors are lower than 5 (maximum of 1.146). Figure 4.1-3 presents the path estimates for the model including their significance level. R^2 values are depicted in the constructs.

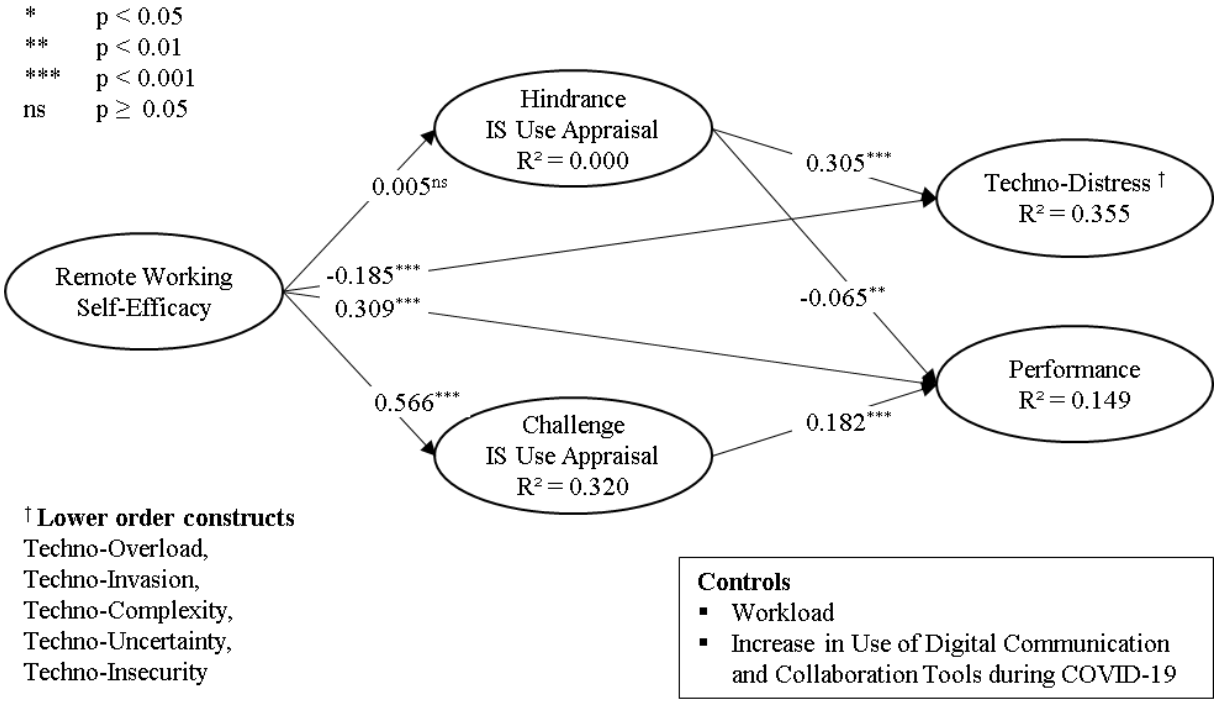


Figure 4.1-3: Model Results of Paper 5

Regarding H1, we find that remote working self-efficacy is associated to technostress with a small effect size (f^2=0.050). Further, the data shows that remote working self-efficacy is a driver of performance in times of work from home with a small effect size (f^2=0.079) supporting H2. Contrary to H3a, we find that it is not significantly related to hindrance IS use appraisal, indicating that there may be different reasons for hindrance appraisal. Yet, we do find a significantly positive relationship between remote working self-efficacy and challenge IS use appraisal and the effect size is large (f^2=0.470). This supports H3b. Regarding the relationship between hindrance IS use appraisal and techno-distress, we find that it is positively associated and that the effect size is small to medium (f^2=0.133). This supports H4. Further, we find the relationship between hindrance IS use appraisal and performance to be statistically significant. Yet, the effect size is marginal (f^2=0.005). Therefore, and considering the large sample size of this study, we consider H5 not supported. Regarding challenge IS use appraisal, we find that it is indeed associated with higher performance with a small effect size (f^2=0.026). This is in support of H6. Regarding controls, workload (β=0.095; $p<0.001$; f^2=0.011) and increased IS use during

COVID-19 (β=0.071; p=0.023; f^2=0.005) are related to performance. Also, both workload (β=0.295; p<0.001; f^2=0.123) and increased IS use during COVID-19 (β=0.226; p<0.001; f^2=0.70) are positively related to techno-distress. Table 4.1-2 summarizes the empirical findings.

		Theoretical Hypotheses	Empirical Results	
H1	neg.	Remote Working Self-Efficacy → Techno-Distress	-	supported
H2	pos.	Remote Working Self-Efficacy → Performance	+	supported
H3a	neg.	Remote Working Self-Efficacy → Hindrance IS Use Appraisal	n.s.	not supported
H3b	pos.	Remote Working Self-Efficacy → Challenge IS Use Appraisal	+++	supported
H4	pos.	Hindrance IS Use Appraisal → Techno-Distress	+	supported
H5	neg.	Hindrance IS Use Appraisal → Performance	o	not supported
H6	pos.	Challenge IS Use Appraisal → Performance	+	supported

Key: n.s. indicates a non-significant effect. For significant effects: o indicates a marginal effect (f^2 <0.02), +/- a small (f^2 ≥0.02), ++/-- a medium (f^2 ≥0.15), and +++/--- a large (f^2 >0.35) effect size.

Table 4.1-2. Overview of Hypotheses and Empirical Results of Paper 5

4.1.5. Discussion

4.1.5.1. Theoretical Implications

The theoretical implications of this work are threefold. They comprise insights on the relationship between self-efficacy and IS use appraisal, insights regarding the individual factors influencing technostress in times of remote work, and insights into how these factors influence performance. Our theoretical contributions are summarized in Table 4.1-3.

First, we follow a call for research by Tarafdar et al. (2019) to investigate the relationship between individual factors and IS use appraisal. We do so in the context of remote work during COVID-19 and with a focus on remote working self-efficacy. We find that hindrance IS use appraisal is not related to the individuals' remote working self-efficacy. Tarafdar et al. (2019) propose low self-efficacy as a factor that may affect appraisal, which indicates that IS is a threatening and disturbing factor. The authors further point out that both hindrance and threat situations are associated with distress. Therefore, it is an interesting finding in our study that

hindrance appraisal is not related to self-efficacy. This is contrary to our hypothesis and previous conceptual work on technostress (Tarafdar et al. 2019). We conclude that hindrance IS use appraisal has a different root that warrants further research. The implications of this finding may be that hindering IS use might be associated with factors that the individual cannot control, regardless of individual self-efficacy. It could thus be that the origins of such stressors lie in either the technology or the work itself. This may be congruent with the conceptualization of Tarafdar et al. (2019) who consider factors related to the design of IS. This implies that organizations may be able to address such issues without the involvement of their employees. If researchers and practitioners identify such sources of techno-distress, they may be able to reduce technostress through organizational measures.

Second, we shed light on the relationship between IS use during remote work brought about by COVID-19 and techno-distress. In this work, we propose that the novel situation of communication and collaboration technology use during COVID-19 is a source of techno-distress and we control for this increased use in our study. We further show that remote working self-efficacy is a way to mitigate techno-distress in times of remote work, which is congruent with previous work on technostress (e.g., Shu et al. 2011) and previous work at the overlap between social cognitive theory and IS use (Compeau et al. 1999). We also show that hindrance IS use appraisal further contributes to the perception of techno-distress.

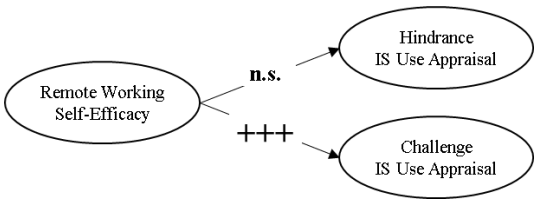
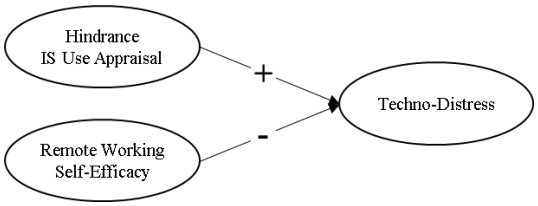
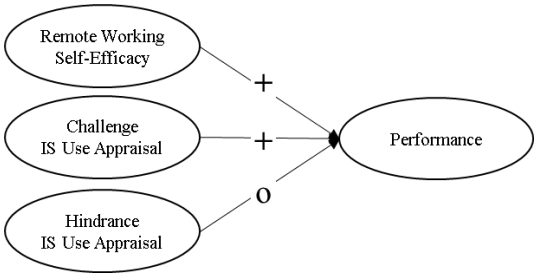
Third, and regarding performance, we find that remote working self-efficacy in general increases performance for remote work during COVID-19, which is congruent with previous work on IS use (e.g., Compeau et al. 1999). The influence of hindrance IS use appraisal, however, is only marginal, which puts the real-world impact and thus its practical relevance of the relationship in doubt (Mohajeri et al. 2020)

Yet, we show that a challenge IS use appraisal further contributes to increased performance. The fact that both remote working self-efficacy and challenge IS use appraisal have positive effects has theoretical implications. As we pointed out, appraisal and self-efficacy are related, yet different. Self-efficacy is an individual characteristic that serves as a resource factor for appraisal (Jerusalem and Schwarzer 2010). Thus, while self-efficacy is rather stable and tends to translate to other situations (Bandura 1977), appraisal may vary between situations and within situations over time depending on outcome expectations. This is because appraisal is a cognition that may change continuously as an individual interacts with the environment (Jerusalem and Schwarzer 2010). Of course, this time effect cannot be captured in a cross-

sectional survey. Yet, it shows that the two constructs are different and may be affected differently.

Regarding our theoretical implications, we advance the current knowledge on technostress research regarding challenge IS use appraisal by identifying remote working self-efficacy as a major antecedent in the particular context of remote work. Previous work has given little recognition to the possible role of it as an antecedent for challenge IS use appraisals. Yet, previous research has stated that controllability of the situation (Gibbons 2010) and a high chance of coping may be associated with a positive side of stress and thus challenge IS use appraisal (Salo et al. 2018). Self-efficacy is in turn an assessment of the own abilities built on past performances and experiences. In that regard, it also captures to some degree the confidence in controlling a situation. A more detailed view of how self-efficacy works is provided by Jerusalem and Schwarzer (2010). In their research they assess the relationship between temporal patterns of appraisal and self-efficacy. Their results suggest that individuals with low self-efficacy may well have challenge appraisals of a situation at first. Yet, over time the negative experiences of failure results in frustration and a decreasing perception of challenge. Thus, self-efficacy heavily affects challenge appraisal.

In summation, self-efficacy is a construct that has been used in many studies on technostress and it may seem trivial to revisit the construct. Yet, our empirical findings show that the relationships may be more complex and not as clear as might be assumed. We conclude that the relationship between self-efficacy and appraisal is worth revisiting. Our empirical results show that researchers may overstate the effect of self-efficacy or challenge appraisal when not measuring the respective other construct. Future studies may provide additional detail on the relationship by following the stress process over time to analyze the temporal interplay (Jerusalem and Schwarzer 2010). Also, previous work has shown that self-efficacy may be shaped more by previous outcomes, such as performance, than it shapes future outcomes (Harrison et al. 1997). Thus, the construct and the empirical results associated with it may be misleading. This further emphasizes the necessity to revisit self-efficacy and appraisal with future research into the matter.

