A Multidimensional Perspective on the Acceptance of Organizational Communication and Collaboration Systems

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Abbreviations

BIT	Behavioral Investment Theory
CCSs	Communication and Collaboration Systems
IDT	Innovation Diffusion Theory
IS	Information Systems
IT	Information Technology
TAM	Technology Acceptance Model
TOE	Technological-Organizational-Environmental Framework
TPE	Technological-Personal-Environmental Framework
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology

Abstract Deutsch

Unternehmen verfügen heutzutage über die Möglichkeit, aus einer breiten Palette von angebotenen Kommunikations- und Kollaborationstools spezifische Anwendungen auszuwählen und diese für unternehmensbezogene Aufgabenstellungen einzusetzen. Um die kontinuierlich steigende Anzahl an Angeboten zu überblicken, beginnen Unternehmen damit, die Auswahl der eingesetzten Kommunikations- und Kollaborationstools den eigenen Angestellten zu überlassen. Inwieweit sich diese Freiheit auf die Entscheidungsfindung der Mitarbeitenden auswirkt, wurde jedoch kaum erforscht. Klassische Adoptionsmodelle der Wirtschaftsinformatik betrachten den Auswahlprozess bislang lediglich aus einer 1:1 Sicht, innerhalb derer der Evaluationsprozess zwischen dem Individuum und der Anwendung betrachtet wird. Bei dieser Betrachtung wird die Existenz alternativer Anwendungen jedoch vernachlässigt. Diese Arbeit untersucht daher sogenannte „multidimensionale“ Evaluationsprozesse, innerhalb derer sich der Nutzende der Präsenz alternativ existierender Anwendungen bewusst ist. Basierend auf dem „technological-personal-environmental Framework“ von Jiang, Chen und Lai (2010) wird jener multidimensionale Prozess im Rahmen dieser kumulativen Dissertation aus insgesamt drei Blickwinkeln betrachtet. Die Ergebnisse weisen darauf hin, dass die Existenz alternativer Anwendungen einen Einfluss auf die Wahrnehmung bezüglich der aktuell genutzten Systeme nimmt. Zudem werden neue Anwendungen nicht isoliert bewertet, sondern im Kontext bereits existierender Systeme.

Abstract English

Businesses now have the ability to select specific applications from a wide range of communication and collaboration tools to deploy them for business-related tasks. To understand the ever-increasing number of offerings, companies are starting to leave the choice of communication and collaboration tools used to their own employees. The extent to which this freedom affects the decision-making of employees, however, has hardly been explored. Classical adoption models of business informatics so far consider the selection process solely from a 1:1 point of view, within which the evaluation process between the individual and the application is considered. In this consideration, however, the existence of alternative applications is neglected. This work therefore investigates so-called "multidimensional" evaluation processes, within which the user is aware of the presence of alternative applications. Based on the "technological-personal-environmental framework" of Jiang, Chen and Lai (2010), this multi-dimensional process is considered from a total of three perspectives within this cumulative dissertation. The results indicate that the existence of alternative applications has an impact on perception of currently used systems. Moreover, the results show that new applications are not evaluated in isolation, but in the context of already existing systems.

1 Introduction

The following chapter is structured as follows: Section 1.1 describes the motivation of the work. Based on current research findings, a research gap is then outlined, and research questions are derived in Section 1.2. Section 1.3 provides an overview of selected research publications as part of this paper-based dissertation.

1.1 Motivation

Over the last 30 years, information technology (IT)-based adoption and diffusion have emerged as popular and well-established research fields within information systems (IS) research. A large body of theoretical and empirical work has been accumulated in the field, built around a multitude of quantitative and qualitative research results (Misra and Mondal, 2011; Yang and Tate, 2012; Asirvatham *et al.*, 2018; Barrane, Karuranga and Poulin, 2018). So far, numerous factors causing the adoption, post-adoption and diffusion of technologies by individuals, as well as by organizations, have been examined (Jeyaraj, Rottman and Lacity, 2006; Olufemi, 2018). Manifested in quantitative research models, such as the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), the Innovation Diffusion Theory (IDT) (Rogers, 1983), the Technology Acceptance Model (TAM) (Davis, 1989) and, for example, the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), IS adoption and diffusion theories aim to predict the user's future behaviour in terms of IT usage. In this regard, the theories are based on a common logic of causality, where the intention to use an IT system is defined as a mental state and can typically be characterized by certain attributes (Riemer and Johnston, 2011; Chaveesuk, Wutthirong and Chaiyasoonthorn, 2018).