Relationship Between Self-Efficacy and Appraisal	
	• Remote working self-efficacy does not affect hindrance IS use appraisal, indicating that hindrance may be unrelated to the individual's believe in his or her own abilities • Remote working self-efficacy has a strong effect on challenge IS use appraisal and is an important antecedent
Individual Factors and Appraisal Influencing Techno-Distress	
	• Confirming recent studies, hindrance IS use appraisal increases the perception of techno-distress • Further, remote working self-efficacy reduces the perception of techno-distress in times of remote work
Individual Factors and Appraisal Influencing Performance	
	• Both Remote working self-efficacy and challenge IS use appraisal increase the perception of individual performance • Yet, the significant negative relationship of hindrance IS use appraisal and performance has no substantial effect size

Key: n.s. indicates a non-significant effect. For significant effects: o indicates a marginal effect (f^2 <0.02), +/- a small (f^2 ≥0.02), ++/-- a medium (f^2 ≥0.15), and +++/--- a large (f^2 >0.35) effect size.

Table 4.1-3: Overview of Theoretical Contributions of Paper 5

4.1.5.2. Managerial Implications

Our findings have several managerial implications. We find that increased use of IS for communication during COVID-19 has adverse consequences on employees in the form of technostress. This may be driven by the novel situation that employees are facing. Yet, our research suggests a number of measures that can be taken to mitigate such technostress.

We find that hindrance IS use appraisal increases technostress and that hindrance IS use appraisal is not associated with the individuals' self-efficacy. This may indicate that there are sources of technostress in the IS use of employees that cannot be mitigated through individual knowledge, but rather that they are inherent in either the work or the technology. This indicates that organizations can indeed take actions on these levels to reduce technostress of their employees. This could involve, for example, providing adequate technology to fulfill the communication needs of the individuals. To the best of our knowledge, such demands have been scarcely investigated. Yet, a recent study has pointed to technology incompatibility as a potential source of demands for employees (Vaziri et al. 2020). Thus, organizations and their IT

departments should consider providing adequate and useful tools to mitigate technostress – particularly in the times of physical distancing.

Further, we find that the remote working self-efficacy of individuals has a strong influence on the perception of technostress during remote work. We find that it not only influences the relationship between IS use and technostress, but also strongly influences challenge IS use appraisal which is associated with increased usefulness and performance. We thus conclude that it is paramount for organizations to provide an environment where employees' can increase their digital literacy in general and remote working self-efficacy in particular. In a way this is also good news, as it is easier to systematically improve than cognitive appraisal, which is said to be highly individual (Lazarus and Folkman 1984). Yet, there are other avenues to affect appraisal, such as cognitive reappraisal or mindfulness (Garland et al. 2009)

4.1.6. Limitations and Future Research

This work has several limitations that leave avenues for future research. For example, our operationalization of appraisal focuses on the general use of IS. While this is congruent with previous research on technostress (e.g. Benlian 2020), research in psychology has suggested that appraisal can change from situation to situation within individuals and have thus suggested different ways of measurement (Searle and Auton 2015). Other studies have included frequent measurements of appraisal within a single stressful situation over time (Jerusalem and Schwarzer 2010). Yet, the detailed measurement appraisal in individual situations requires a complex data collection, and it has been pointed out that it has thus been omitted for obvious reasons of practicality in many studies (Jerusalem and Schwarzer 2010). Nonetheless, we acknowledge this as a shortcoming of our study and encourage future work to look into more detailed analyses.

Further, the relationship between self-efficacy, appraisal, and outcomes may be affected by previous outcomes more than it is a determinant of future outcomes (Sitzmann and Yeo 2013). This is an intriguing proposition that has not been investigated in relationship to technostress to the best of our knowledge. Such analyses require data that goes beyond cross-sectional surveys and may consider both appraisal and self-efficacy and their relationship. Further, there are other factors that may affect the measurement of the relationship between these variables. For example, previous work has shown that there may be problems with overconfidence and overestimation of performance in self-assessment, which have been referred to as the Dunning-Kruger-Effect (Kruger and Dunning 1999). Such issues could be considered in future work.

Regarding the COVID-19 pandemic, we acknowledge that more stressors exist that may lie outside of the realm of IS use and technostress, such as childcare, job insecurity, and a lack of social contact. IS use may well have had positive effects during COVID-19, for example to stay in touch with co-workers and to continue work from home.

4.1.7. Conclusion

Due to the physical distancing measures to counteract COVID-19, digital communication tools and their use has changed the way we work and remote work has increased dramatically. In this work, we investigate the positive and negative consequences of IS use in times of COVID-19 and how they differ between individuals. This follows a call for research inquiries into the factors that influence individual appraisal of IS use situations and thus its positive and negative sides (Tarafdar et al. 2019). We find that hindrance IS use appraisal is associated with higher technostress. Yet, hindrance IS use appraisal is not associated with remote working self-efficacy, which suggests that some sources of technostress cannot easily be changed by individuals. Rather, they might be rooted in the provided technologies or the circumstances of digital work. Such factors may be captured in a hindrance IS use appraisal. Nonetheless, we find that high levels of remote working self-efficacy are associated with lower levels of technostress, emphasizing the role of specific competences in mitigating stress during remote work. Further, we find that remote working self-efficacy is also positively related to challenge IS use appraisal, which enables growth and gains and thus leads to higher performance. As a theoretical contribution, we shed light on the relationship between IS use and technostress and show that remote working self-efficacy is an important antecedent of IS use appraisal. For practitioners, we emphasize the role of both the provision of adequate technology for remote work and the role of remote working self-efficacy of their employees to reduce technostress and increase performance in remote work situations. Further research may go into more detail on the appraisal process and differentiate between different stressors as well as different situations.

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Appendix 4.1/A – Measurement Items

Increased Use of Digital Communication Tools during COVID-19 (based on: Venkatesh et al., 2012)	
Three-point Likert Scale: substantially less than before, remained the same, substantially more than before	
IUC01	How frequently are you using email for business purposes compared to before the corona pandemic?
IUC02	How frequently are you using instant messaging (e.g., via MS Teams, Slack, WhatsApp) for business purposes compared to before the corona pandemic?
IUC03	How frequently are you using audio calls (e.g., via telephone, MS Teams, Skype) for business purposes compared before the corona pandemic?
IUC04	How frequently are you using video calls (e.g., via MS Teams, Skype, Zoom) for business purposes compared to before the corona pandemic?
Remote Working Self-Efficacy (source: Wang and Haggerty 2011)	
RSE01	I have confidence that I can complete my virtual work because I can access appropriate support staff readily.
RSE02	I have confidence that I can complete my virtual work because I can access information needed to perform my job.
RSE03	I have confidence that I can complete my virtual work because I can set objectives that align with the organization's goals.
RSE04	I have confidence that I can complete my virtual work because I can prioritize tasks to use my time effectively.
Challenge IS Use Appraisal (source: LePine et al., 2016)	
CA01	Using digital technologies to fulfill the demands of my job helps me improve my personal growth and well-being.
CA02	I feel the demands of my job relating to the use of digital technology as a challenge to achieve personal goals and accomplishment.
CA03	In general, I feel that the use of digital technology promotes my personal accomplishment.
Hindrance IS Use Appraisal (source: LePine et al., 2016)	
HA01	Using digital technologies to fulfill the demands of my job thwarts my personal growth and well-being.
HA02	I feel the demands of my job relating to the use of digital technology constrain my achievement of personal goals and development.
HA03	In general, I feel that the use of digital technology hinders my personal accomplishment.
Performance (source: Frone et al., 1997)	
PF01	I am viewed by my supervisor as an exceptional performer.
PF02	I am viewed as an exceptional performer in this organization.
PF03	I have a reputation in this organization for doing my work very well.
PF04	My colleagues think my work is outstanding.

Workload (source: COPSOQ III / Burr et al., 2019)	
WL01	Do you have to work very fast?
WL02	Do you work at a high pace throughout the day?
WL03	Is it necessary to keep working at a high pace?
Techno-Distress: Techno-Overload (source: Ragu-Nathan et al., 2008)	
TO01	I am forced by this technology to do more work than I can handle.
TO02	I am forced by this technology to work with very tight time schedules.
TO03	I am forced to change my work habits to adapt to new technologies.
TO04	I have a higher workload because of increased technology complexity.
Techno-Distress: Techno-Invasion (source: Ragu-Nathan et al., 2008)	
TI01	I have to be in touch with my work even during my vacation due to this technology.
TI02	I have to sacrifice my vacation and weekend time to keep current on new technologies.
TI03	I feel my personal life is being invaded by this technology.
Techno-Distress: Techno-Complexity (source: Ragu-Nathan et al., 2008)	
TC01	I do not know enough about this technology to handle my job satisfactorily.
TC02	I need a long time to understand and use new technologies.
TC03	I do not find enough time to study and upgrade my technology skills.
TC04	I find new recruits to this organization know more about computer technology than I do.
TC05	I often find it too complex for me to understand and use new technologies.
Techno-Distress: Techno-Insecurity (source: Ragu-Nathan et al., 2008)	
TS01	I feel constant threat to my job security due to new technologies.
TS02	I have to constantly update my skills to avoid being replaced.
TS03	I am threatened by coworkers with newer technology skills.
TS04	I feel there is less sharing of knowledge among coworkers for fear of being replaced.
Techno-Distress: Techno-Uncertainty (source: Ragu-Nathan et al., 2008)	
TU1	There are always new developments in the technologies we use in our organization
TU2	There are constant changes in computer software in our organization.
TU3	There are constant changes in computer hardware in our organization.
TU4	There are frequent upgrades in computer networks in our organization.

Items measured on a five-point Likert scale unless stated otherwise

4.2. A Dark Side of IT Consumerization: How Mixed IT Portfolios with Private and Business IT Components Cause Unreliability

Abstract

With increasing mobile work and work-from-home in the wake of the COVID-19 pandemic, the usage and relevance of consumer IT for business purposes have substantially increased. In many instances, the adoption of IT consumerization has been due to the bare necessity of having no adequate alternative. In this light, an understudied area of IT consumerization, the adverse outcomes for employees using consumer IT for business purposes, is of ma-jor importance. We conduct a mixed-methods study to investigate the adverse outcomes of IT consumerization. We build on prior studies and own end-user interviews to draw connections between IT consumerization and techno-unreliability. A subsequent quantitative survey of 162 full-time employees shows that IT consumerization is indeed associated with an increase in techno-unreliability. The emergence of this type of stress is moderated by the users' general computer-self efficacy and leads to various job-related and health-related outcomes. We show that perceived unreliability is driven by users' experience while trying to integrate private and business IT components for business purposes. We follow up on this observation through a qualitative analysis of open-ended survey questions to detail users' experience. Our findings emphasize the need to examine the dark side of IT consumerization, despite its well-studied positive effects. We suggest that organizations should strive to integrate business and private IT as much as IT security constraints allow for, to reduce the technostress of their employees.

Keywords: IT consumerization, BYOD, technostress, self-efficacy, integration

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Status: Working paper

4.2.1. Introduction

Today, many IT users are responsible for their entire individual information system. Such individual information systems include infrastructure (e.g., Wi-Fi, mobile data plans), devices (e.g., smartphones and laptops), as well as applications and services that run on these devices (e.g., instant messengers) (Baskerville 2011). Many times, such IT portfolios involve substantial amounts of mobile, fast, and innovative. User experience with such privately-owned IT raises the bar for business IT. It has long caused employees to bring their own IT into the workplace, referred to as IT consumerization (Niehaves et al. 2012). IT consumerization has been studied widely with an emphasis on organizational advantages, such as increased innovation and productivity (e.g., Bautista et al. 2018; Junglas et al. 2019) and organizational disadvantages, such as security and privacy risks (e.g., Gewald et al. 2017), as well as end-user advantages and reasons for adoption (e.g., Ortbach 2015). Adverse outcomes for the end-users, however, have been studied scarcely (Köffer et al. 2014). Two recent developments emphasize a renewed need to do so.

First and foremost, we are currently experiencing a substantial increase in mobile work and work-from-home sparked by global social distancing measures in the wake of the COVID-19 pandemic. Particularly the need for digital communication and collaboration has risen during the pandemic. These circumstances have forced many end-users into mobile work regardless of individual IT adoption decisions. Furthermore, this development has caught many organizations off guard and without adequate IT to meet the needs of an entire organization working remotely. Thus, many employees have felt the need to use their private infrastructure, devices, and applications to fill those voids. This increase of involuntary mobile work will undoubtedly highlight the disadvantages of IT consumerization, particularly for its end users. Two known disadvantages are increased workload and IT-related stress (Niehaves et al. 2012). We expect that also in post-pandemic times, we will see higher levels of mobile work and work-from-home than we saw before COVID-19.

Second, a recent literature analysis and call for research has highlighted the need to understand better the creative and innovative use of IT (Tarafdar et al. 2019), which has been associated with IT consumerization (Junglas et al. 2019). While there are certainly opportunities for future research regarding positive psychological outcomes of IT consumerization, researchers need also to understand the potential adverse outcomes to view such opportunities in the right light. One aspect relevant in the context is understanding the interplay between the technologies (in this case, consumer IT) and the end-user. Research has suggested that both the mitigation of

adverse effects (e.g., Shu et al. 2011; Tarafdar et al. 2015) and the fostering of positive effects (Salo et al. 2018) are related to the individual capabilities of the end-users. Nevertheless, organizations have a responsibility to provide their employees with adequate IT.

Related to the current increase in work-from-home and the associated increase in consumer IT use, we take a detailed look at the negative side of using mixed IT portfolios consisting of both privately-owned and business-owned IT components. To do that, we conduct a concurrent nested mixed-methods study with a dominant quantitative strand. With this, we aim to answer the following research question:

How does IT consumerization use behavior affect perceived unreliability, and what factors drive the relationship?

Our study finds that poor integration between the privately-owned and business-owned components of a mixed IT portfolio is a major driver of unreliability, leading to adverse outcomes. These outcomes include switching exhaustion, transition costs, and dissatisfaction with the IT portfolio. We further find that particularly users with low computer self-efficacy are prone to experiencing such issues. In our qualitative strand, we provide concrete categories of problems that may arise and that organizations should be aware of when designing their IT consumerization policies.

4.2.2. Theoretical Background

4.2.2.1. IT Consumerization

An information system (IS) is a socio-technical system comprising technology, information, and social artifacts (Lee et al. 2015). Increasingly, individuals build, administrate, and use their own IT (Baskerville 2011). Because of this new autonomy, individuals can bring their own IT components wherever they go, including the workplace. This phenomenon is known as IT consumerization – the use of privately-owned IT components for business purposes (Niehaves et al. 2012). There have been many studies investigating this phenomenon in the past years. Research has covered four areas: advantages for employees, disadvantages for employees, organizational advantages, and organizational risks (Niehaves et al. 2012).

Regarding advantages for employees, studies have focused on the antecedents of use decisions. This focus has led to a thorough understanding of why employees participate in bring your own device programs or bring their privately-owned devices to work. Many of these studies build upon established technology acceptance and use literature, such as UTAUT, TAM, and TPB (e.g., Bautista et al. 2018; Gewald et al. 2017; Ortbach 2015). These studies find that primarily

the benefits for work purposes, such as increased usefulness and ease of use, drive adoption decisions.

From an organizational perspective, outcomes of IT consumerization use behavior are increased productivity and work quality (e.g., Bautista et al. 2018). Furthermore, advantages such as increased creativity, innovativeness, mobility, and flexibility (Behrens 2009; Gewald et al. 2017; Junglas et al. 2019; Ortbach 2015) are associated with IT consumerization. Many of these advantages are advantageous for organizations and the employees themselves. Lastly, indirect organizational benefits, such as increased employer attractiveness (Gewald et al. 2017) and organizational commitment (Doargajudhur and Dell 2019), have been added to the list of benefits. There is also a stream of research that has focused on the negative sides of IT consumerization from an organizational point of view. Such risks mainly include IT security and data privacy issues (Gewald et al. 2017; e.g., Gewald et al. 2017) and a loss of organizational control (Behrens 2009).

Direct connections between negative consequences for the individual and IT consumerization have been scarcely investigated. These include that organizational encouragement for IT consumerization increases work-to-life conflict (Köffer et al. 2014). In addition, qualitative results exist from user interviews (Niehaves et al. 2013b), case studies (Niehaves et al. 2013a; Ortbach et al. 2013), and analyses of practitioner literature (Niehaves et al. 2012). All of which points into the direction that IT consumerization indeed leads to adverse outcomes for the individual. The studies raise evidence for an increase in stress levels regarding the use of consumer IT. An observation that is closely related to research on technostress. To the best of our knowledge, no empirical studies exist that have investigated the harmful effects of mixed IT portfolios concerning actual use behavior quantitatively and in-depth.

4.2.2.2. The Dark Side of IT Consumerization

Studies have previously connected IT consumerization research with technostress. Early on, evidence in practitioner literature regarding IT consumerization hints at stress as a possible outcome (Niehaves et al. 2012). Technological ubiquity and blurring of boundaries between private and work life were identified as potential reasons. Others found that organizational encouragement for dual use of mobile IT does indeed translate to both work overload and work-to-life conflict (Köffer et al. 2014). IT consumerization may lead to a higher workload due to ubiquitous access, resulting in stress (Niehaves et al. 2013a).

This was echoed in an interview study that found increased reachability, lack of competence, workflow changes, and system redundancies to be drivers of adverse outcomes of IT consumerization (Ortbach et al. 2013). System redundancies are described as frequent changes of systems, multi-system usage, and redundancy of data.

In summation, extensive research has focused on reachability with aspects, such as increased work-home conflict. Aspects related to the mixed IT portfolio itself, such as workflow changes and system redundancies, have seen little attention. There is also little evidence of how these factors interplay with a lack of competence.

4.2.2.3. Negative Psychological Effects of IT Use

The findings regarding the dark side of IT consumerization can be closely related to research on psychological stress. Stress results from the interplay between environmental demands and personal resources, in which the demands tax or exceed the person's resources (Lazarus and Folkman 1984). Studies regarding stress due to digital technologies date back to the clinical psychologist Craig Brod (1982), who introduced the term technostress in 1982, which he described as a failure of employees to adapt to modern office technology, which leads to stressful experiences. Based on that, technostress is defined as "stress that users experience as a result of their use of IS in the organizational context" (Tarafdar et al. 2015, p. 103). In this paper, we thus focus on the organizational context rather than the private one.

Technostress is a consequence of technology use (Ayyagari et al. 2011). E-mail use has been identified as a driver of stress, the effect of online social network use on technostress has been investigated, and use has been included as a control variable (Stich et al. 2019) in stress research. Specific demanding conditions during IT use create technostress. These demands must be met using personal resources. Research has identified several technostress creators, such as invasion, overload, complexity, uncertainty, insecurity (Ragu-Nathan et al. 2008), and unreliability (Adam et al. 2017; Ayyagari et al. 2011).

Technostress has been associated with a negative impact on the organizational commitment of an individual (i.e., how strongly an employee is involved in the organization and how strongly he or she identifies with it), the identification with the employer's values and goals, and ultimately commitment to the workplace (continuance commitment, i.e., an employee's attachment to an organization). Further, (techno)stress has adverse effects on the individual's health and

well-being, such as increased exhaustion and burnout (Galluch et al. 2015). Similarly, the impact of technostress on IS-related outcomes has been investigated. Among others, these include satisfaction with IS (Tarafdar et al. 2010) and discontinued usage intention (Maier et al. 2015).

In summary, while technostress and IT consumerization are rich research streams, the overlap has been studied scarcely. However, with the recent advent of work-from-home, consumer technologies have seen renewed interest. Thus, an investigation of the overlap is both topical and relevant to organizations and employees alike.

4.2.3. Mixed-Methods Design and Pre-Study

4.2.3.1. Mixed-Methods Design

We conduct a pre-study and applicability check of the problem at hand based on semi-structured interviews. After that, the main study follows a mixed-methods approach (Venkatesh et al. 2013; Venkatesh et al. 2016) with the purpose of completeness. In the quantitative strand, we test hypotheses derived from the literature. In the qualitative stream, we derive insights based on qualitative data collected as part of our survey. This stream helps us provide a more meaningful picture and richer explanations of the phenomenon and more detailed insights for practice. The quantitative strand is the dominant part – it uses a structural equation model based on survey data. The qualitative part uses coding principles from grounded theory to analyze the open-ended questions (Strauss and Corbin 1990). Table 4.2-1 sketches the overall design. We draw meta-inferences over both the qualitative and quantitative strands in the discussion.

Study	**Pre-study**	**Main study**	
Data collection	semi-structured interviews (n = 5)	structured online survey (n = 161)	
Strand	qualitative (less dominant)	quantitative (dominant)	qualitative (less dominant)
Analysis method	coding	PLS-SEM	coding
Key inference	stimulus and applicability check for hypothesis development	statistical hypothesis testing	further assessment of quantitative findings

Table 4.2-1: Overview of Mixed-Methods Design

4.2.3.2. Qualitative Pre-Study

Issues regarding workflow changes and system redundancies in mixed IT portfolios are scarce. Thus, we aim at understanding relevant moderators and individual-level outcomes for the context of IT consumerization. We interview users of a knowledge-intense service organization regarding their negative experiences related to such issues while using consumer IT for business

purposes. Upon receiving descriptions of stressful user experiences, we followed up with questions regarding stress creators, resources, individual characteristics, and technology characteristics. The interviews were recorded and transcribed. The transcripts were coded. Contrary to grounded theory, this coding iteration was a deductive approach based on the authors' domain knowledge. The interviewees' experience centered around the technostress creator unreliability. Regarding resources and other influencing factors, our interviewees mentioned general computer self-efficacy and IT portfolio integration to be important. The results are presented in Table 4.2-2.

Construct	Example based on the Data
Unreliability	
"Degree to which features and capabilities provided by the [digital] technology are [not] dependable" (Ayyagari et al. 2011, p. 837)	"I was working on a document on the business laptop, pressed the save button and closed the laptop. At home, I opened my private laptop, opened the file and all my changes were unavailable. Saving or synchronization did not work, I have no idea." "We were both working on the same presentation and the next day I opened it [on my private laptop] and part of the progress was gone. And then there was an error message."
General Computer Self-Efficacy	
"An individual's perception of efficacy in performing specific computer-related tasks" (Marakas et al. 1998, p. 127)	"I would describe myself as a tech-savvy person and able to deal with digital technologies. […] Therefore, such situations are less stressful for me than for someone in whom these characteristics are less pronounced. " "I would not consider myself incompetent in IT, but at that moment I lacked the knowledge to deal with the specific situation without any problems. Now I know better."
IT Portfolio Integration	
The ability to integrate data, communication and collaboration technologies, and other applications and services within one's individual information system (based on Rai and Tang 2010)	"The problem that printing [from my private laptop] didn't work was that there was no VPN connection, and the printer only allows devices from the network." "I had two computers that I worked with. The private computer was not integrated into the business IT infrastructure, which means that I had no access to e-mails and data from the business computer and then always had to transfer everything from the business computer to the other computer."

Table 4.2-2: Results of Qualitative User Interviews

4.2.4. Hypotheses Development

We aim to shed light on the relationship between IT consumerization use behavior and the users' perception of unreliability. Prior literature and our interviews show that this relationship is of interest regarding adverse outcomes of IT consumerization. Relevant influencing factors are identified in the interviews. First, the impact of the degree of integration between privately-owned and business-owned components of the IT portfolio used for business purposes. We define an IT portfolio for business purposes as the composition of private and business IT components (such as devices, applications, and services) used for business purposes (cf. Junglas et al. 2019). Second, the users' computer self-efficacy is considered a resource to mitigate the adverse impact of IT consumerization. In addition, three adverse outcomes of unreliability in the specific context of IT portfolios consisting of private and business IT for business purposes were identified: dissatisfaction with IT portfolio, transition costs, and switching exhaustion. The following sub-sections develop our hypotheses in more detail. Figure 4.2-1Figure 4.2-1 summarizes the research model.

4.2.4.1. IT Consumerization and Unreliability

System redundancies can be a source of stress in the context of IT consumerization (Ortbach et al. 2013). We propose that this is because they cause the perception of unreliability (Adam et al. 2017), which is defined as the "degree to which features and capabilities provided by the technology are [not] dependable" (Ayyagari et al. 2011, p. 837). This definition focuses on individual technologies and not necessarily their interplay. However, in our interviews, switching between privately-owned and business-owned components of an IT portfolio for business purposes was the most frequently reported source of stress related to IT consumerization. The users reported occasions where the integration of data collected or processed through privately-owned IT caused problems when they were transferred to business IT solutions and vice versa. For example, one interviewee mentioned that using a privately-owned cloud solution was necessary to transfer data, which causes technical problems and may result in the loss of work progress. Another interviewee reported that a small computer program written for business purposes using privately-owned IT could not be tested on the business-owned IT due to restrictive security settings. Upon the analysis of these stressful situations, we suggest that this is related to perceived unreliability. We hypothesize:

H1: IT consumerization use behavior increases unreliability.

4.2.4.2. Effect of Portfolio Integration

Switching from privately-owned IT to business-owned IT is generally possible but associated with data transfer or information exchange between the different components, which we refer to as a lack of portfolio integration (Rai and Tang 2010). Our interviewees mentioned a seamless integration of the different components of their IT portfolio to be one of the most important factors for effective IT consumerization. They frequently report issues regarding integration that lead to the perception of unreliability. For example, barriers related to the transfer of data and access to an organization's network through private IT components were reported to create the necessity for workarounds. Such workarounds are a source of unreliability and cause frustration. Nevertheless, when organizations provide seamless integration of the various privately-owned and business-owned components, such issues decrease. Hence, we hypothesize:

H2: IT portfolio integration reduces unreliability.

4.2.4.3. Effect of General Computer Self-Efficacy

Personal resources play an essential role in the perception of stress. Relevant personal resources are digital literacy (Tarafdar et al. 2019) or technology competence (Tarafdar et al. 2015). This role is echoed by IT consumerization literature that finds an association with easier problem solving for people with high technological competence (Niehaves et al. 2013b). Further, the lack of competence is mentioned as the most frequent antecedent of technostress when engaging in IT consumerization (Ortbach et al. 2013).

In our interviews, respondents explained how they coped with stressful situations through creative solutions and workarounds. For example, one interviewee suggested that he lacked the technological competence to deal with data loss while transferring files between multiple components of his mixed IT portfolio. On the contrary, another employee stated that his background in IT helps him be calmer and more resilient when it comes to overcoming issues with IT. Such digital problem-solving competencies are strongly related to general computer self-efficacy (Shu et al. 2011). This suggests a direct effect of general computer self-efficacy on technostress creators, such as unreliability:

H3: General computer self-efficacy reduces unreliability.

4.2.4.4. The Effect of Unreliability on Outcomes

Our interviews suggest that problems arising from integrating privately-owned and business-owned components of an IT portfolio and the resulting perception of unreliability increase the individuals' dissatisfaction with their IT portfolio (cf. Au et al. 2008). Dissatisfaction with IT portfolio is the user's affective and cognitive evaluation of a consumption-related lack of need fulfilment experienced with the IT portfolio (Au et al. 2008). For example, one interviewee suggested that technical restrictions are a limiting factor of successful integration and that there would be better technical ways to facilitate it.

H4a: Unreliability increases dissatisfaction with the IT portfolio.

Another result of switching between different technologies, such as online social networks, is heightened transition costs (Maier et al. 2015). Previous research finds that a lack of integration between different social media sites leads to high transition costs. Transition costs reflect the time and effort required in such situations. As pointed out, switching from privately-owned IT to business-owned IT components is generally possible but associated with data transfer and communication efforts, referred to as portfolio integration (Rai and Tang 2010). Thus, we propose:

H4b: Unreliability increases transition costs.

Technostress has several adverse outcomes regarding the individuals' well-being. Particularly the effect on psychological strain has been studied extensively (e.g., Ayyagari et al. 2011; Galluch et al. 2015; Maier et al. 2015). Strain is one of the most important long-term problems that arise from stressful situations. To isolate the psychological effects of switching between different IT, switching exhaustion has been conceptualized (Maier et al. 2015). In other words, "the cause of the perception of exhaustion [is] the switching process" (Maier et al. 2015, p. 291). While the construct was developed in the context of online social network use, we adapt it to the context of IT consumerization and hypothesize:

H4c: Unreliability increases switching exhaustion.

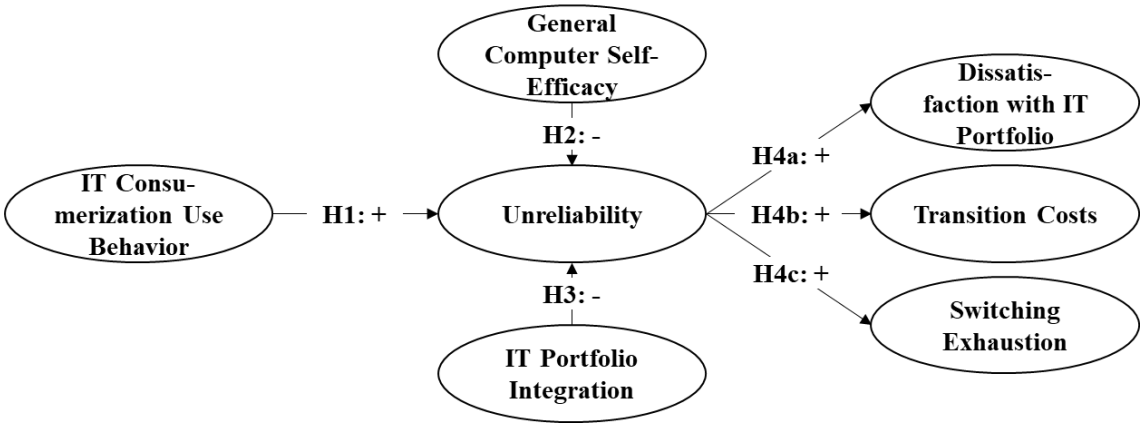

Figure 4.2-1: Research Model of Paper 6

4.2.5. Quantitative Empirical Analysis

4.2.5.1. Survey Design and Procedures

To test the model empirically, we design an online survey. The questionnaire starts with an explanation of the survey's scope and explains the use of private and business IT for business purposes. Participants indicate their level of IT consumerization use behavior (Junglas et al. 2019). We further measure unreliability (Ayyagari et al. 2011) as well as its outcomes (Au et al. 2008; Maier et al. 2015). Lastly, computer self-efficacy (Marakas et al. 2007) and perceived IT portfolio integration (Rai and Tang 2010) are measured. All scales are reflective. We measure all items on a seven-point Likert scale. Where necessary, we adapt the items to the IT consumerization context. Appendix 4.2/A provides an overview of all items. We furthermore asked an open-ended question regarding stressful or frustrating situations from switching between private IT to business IT and vice versa.

We restrict participation to full-time employees and distribute the survey via the online crowdsourcing market Amazon Mechanical Turk (MTurk) in April 2020, during the first wave of the COVID-19 pandemic. Such internet-based platforms allow the recruiting of participants for surveys and other tasks (Steelman et al. 2014). MTurk's participant pool is closer to the U.S. population than traditional university subject pools (Paolacci et al. 2010). Further, MTurk has been frequently used in IS research before (e.g., Kehr et al. 2015). Participants received a monetary reward of USD 1.30 for completing the survey. To ensure data quality, we implemented several measures. Next to a traditional attention check ("If you are answering this survey cautiously, tick the second box from the left.") and an instructional manipulation check (Oppenheimer et al. 2009), we assessed open-ended questions to identify "unusual comments" (Chmielewski and Kucker 2020).

4.2.5.2. Results

162 participants completed our survey and passed our quality gates, of which 32.7% are female, 65.4% male. Three participants stated to be of another gender. The average age of respondents was 39 years. We assess our research model through structural equation modeling (PLS-SEM) using SmartPLS 3.2. We start with the evaluation of the measurement model before assessing the structural model and testing our hypotheses.

Evaluation of the Measurement Model

Regarding internal consistency reliability (ICR), all scales exceed the threshold of 0.708 with a minimum of 0.800 for Cronbach's Alpha (Alpha) and a minimum of 0.879 for composite reliability (CR). For convergent validity, we examine indicator reliability and average variance extracted (AVE). Convergent validity is satisfactory as the minimum of all indicators' outer loadings is 0.780, and the minimum AVE is 0.708. For discriminant validity, we first examine each indicator's cross-loadings with all other constructs to check whether they are lower than the indicator's outer loading on the construct. Our data meets this criterion. Second, each construct's square root of the AVE is higher than the highest correlation with other constructs (Fornell-Larcker criterion). Thus, discriminant validity is supported. Table 4.2-3 shows means, standard deviations (SD), Alpha, CR, and AVE for all constructs. Information on (Cross-)Loadings and the Fornell-Larcker criterion can be found in Appendix 4.2/B and 4.2/C.

	# Items	Mean	SD	Loadings	Alpha	CR	AVE
IT Consumerization Use Behavior	3	4.844	1.853	0.780-0.892	0.800	0.879	0.708
Unreliability	3	5.287	1.272	0.951-0.966	0.957	0.972	0.920
Perceived IT Portfolio Integration	4	2.745	1.791	0.843-0.892	0.896	0.927	0.761
General Computer Self-Efficacy	6	6.069	1.295	0.824-0.934	0.944	0.954	0.777
Dissatisfaction with IT Portfolio	4	2.455	1.239	0.913-0.923	0.938	0.956	0.844
Transition Costs	3	3.434	1.712	0.926-0.957	0.941	0.946	0.962
Switching Exhaustion	4	3.091	1.850	0.939-0.953	0.962	0.963	0.973

Table 4.2-3: Descriptive Statistics, Main Factor Loadings, Internal Consistency, and Average Variance Extracted

Evaluation of Structural Model and Hypotheses Testing

Collinearity is not an issue since all variance inflation factors of the constructs are lower than 5.0 (max. of 1.262). Figure 4.2-2 presents the path estimates for the model, including their significance level.

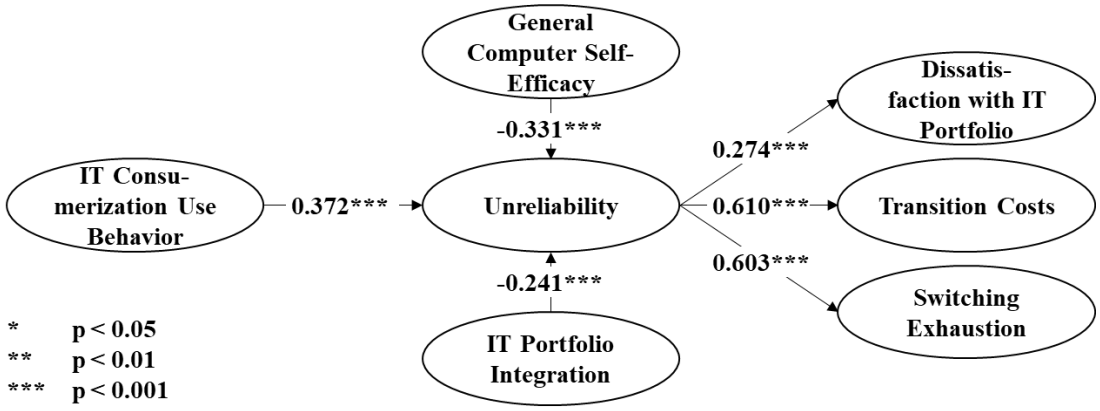

Figure 4.2-2: Model Results of Paper 6

Table 4.2-4 displays the corresponding R^2 and R^2 adjusted values.

	R^2	R^2 Adj.
Unreliability	0.255	0.240
Dissatisfaction with IT Portfolio	0.075	0.069
Transition Costs	0.372	0.368
Switching Exhaustion	0.364	0.360

Table 4.2-4: Explained Variance in the Structural Equation Model

We find that IT consumerization use behavior is positively related to unreliability, which supports H1. Also, the general computer self-efficacy and IT portfolio integration are found to have a significant and negative association with unreliability. This finding supports H2 and H3. Lastly, H4a-H4c are supported as unreliability is positively related to dissatisfaction with the IT portfolio, transition costs, and switching exhaustion. Table 4.2-5 summarizes our hypotheses and their respective empirical results.

Theoretical Hypotheses			Empirical Results	
H1	pos.	IT Consumerization Use Behavior → Unreliability	supported	++
H2	neg.	Perceived IT Portfolio Integration → Unreliability	supported	-
H3	neg.	General Computer Self-Efficacy → Unreliability	supported	-
H4a	pos.	Unreliability → Dissatisfaction with IT Portfolio	supported	+
H4b	pos.	Unreliability → Transition Costs	supported	+++
H4c	pos.	Unreliability → Switching Exhaustion	supported	+++

Note: plus signs indicate a significant and positive effect, minus signs a significant and negative effect, n.s. would indicate a non-significant effect at the 5% level. For significant effects, +/- indicates a small ($f^2 \geq 0.02$), ++/-- a medium ($f^2 \geq 0.15$), and +++/--- a large ($f^2 > 0.35$) effect size.

Table 4.2-5: Overview of Hypotheses and Empirical Results of Paper 6

Evaluation of the Qualitative Survey Data

For the qualitative strand of our main study, we asked the respondents to name stressful or frustrating situations from switching between privately-owned and business-owned IT and vice versa. We collected 130 valid responses to this question. These answers were inductively coded using open coding. Initial codes were then reorganized into broader categories, a process that can be described as axial coding (Strauss and Corbin 1990). Our findings are presented in Table 4.2-6.

We find several aspects that contribute to the perception of unreliability due to a lack of IT portfolio integration. First, a lack of reliable access to company resources is reported to be a source of frustration. Such a perception can be caused by slow VPN connections, unavailable business servers, or network issues. This creates problems while trying to cross the boundaries from private to business IT. Second, we find several aspects related to data and file transfer that are a source of unreliability for many employees. File transfer is perceived as tedious, particularly when direct options are unavailable and workarounds, such as file forwarding via e-mail, have to be employed to switch from business to private solutions and vice versa.

Similarly, a lack of seamless integration between private and business IT components can cause data inconsistencies or the need to manage data redundantly. This is particularly the case when options for automatic synchronization are missing or not working properly. In extreme cases, the need for workarounds or manual file transfer can result in data loss. This is a major source of frustration as a productivity loss often accompanies it. Lastly, incompatibility between different operating systems in a mixed IT portfolio consisting of unaligned private and business IT components creates issues. Workarounds, such as file converters, have to be employed by the individuals, hindering their workflow. Third, known routines can be adversely affected due

Description	Example Based on the Data
Lack of Reliable Access Difficulties, such as unreliability and slow speeds, with accessing business resources from private devices – particularly through secure connections via VPNs.	"Accessing the shared server through VPN can be difficult if there are server problems or network issues. Sometimes the server can be down for hours, and I cannot access files." "I was unable to maintain a stable connect[ion] with my VPN for work but a technician talked me through it, and it was eventually resolved."
Issues Primarily Related to Data Transfer	
Tedious File Transfer Transferring data from one device to another is perceived as tedious. Lack of speed and time-consuming workarounds cause frustration.	"I have found it difficult to have a particular software on my business IT working. So, I use my private device to complete the job. But it is almost not possible to upload the results to the server of my company from a private IT component without the approval of the IT personnel [...]. So, I have to forward this result to my business IT before uploading which turns out to be an extra effort." "I have Photoshop on my business laptop but use my personal desktop for most of my work. When I download a photo that needs editing, I have to e-mail it to myself to my laptop so I can use Photoshop."
Data Inconsistencies and Redundancies Unsuccessful syncing of applications between private and business IT devices creates frustration, particularly where inconsistent data must be managed redundantly.	"Working from home, there have been some glitches where some applications are not talking to one another. There should be no time [gap] when I update one database which should then carry over to other applications." "I had some issues syncing up e-mails between three devices because one of the devices was on an older operating system. This laptop cannot be upgraded any further so it's causing me some issues."
Loss of Data while Switching Loss of data while transferring data from private to business component and vice versa, particularly when unreliable workarounds are necessary.	"The last time I had to switch from an IT component to the other, I ended up losing almost all my files because it was not well backed up. It was so frustrating that I had to call the company to help find a way to recover some of the important documents." "I lost my flash drive on which I put the data [I wanted to transfer]. It was very frustrating."
Issues Primarily Related to IT Usage	
Incompatibility Incompatibility of private and business IT. Mainly because of different operating systems and specific file types that cannot be accessed.	"Sometimes some files are not compatible across devices, especially between Mac and PC. It is annoying to try to figure out how to convert them." "I have my work saved on my [private] laptop and I want to access that work on my business phone, but not all of the data is fully transferable. I.e., Excel documents are only on my laptops."
Inability to Use same Software Problems with the installation of business applications on the private device or vice versa cause undesired barriers. This can be due to incompatible hardware and software, IT policies, licenses, or a lack of admin rights.	"I am not allowed to use e-mail on my private IT component so when my manager uses instant messaging to alert me that I have to check my e-mail I need to use my business IT component (laptop)." "Trying to log on to our all-employee virtual meeting using Microsoft Teams – I couldn't get the native app on my PC to work, so switched to the app on my phone, and then the Web app."

Table 4.2-6: Coding Scheme of Qualitative Survey Data

to the inability to use the same software on private and business IT. This can be caused by incompatibility between technologies or by deliberate decisions by organizations, such as IT policies. It creates boundaries between the components, which take up additional time and are undesired by the employees.

While these categories help gain a detailed understanding of users' experience, they are not without interrelations and interdependencies. For example, loss of data could result from a tedious file transfer workaround gone wrong, and incompatibility could result in an inability to use the same software. However, the categories can also occur independently. For example, the inability to use the same software can be due to IT policies. Despite these limitations, we consider the list a good overview of the underlying issues of unreliability due to a lack of integration between business and private IT that may guide decisions in practice.

4.2.6. Discussion

Our research was motivated by two major recent developments. First, the COVID-19 pandemic and its social distancing measures force employees into more mobile work and work-from-home. This has specifically increased the need for digital communication and collaboration. This development was frequently accompanied by a need for IT that is not provided by the employer and, thus, resulted in increased IT consumerization. Second, prior research has stated the need to better understand innovative IT use associated with IT consumerization (Tarafdar et al. 2019). However, adverse effects on the individual have been studied scarcely. This scarcity is particularly true for the role of mixed IT portfolios and the integration of privately-owned and business-owned IT components. Thus, we build a theoretical model and analyze the effect of IT consumerization on unreliability as well as associated outcomes and the influence of computer self-efficacy and perceived portfolio integration. We use a qualitative pre-study to inform our theorizing and test the theoretical model quantitatively through survey data. The data supports our hypotheses. Qualitative data from open-ended survey questions adds richness to the understanding of the relationships. Such reasons lie in the lack of access to company resources, data and file transfer issues, and the inability to use the same software on private and business systems. The resulting technostress leads to dissatisfaction with the IT portfolio, switching exhaustion, and transition costs that hamper performance. Such negative effects of IT consumerization are mitigated for users with high general computer self-efficacy.

4.2.6.1. Theoretical Contribution

We find that IT consumerization and the use of mixed IT portfolios that are poorly integrated have multiple negative consequences. Based on extant literature and qualitative interviews, unreliability is a major mediator of this relationship. This is important to notice since prior research on IT consumerization has found higher usefulness and ease of use to be the key drivers for individuals' IT adoption decisions in general (Venkatesh et al. 2012) and IT consumerization in particular (Ortbach 2015). The perception of IT to not behave consistently and its features to not be dependable tends to go against classical antecedents of technology acceptance like perceived ease of use and perceived usefulness. Here, we see a need for a deeper investigation to understand this paradox.

As a first step to deepening this understanding, we find that perceived IT portfolio integration is a crucial factor for the seamless operation of IT portfolios for business purposes, including private IT components. To the best of our knowledge, this perception has not been considered in the IT consumerization literature so far, and we contribute to it by raising this issue. We find that issues with integration between multiple components of a mixed IT portfolio lead to a higher perception of unreliability. While the duality of IT components certainly raises issues with integration, which we show in this study, such issues can also emerge between multiple heterogeneous IT components provided by the business. For example, different manufacturers of IT and their respective operating systems might cause such issues, which, thus, should be regarded in future research. While poor integration may be an issue with IT portfolios consisting of only business-owned IT components, their management is easier and lies in the hand of IT departments. This is different for mixed IT portfolios, where users are administrating their privately-owned components.

Thus, it is apparent that the general computer self-efficacy of the users also plays a vital role in this relationship. We find that general computer self-efficacy influences the effect of IT consumerization on technostress creators in several ways. This is congruent with the transactional model of stress that most technostress research is based on. Here, stress emerges when external demands tax or exceed the resources an individual can use to meet the demands (Lazarus and Folkman 1984). General computer self-efficacy is such a resource. This finding is also important for the individuals themselves when deciding whether to engage in IT consumerization. This yields several practical implications that we discuss in the next section.

We extend upon our findings through a qualitative analysis of users' experience of poor integration of privately-owned and business-owned IT. We find a host of different problems that

can arise, which center around universal access to company resources, data transfer, synchronization, and compatibility issues. These insights also extend our understanding of the technostress phenomenon and may guide future work on mitigating technostress related to IT consumerization.

4.2.6.2. Practical Implications

When employees increasingly use privately-owned IT for business purposes, it is crucial to understand the personal consequences of this adoption decision. Our qualitative investigation reveals several issues that employees face when business IT and private IT are poorly integrated. Some of these issues can be overcome by the organization: For example, seamless solutions for data transfer that employees can integrate onto their private devices may help with issues with data loss or data redundancies. Many cloud-based office suits offer such integration that can be made available to private devices based on the organizations' IT policies. Several of these changes come as a tradeoff between IT security and user-friendliness. With recent security incidents which have gained global attention, and home-office workers becoming an increasingly popular gateway for hackers, many companies tend to the side of caution with their IT policies. However, they should be aware that restricting access to company resources causes stress in employees. This stress is associated with adverse health effects, decreased satisfaction with IT, and decreased productivity due to transition costs.

Our findings further show that such stressful situations are particularly problematic for IT users that lack personal IT-related resources, measured as general computer self-efficacy, to overcome such issues. Thus, we conclude that IT consumerization is only reasonable if individuals can handle the technologies of their IT portfolio and the complexity introduced by the interplay of privately-owned and business IT components. Thus, IT consumerization should be cautiously used by employees that lack the resources to deal with its additional demands.

Further, privately-owned IT components usually receive less organizational support, which is an essential external resource for inhibiting technostress. In order to prevent the identified negative consequences of IT consumerization, organizations would be well-advised to start offering support for privately-owned IT. This would allow both the organization and its employees to benefit from the advantages associated with IT consumerization without risking their employees' well-being and productivity. Alternatively, organizations may offer all relevant IT components, with high quality and ease of use, that their employees need for mobile work and work-from-home to reduce IT consumerization and its adverse outcomes. Yet, this naturally hampers its benefits.

In summation, both restrictive as well as laissez-faire IT consumerization policies may have adverse effects on users that struggle with IT. Organizations should thus embrace IT consumerization, offer technical support as well as adequate technological integration of private IT devices into their portfolio in order to reap the benefits and mitigate the risks of IT consumerization.

4.2.7. Limitations and Conclusion

Our study has a number of limitations that leave room for further research. In the quantitative empirical part, we use data from a single cross-sectional survey in times of the COVID-19 pandemic, which leads to limitations in testing the robustness and generalizability of results. Future research should follow up with generating additional data sets to test robustness and generalizability. Particularly the relationship between IT portfolio integration and technostress seems promising for future research and should be further validated.

Further, in our research, we emphasize the role of unreliability, which has been scarcely studied in the context of IT consumerization. We show that IT portfolio integration plays a significant role in this relationship. While we elicit several reasons why IT consumerization creates such problems, for example, through a lack of strategic alignment of the components, we do not think that the outlined problems are limited to this domain. Poorly managed or historically grown business IT portfolios may have similar issues. Future research could thus explore the impact of integration on technostress within other IT portfolios.

Previous work has raised research questions regarding different types of stress, particularly challenge stress (2019). One element mentioned to create challenging situations for users is innovative work behavior (Tarafdar et al. 2019). This factor is said to be facilitated by IT consumerization (Junglas et al. 2019). While unreliability is likely a hindrance or a threat to most individuals, future research should look into ways that IT consumerization can contribute to the bright side of technostress. Despite these suggestions for future research, the paper at hand contributes to the scholarly discourse on both the effects of IT consumerization and the antecedents of technostress. It provides several suggestions for practitioners to govern and manage IT consumerization and mixed IT portfolios.

In conclusion, our research sheds light on the adverse effects of IT consumerization concerning technostress and its consequences. We find unreliability to be particularly relevant in this context. With a mixed-methods design, we detail why a mixed IT portfolio of business and private IT components creates a sense of unreliability. Our research further contributes concrete issues

that users experience and suggests how these effects can be attenuated on an organizational and individual level. We conclude that IT consumerization needs to be adequately managed and integrated into the existing business-owned IT landscape to reduce individual exhaustion, increase satisfaction with the IT portfolio, and reduce transition costs that inhibit performance. We further suggest that IT consumerization makes the most sense for users with a high level of IT-related resources to successfully overcome the remaining boundaries between privately-owned and business-owned IT.

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Appendix 4.2/A – Measurement Items

IT Consumerization Use Behavior (source: Junglas et al. 2019)	
ITC01	I use my private devices (e.g., smartphone, iPad, or private laptop) for business purposes.
ITC02	I use mobile applications downloaded from the Web for business purposes.
ITC03	I use my private services (e.g., Skype, Twitter, Facebook, text messaging) for business purposes.
Unreliability (source: Ayyagari et al. 2011)	
UNR01	The features provided by components of my IT portfolio for business purposes are not dependable.
UNR02	The capabilities provided by components of my IT portfolio for business purposes are not reliable.
UNR03	Components of my IT portfolio for business purposes do not behave in a highly consistent way.
Perceived IT Portfolio Integration (source: Rai and Tang 2010)	
PPI01	My IT portfolio for business purposes easily accesses data from its various components.
PPI02	My IT portfolio for business purposes provides seamless connection between its various components (e.g., devices, services, data).
PPI03	My IT portfolio for business purposes has the capability to exchange real time information between its various components.
PPI04	My IT portfolio for business purposes easily aggregates relevant information from its various data sources (e.g., file storage, messaging, email, office suite).
General Computer Self-Efficacy (source: Marakas et al. 2007)	
CSE01	I believe I have the ability to describe how a computer works.
CSE02	I believe I have the ability to install new software applications on a computer.
CSE03	I believe I have the ability to identify and correct common operational problems with a computer.
CSE04	I believe I have the ability to unpack and set up a new computer.
CSE05	I believe I have the ability to remove information from a computer that I no longer need.
CSE06	I believe I have the ability to use a computer to display or present information in a desired manner.
Dissatisfaction with IT Portfolio (source: Au et al. 2008)	
DIS01	I am very contented with my IT portfolio for business purposes. *(reverse-coded)*
DIS02	I am very pleased with my IT portfolio for business purposes. *(reverse-coded)*
DIS03	I feel delighted with my IT portfolio for business purposes. *(reverse-coded)*
DIS04	Overall, I am very satisfied with my IT portfolio for business purposes. *(reverse-coded)*
Transition Costs (source: Maier et al. 2015)	
TC01	It takes a lot of time to maintain the level of information exchange with my business environment using different components of my IT portfolio for business purposes.
TC02	It takes a lot of time to maintain the level of communication with my business environment using different components of my IT portfolio for business purposes.
TC03	Overall, it takes a lot of time to maintain the established level of socializing with my business environment when using different components of my IT portfolio for business purposes.
Switching Exhaustion (source: Maier et al. 2015)	
SE01	Switching from one component of my IT portfolio for business purposes to one or more other components stresses me out.
SE02	I feel tired by switching from one component of my IT portfolio for business purposes to one or more other components.
SE03	Switching from one component of my IT portfolio for business purposes to one or more other components is a strain for me.
SE04	I feel drained from activities involved in switching from one component of my IT portfolio for business purposes to one or more other components.

Appendix 4.2/B – Factor Loadings

(Main loading in bold font)

		ITC	UNR	PPI	CSE	SAT	TC	SE
ITC	ITC01	**0.780**	0.114	0.281	0.279	-0.227	0.105	0.033
	ITC02	**0.892**	0.221	0.306	0.280	-0.186	0.150	0.170
	ITC03	**0.848**	0.183	0.168	0.068	-0.151	0.145	0.252
UNR	UNR01	0.209	**0.966**	-0.286	-0.267	0.243	0.610	0.606
	UNR02	0.178	**0.951**	-0.315	-0.327	0.266	0.591	0.565
	UNR03	0.236	**0.961**	-0.317	-0.228	0.280	0.553	0.563
PPI	PPI01	0.273	-0.312	**0.882**	0.384	-0.513	-0.208	-0.162
	PPI02	0.260	-0.272	**0.873**	0.322	-0.526	-0.220	-0.121
	PPI03	0.272	-0.295	**0.892**	0.388	-0.428	-0.242	-0.208
	PPI04	0.218	-0.217	**0.843**	0.317	-0.508	-0.183	-0.090
CSE	CSE01	0.268	-0.144	0.328	**0.824**	-0.209	-0.121	-0.150
	CSE02	0.206	-0.313	0.360	**0.934**	-0.325	-0.207	-0.251
	CSE03	0.250	-0.217	0.406	**0.871**	-0.321	-0.150	-0.220
	CSE04	0.164	-0.194	0.315	**0.844**	-0.177	-0.231	-0.284
	CSE05	0.193	-0.278	0.322	**0.899**	-0.268	-0.222	-0.264
	CSE06	0.224	-0.293	0.423	**0.913**	-0.331	-0.236	-0.270
DIS	DIS01	-0.205	0.271	-0.524	-0.315	**0.917**	0.206	0.201
	DIS02	-0.234	0.239	-0.560	-0.367	**0.923**	0.172	0.178
	DIS03	-0.157	0.209	-0.450	-0.223	**0.913**	0.105	0.146
	DIS04	-0.188	0.276	-0.524	-0.256	**0.922**	0.099	0.166
TC	TC01	0.137	0.616	-0.245	-0.213	0.171	**0.957**	0.604
	TC02	0.134	0.571	-0.243	-0.212	0.165	**0.954**	0.550
	TC03	0.193	0.538	-0.209	-0.219	0.115	**0.926**	0.605
SE	SE01	0.149	0.562	-0.187	-0.333	0.178	0.556	**0.939**
	SE02	0.203	0.596	-0.197	-0.308	0.199	0.622	**0.948**
	SE03	0.183	0.556	-0.120	-0.220	0.175	0.576	**0.953**
	SE04	0.214	0.571	-0.145	-0.190	0.166	0.595	**0.952**

Note: ITC = IT Consumerization Use Behavior, UNR = Unreliability, PPI = Perceived IT Portfolio Integration, CSE = General Computer Self-Efficacy, DIS = Dissatisfaction with IT Portfolio, TC = Transition Costs, SE = Switching Exhaustion

Appendix 4.2/C – Inter-Factor-Correlations

(Square root of AVE in the diagonal)

	ITC	UNR	PPI	CSE	DIS	TC	SE
ITC	**0.841**						
UNR	0.216	**0.959**					
PPI	0.296	-0.319	**0.872**				
CSI	0.241	-0.286	0.408	**0.881**			
DIS	-0.215	0.274	-0.563	-0.318	**0.918**		
TC	0.162	0.610	-0.246	-0.227	0.160	**0.946**	
SE	0.198	0.603	-0.172	-0.277	0.190	0.620	**0.948**

Note: ITC = IT Consumerization Use Behavior, UNR = Unreliability, PPI = Perceived IT Portfolio Integration, CSE = General Computer Self-Efficacy, DIS = Dissatisfaction with IT Portfolio, TC = Transition Costs, SE = Switching Exhaustion

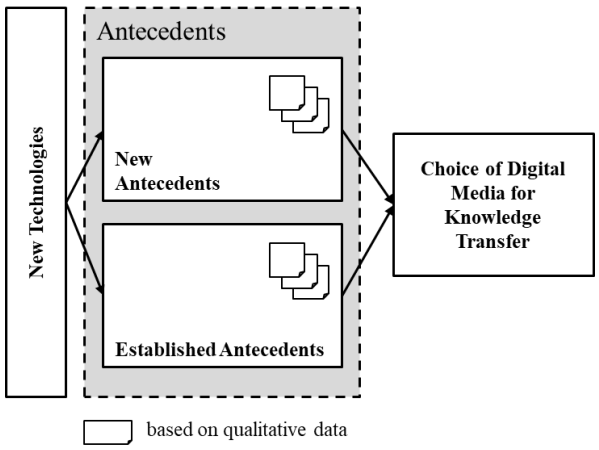
5. General Discussion, Future Research, and Conclusion

In the following, the integrated discussion of the results of this dissertation's chapters are presented. The dissertation at hand aims at providing insights related to communication and collaboration technology use. Thus, this work focuses on antecedents, use processes, and outcomes along the Chapters 2, 3 and 4. To integrate these findings, Chapter 5.1 contains a summary of the individual results of the research papers and draws broader connections from them to the overall topic of this dissertation. The summarized findings are depicted in Figure 5.1-1 to Figure 5.1-6. In each figure, the focus of the respective paper and corresponding chapter is highlighted in grey. The discussion of the findings is followed by an outlook on future research in the research area of this dissertation in Chapter 5.2. Chapter 5.3 finally concludes the dissertation.

5.1. Summary of Results and Meta-Inferences

5.1.1. Results Regarding Antecedents of the Use of Communication and Collaboration Technology

Paper 1 (Chapter 2.1) identifies factors that drive the choice of digital media for knowledge transfer through a systematic literature analysis and synthesizes existing empirical evidence on the relationships. Further, expert interviews evaluate the impact of new technologies, such as AI. Figure 5.1-1 summarizes the research findings schematically. It shows important elements of the respective research framework of the paper depicted in Figure 2.1-4 (Paper 1) in an aggregated way and summarizes the findings. Such figures are shown for each paper. The rectangular squares represent aspects relevant to the study and its context. In the following papers, some aspects of a study consist of constructs that were measured quantitatively. Such constructs are depicted as oval circles. If an aspect of the paper contains multiple constructs, a rectangular square is used and marked with multiple oval circles. Constructs derived from qualitative data are marked with a folded edge. If multiple constructs are used in an aspect of the study, multiple symbols are depicted inside a rectangular square. If both qualitative and quantitative data was used as part of an aspect of the study, symbols for both ovals and squares with folded edges are displayed inside a rectangular square.



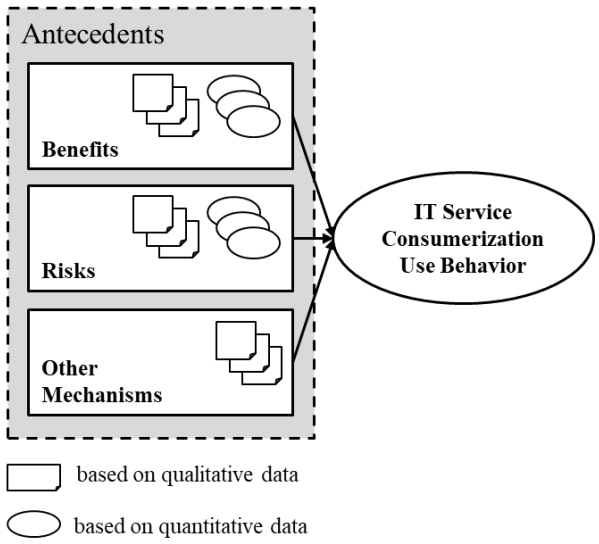
This dissertation…

- Summarizes established antecedents of knowledge transfer.
- Expands known antecedents through expert interviews.
- Assesses the directionality of effect of the antecedents on choice of digital media for knowledge transfer.
- Finds that the emergence of new technologies, such as AI, may change the influence or relevance of several antecedents.

Figure 5.1-1: Summarized Research Findings of Paper 1

The findings are based on a sample of 215 studies out of which 15 yield relevant antecedents. In a second part, eight semi-structured expert interviews are conducted to reveal if and how the rise of new technological advances, such as AI, change the influence of established antecedents or necessitate an expansion of antecedents. Based on our analysis, we present a framework and relate our findings to existing media choice theories. In line with recent reviews on media choice theories, we argue that the fragmentation of both the existing theories and the empirical evidence on the matter pose challenges to the field. Further, we reveal two additional factors influencing media choice for knowledge transfer and find that emerging technologies such as AI may potentially have a strong impact on the relevance of some antecedents. For practitioners, our results may be helpful as they suggest that effective management of the employees' use of digital media for knowledge transfer starts with an understanding of the influencing factors that drive choice. We further suggest that it is not given that technological advancements automatically imply use. Rather, there are several influencing factors that users consider when deciding between different alternatives.

Paper 2 (Chapter 2.2) examines rationales for IT service consumerization use behavior – the use of privately-owned communication and collaboration services for business-purposes. A detailed view of the reasons for use decisions in the post-adoptive phase is essential for organizations. Figure 5.1-2 summarizes our findings.



This dissertation…

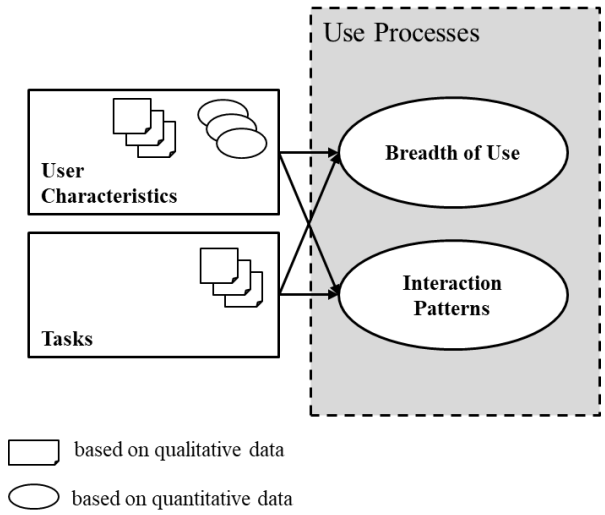
- Establishes IT service consumerization as a deliberate portfolio decision.
- Shows use decisions for IT service consumerization are driven by benefits rather than risks.
- Identifies post-adoptive exogenous mechanisms for IT service consumerization, such as the evaluation of the technologies' features.
- Exploratorily expands knowledge on mechanisms that drive IT service consumerization beyond the ones tested within the model.

Figure 5.1-2: Summarized Research Findings of Paper 2

In this paper, we conduct a mixed-methods study. First, we develop a net-valence model that allows us to investigate the influence of perceived benefits and risks on use decisions. Based on survey data from 221 respondents, we analyze a structural equation model and find evidence that benefits outweigh the risks. In a consecutive qualitative strand, we analyze 348 valid answers to two open-ended survey questions through inductive coding and find rationales that explain what concrete benefits and risks users consider when engaging in IT service consumerization and why they are important. With our research, we also establish IT service consumerization in the post-adoption phase as a portfolio decision and suggest additional mechanisms and reasons for use decisions that may inspire future research. Our results help practitioners recognize the importance of managing IT consumerization on a service-level and suggest that the provision of powerful business alternatives is essential to influence use decisions.

5.1.2. Results Regarding Use Processes of Communication and Collaboration Technology

In Paper 3 (Chapter 3.1), we investigate the use of communication and collaboration technology at the workplace in an integrated way. This paper focuses on identifying different heterogeneous use behaviors. Figure 5.1-3 summarizes the findings.



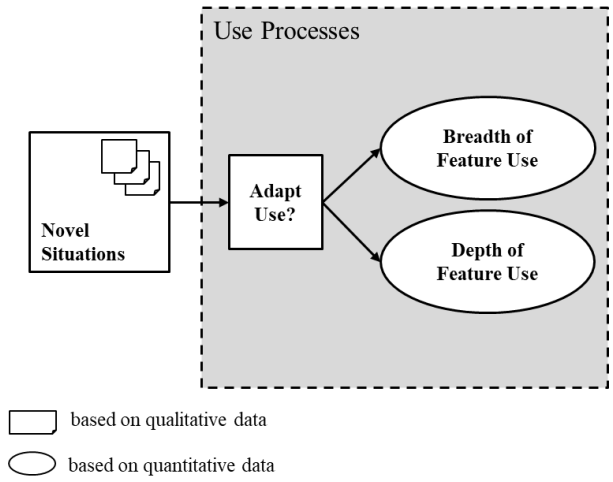
This dissertation…

- Clusters and describes heterogeneous user behaviors within a communication channel and collaboration platform.
- Identifies influencing user characteristics, such as hierarchy, that correspond with user behavior.
- Qualitatively assesses further rationales, such as tasks, as antecedents of use behavior.
- Concludes that organizations can use such insights to enhance collaborative work in the digital workplace.

Figure 5.1-3: Summarized Research Findings of Paper 3

Digital trace data from 146 employees is used for this study. The endeavor is rooted in the knowledge-based theory of the firm and social capital theory. In the quantitative strand, an exploratory clustering approach was used to derive eight heterogeneous user roles from the trace data. Further analysis of user characteristics, such as their organizational hierarchy, show explanatory power regarding the identified behavioral differences. In a subsequent qualitative strand, we conduct nine semi-structured user interviews and reveal further antecedents such as individual tasks of the users, that may explain different user behavior. For example, we observe that top management is heavily involved in communication, while middle management bridges the gaps between top managers and employees by turning visions into tangible content. Other users report about an in-role understanding of knowledge sharing, which leads to an increased use of the collaboration technology. Employees heavily involved in tasks that require teamwork show a tendency towards co-creation of content with colleagues. Lastly and congruent with the positive effect of social ties on social capital, we argue that outliers can potentially be hidden leaders and candidates for promotions. This research contributes to an understanding of heterogeneous user behavior in a digital workplace.

Paper 4 (Chapter 3.2) deals with heterogeneous use of communication and collaboration technology over time. Figure 5.1-4 contains the key constructs and relationships identified in the study.



This dissertation…

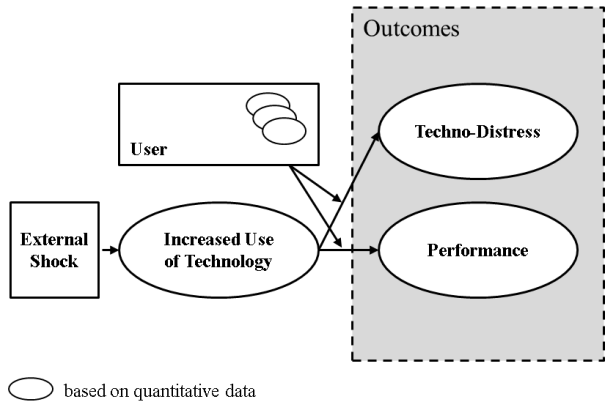
- Finds and describes different user behaviors regarding feature use within a communication and collaboration tool.
- Assesses changes in user behavior across time and because of an external shock.
- Analyses process data to derive further novel situations that may lead to an adapted user behavior.

Figure 5.1-4: Summarized Research Findings of Paper 4

In this mixed-methods study, we focus on breadth and depth of feature use by including different features of Microsoft Teams. The study uses trace data from a German service organization, with between 158 and 182 active employees at the time of analysis. In our quantitative strand, we conduct a cluster analysis on longitudinal real-world data and reveal seven types of behaviors that exist throughout three time periods. Further analysis shows that individual feature use varies within and between individuals over time and that the growth rate increased during the first wave of the COVID-19 pandemic due to work-from-home. In the qualitative strand, we conduct ten user interviews to gain an understanding of why user behavior changes in the post-adoption phase. We find that habits were deliberately altered, and user behavior was consciously adapted when users encountered novel situations, such as a change in team, a change in tasks, or new work-from-home policies. With this study, we extend the knowledge of post-adoptive behavior, which assists practitioners in a deeper understanding of use that may help them adjust to the new normal or to react to new situations beyond the COVID-19 pandemic.

5.1.3. Results Regarding Outcomes of the Use of Communication and Collaboration Technology

Paper 5 investigates the increased use of communication and collaboration technology due to remote work brought about by the external shock of COVID-19. A particular emphasis lies on differences between individuals and how their perception influences whether the increase in use has an effect on technostress, and psychological strain. A brief overview of the study is depicted in Figure 5.1-5.



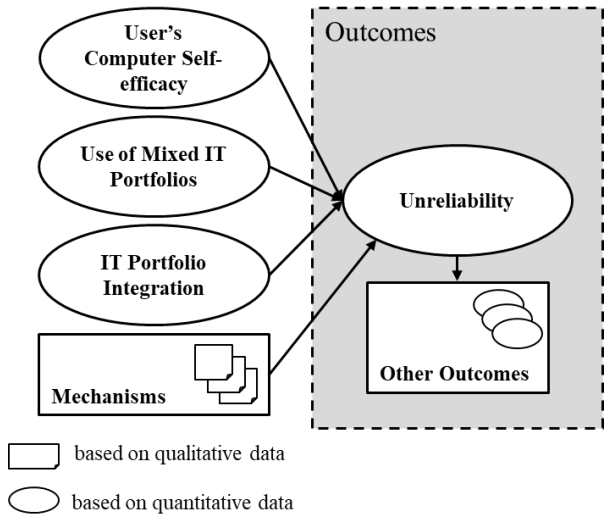
This dissertation…

- Finds that remote working self-efficacy mitigates techno-distress and is associated with higher performance in light of increased use of communication and collaboration technology during COVID-19.
- Identifies a user's remote working self-efficacy as a driver of challenge IS use appraisal but not hindrance IS use appraisal.
- Shows that a user's hindrance IS use appraisal contributes to techno-distress and challenge IS use appraisal is associated with performance.

Figure 5.1-5: Summarized Research Findings of Paper 5

In this paper, a cross-sectional study of 1,553 German employees is conducted. At its center lies the investigation of the relationship between individual appraisal of the changed use of communication and collaboration technologies and remote working self-efficacy. We find that the increased use of technologies is a source of techno-distress and that individual user characteristics and perceptions moderate this relationship to some extent. We find that remote working self-efficacy is not associated with hindrance IS use appraisal, but strongly associated with challenge IS use appraisal. This implies that hindrance IS use appraisal has a different root and is not related to the individuals' resources. Yet, remote working self-efficacy mitigates techno-distress during remote work situations, such as the one experienced during COVID-19. Both remote working self-efficacy and challenge IS use appraisal are associated with performance during remote work. We advance the current knowledge of technostress research regarding challenge IS use appraisal by identifying its relationship with remote working self-efficacy. In summation, the paper shows that the novel use situation during the COVID-19 pandemic was perceived differently by different individuals, which lead to different levels of techno-distress and performance. We show that individual user differences exist that influence this relationship.

Lastly, in Paper 6 we investigate adverse outcomes of using mixed IT portfolios consisting of both privately-owned and business-owned technology. Figure 5.1-6 shows the results of the study.



This dissertation…

- Finds that the use of poorly integrated mixed IT portfolios consisting of privately-owned and business-owned IT components drives unreliability.
- Identifies users' IT-related resources, such as computer self-efficacy, as an important influencing factor.
- Qualitatively summarizes mechanisms that contribute to the perception of unreliability due to a lack of IT portfolio integration.
- Shows adverse outcomes on the individual level that arise from such unreliability.

Figure 5.1-6: Summarized Research Findings of Paper 6

In the paper, we conduct a mixed-methods study based on qualitative and quantitative survey data of 224 full-time employees. We investigate whether the use of mixed IT portfolios increases unreliability, a known techno-stressor. We find that users experience unreliability when integration of their IT portfolio is poor. Yet, users' computer self-efficacy has a positive influence and reduces unreliability – for example through the successful use of workarounds. The perception of unreliability in turn influences other outcomes, such as dissatisfaction with the IT portfolio, switching exhaustion, and raises transition costs. In the qualitative part of our analysis, we identify reasons for this effect and show how mixed IT portfolios consisting of privately-owned and business-owned IT components can cause unreliability. Such reasons refer to a lack of integration, compatibility issues, and include issues with data transfer and other problems related to the use of technology. This paper shows practitioners that IT consumerization has individual-level dark sides that need to be considered. For example, organizations may provide access to resources and tools that bridge the gaps between privately-owned and business-owned components. Further, they should be aware that users may need assistance with their privately-owned IT when using it for business purposes to mitigate the identified risks.

5.2. Limitations and Outlook for Future Research

5.2.1. Future Research Regarding Antecedents of the Use of Communication and Collaboration Technology

Chapter 2 consists of two papers which deal with the choice of digital media for knowledge transfer (Paper 1) and the antecedents of IT service consumerization (Paper 2). Both areas are of high relevance for communication and collaboration research for reasons presented in this dissertation. While the two studies presented in this dissertation contribute to the scientific body of knowledge, they also come with limitations and room for future work.

Consistent with the aim of this dissertation, Paper 1 (Chapter 2.1) focuses on explaining user behavior – in this case the choice for digital media. While this is a topic of interest, the literature on media choice also often links choice to performance outcomes (e.g., Dennis et al. 2008). Gaining a deeper understanding of this linkage has important implications, particularly for practice. Interesting outcomes to study could be the success of the knowledge transfer, or group-level and organizational performance. Further, the various antecedents presented in this qualitative evidence synthesis have yet to be considered in conjunction. Future empirical research could draw conclusions regarding the importance of these antecedents in an integrated way, for example through experiments, quantitative meta-analyses, or questionnaire-based research inquiries. Additional quantitative testing regarding the influence of the antecedents identified in this study on actual user choice would be a reasonable next step. Further, we identify some antecedents that show contradictory empirical results in previous studies. There may be moderating factors at play and investigating such relationships could be a fruitful avenue for future research.

Paper 2 (Chapter 2.2) also has limitations and leaves room for further research. The paper identifies antecedents of IT service consumerization. In the study, we restrict our data collection to one communication and one collaboration service, which may impair generalizability of our results. In the qualitative part of our analysis, we identified additional mechanisms, such integration preference, networking, and the fostering of informal contacts using private services. This indicates that there are more relevant antecedents than have been included in our empirical model. This leaves avenues for future work. For example, moderating variables of use, such as segmentation or integration preferences concerning the private and business domain could be considered (e.g., Ostermann and Wiewiorra 2016; Vaziri et al. 2020). We also report on employees that value security features of consumer IT (for example end-to-end encryption) in the qualitative part of our analysis. Yet, others report that security concerns regarding consumer IT

strongly inhibit use. The root of this duality could be subject to future research and would contribute to a deeper understanding of IT consumerization use behavior.

In summation, there are many antecedents for technology use in general and the specific forms of technology use studied in this dissertation. While the use situations investigated in this dissertation are of high relevance, they cannot cover all use cases. Even though several antecedents and rationales may be transferable to other contexts, their generalization beyond the scope of the individual papers in this dissertation has not been investigated. Future work could contribute by doing so. Another promising research stream for future work are portfolio decision in the post-adoptive phase, where individuals choose between different technologies for different work purposes. Also, research has indicated that the influence of antecedents may change over time. For example, certain antecedents may become less important in the post-adoptive phase when habits have been formed and use has become rather automatic (e.g., Karahanna et al. 1999). In contrast, situations of uncertainty where use behaviors are reevaluated may be circumstances where certain antecedents become more relevant than others.

5.2.2. Future Research Regarding Use Processes of Communication and Collaboration Technology

Chapter 3 contains two papers that investigate different behaviors regarding communication and collaboration technology use. Both papers are based on digital trace data of communication and collaboration software within a German service organization. On the one hand, Paper 3 emphasizes interaction patterns between individuals and across multiple technologies. On the other hand, Paper 4 focuses on a longitudinal analysis and considers changes in use behavior.

Like all research, Paper 3 comes with several limitations. First, the data set is from a single organization and contains a rather small number of individuals, which limits generalizability. Yet, the case is well-suited to study knowledge workers in the digital workplace and many identified user types can be associated with those found in previous studies. A frequent problem in the context of digital trace data is that it only captures interactions within the particular digital technology and neglects undocumented face-to-face interactions or interactions through other technologies (Wang and Noe 2010). Further, the content of the communication interactions is unknown with the anonymized data used in this study. While this issue will likely remain for privacy reasons, more sophisticated anonymization techniques could be employed, such as hashing of words and speech acts that allow for an analysis of the content to some degree while maintaining the anonymity of the data (e.g., Carvalho and Cohen 2006). Lastly, while the study uses time-series data, this property was only used to identify interaction patterns. The resulting

user behaviors were flattened and changes over time were not considered. Yet, it would be worthwhile studying changes in behavior, for example based on external factors. This limitation has been partially addressed in Paper 4, which uses longitudinal data.

Regarding the limitations of Paper 4, it is also based on only one organization, which certainly limits generalizability. Further research may include different types of organizations and investigate organization-specific differences. Also, the data set includes trace data for only four different high-level features. While pervious literature suggests parsimony in selecting features for consistent empirical results (DeSanctis and Poole 1994), considering additional features would enrich our understanding of feature use. Further, our research focuses on the external shock of COVID-19 and draws conclusions about other novel situations that may drive changes in user behavior. While the other novel situations are theoretically supported and anecdotally reported in our user interviews, a thorough quantitative investigation of such circumstances would be fruitful. Thus, further research could test our proposed model empirically. Such tests could be based on an investigation of whether changes in tasks and changes in teams have an impact on the individuals' use behaviors.

To sum up, investigating different use behaviors and their changes based on real-world data seems to be a promising area for future research. Combining trace data with other types of data, such as questionnaire data, performance assessments, or organizational meta-data could lead to rich data sets that may overcome current limits of research regarding in-depth studies of post-adoptive use processes. So far, data privacy issues have limited such studies and the anonymization techniques used in Paper 3 and 4 may prove to be helpful in this regard.

5.2.3. Future Research Regarding Outcomes of the Use of Communication and Collaboration Technology

In Chapter 4, two papers contribute to our understanding of adverse outcomes of technology use with an emphasis on technostress. Both papers are based on survey data. Paper 5 is concerned with the increase of technology use in times of COVID-19 and its effect on technostress. Paper 6 puts an emphasis on mixed IT portfolios of privately-owned and business-owned components and how such portfolios may contribute to technostress and other adverse outcomes.

Paper 5 comes with limitations and room for further research. For example, we measure individual appraisal regarding the general use of technologies, rather than specific situations. While this is congruent with previous research on technostress, research in psychology has suggested that appraisal depends both on the individual as well as the situation (Searle and Auton 2015). Thus, more frequent measurements or measurements aimed at specific use situations could be

employed in future studies to gain more detailed insights on the relationship between individual appraisal and self-efficacy in regard to technostress (e.g., Jerusalem and Schwarzer 2010). Further, the literature suggests that the relationship between self-efficacy and performance may be driven more by previous outcomes than it shapes future outcomes (Harrison et al. 1997). This may be different for appraisal, which varies during an encounter and as the individual interacts with its environment. Investigating such relationships in more detail should be considered in future work.

Paper 6 is based on data from a single cross-sectional survey in times of the COVID-19 pandemic. This leads to limitations regarding generalization of its findings. It further focuses on only one techno-stressor (unreliability). While this stressor is of particular relevance to the use of mixed IT portfolios, a broader investigation of techno-stressors driven by the use of such portfolios could be worthwhile. In this study, we find that poor IT portfolio integration plays an important role in the relationship between the use of privately-owned IT for business purposes and unreliability. There are several indicators that point to a mixed IT portfolio being a driver of the relationship, yet the data also suggests that this relationship may occur in poorly managed IT portfolios that are purely business-owned. Thus, future research could further investigate this issue in a broader context. Lastly, IT consumerization has been associated with positive stress and innovative technology use (Tarafdar et al. 2019). While the adverse outcomes are certainly noteworthy, an integrated view on IT consumerization that considers both bright and dark sides may provide opportunities for future research.

In conclusion, there are several outcomes of technology use that need to be carefully considered. This dissertation follows the tradition of technostress research and puts an emphasis on adverse outcomes. Yet, there have been recent publications that call for the consideration of positive outcomes, too. This applies both for the relationship between technology use and performance, as well as to the relationship between technology use and the positive side of stress (coined techno-eustress, or challenge stress) which has the potential to cause positive emotions (Benlian 2020; Califf et al. 2020). Pursuing such avenues in future research seems fruitful and may provide a more complete picture of technology use and its various outcomes.

5.3. Conclusion

This dissertation makes contributions to IS research in the field of technology use with an emphasis on communication and collaboration technology. Societal and technological factors, such as the rise of innovative technology and the work-from-home situations during the COVID-19 pandemic, have recently transformed the digital workplace and digital work as we

knew it. Thus, a detailed understanding of why communication and collaboration technologies are used, how they are used, and what consequences arise from their use is of great importance. To address this need, the six papers contained in this dissertation follow the categorization of Burton-Jones et al. (2017) to contribute to the three areas of antecedents, use processes, and outcomes of communication and collaboration technology use. Further, following trends towards IT consumerization (e.g., Gewald et al. 2017), both the use of privately-owned and business-owned technologies for business purposes are considered in this dissertation. Regarding antecedents, established antecedents for the choice of technologies for knowledge transfer are derived from previous work and the influence of their relevance in the light of new emerging technologies are investigated. Further, the choice between privately-owned and business-owned technologies is analyzed. Regarding use, different types of user behavior and reasons for their emergence are investigated. Subsequently, mechanisms for changes in user behavior in light of novel situations are identified. Regarding outcomes, increased technology use due to an external shock and its effect on technostress moderated by individual user appraisal is investigated. Lastly, adverse effects of the use of mixed IT portfolios consisting of privately-owned and business-owned components are assessed. With this, the dissertation at hand makes contributions to the rich body of knowledge on technology use. It provides relevant insights to practitioners in how to manage technology use in a human-centric way through considering the risks of technology use while reaping its multifaceted benefits. In addition, the results presented in this dissertation may inspire fruitful future research on a topic that is potentially more relevant today than ever before.

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