While the intention to use a technology is potentially determined by several predictors, the relationship between user and system is usually understood as an isolated 1:1 relationship (Sedera *et al.*, 2016). The 1:1 relationship implies that the user considers the system as the only viable alternative to accomplishing a task, regardless of the existence of alternative systems (Sedera *et al.*, 2016). This understanding is particularly shaped by organizational research, where a user has only one specific system to solve a task (Yoo, 2010). Today, the paradigm emerges in all three phases of the IS life cycle as defined by Furneaux and Wade (2010, 2011). Hence, it has been identified and criticized in 1) the adoption phase (Sedera *et al.*, 2016), 2) the continuance phase (Kim, Jeon and Choi, 2011; Pham and Ho, 2015) and 3) the termination phase (Maier *et al.*, 2015).

The dissemination of the 1:1 perspective is initially comprehensible, especially in organizations where the use of particular enterprise communication and collaboration systems (CCSs) is often mandatory and users have no choice as to which system to use (Koh *et al.*, 2010). CCSs are particularly defined as enterprise architectures that are used as a communication and collaboration tool for business and IT alignment (Banaeianjahromi and Smolander, 2017; Niemi and Pekkola, 2017). In a mandatory environment, a low level of acceptance rarely results in non-usage, but rather in subtle forms of IS reluctance, such as lack of interest, persistence in old ways or the design of workarounds to avoid technology usage (Lapointe and Rivard, 2005). However, recent studies show that the mandatory use of CCSs applies different criteria to the user in terms of adoption and continuance usage than in a situation where the user has alternatives to choose from (Bhattacherjee *et al.*, 2018; Walther *et al.*, 2018). This raises the question of whether this 1:1 perspective also applies in the context of organizations in which the choice of a CCS to solve a particular task is left up to the employee. According to recent literature, multidimensional relationships in the context of organizations are facilitated, for example, through the emergence of cloud computing that offers software as a service (SaaS) (Walther *et al.*, 2013, 2018). In this case, the user is in a 1:n relationship with the system, where 1:n means that the user can choose freely among the systems (Sedera *et al.*, 2016).

In the context of this dissertation, the 1:n relationship is referred to as a multidimensional relationship, whereby 'multidimensionality' describes the acceptance of systems dependent on the presence of alternative systems. The following section describes how a new perspective on the multidimensional usage intention of CCSs in the context of organizations is equally relevant for research and practice.

Scientific Relevance

In the context of IS research, the consideration of such 1:n relationships remains rare. Yet, the primary focus on multidimensionality has been on the consideration of selection processes that take place in a private context, e.g. the selection of a social networks (e.g. Maier et al., 2015) or a mobile phone provider (e.g. Kim, Jeon and Choi, 2011). Nevertheless, in the context of organizational research, there is hardly any research dealing with multidimensional relationships (Sedera *et al.*, 2016). However, the examination of these multidimensional relationships has a high added value for current research in the field. For example, even in mandatory settings, researchers could identify

so-called ‘shadow IT’, a phenomenon where users have started to use unauthorized IS in the context of organizational ecosystems (Silic and Back, 2014). This phenomenon directly refers to the concept of multidimensionality, since employees are in a situation where they are influenced by the presence of alternative ITs. Furthermore, research on IT adoption and post-adoption could gain from the insights of multidimensional research approaches, since researchers are already calling for more multifaceted and integrated frameworks, especially from the perspectives of technology, the individual and the environment (Al-Natour and Benbasat, 2009; Jacobsson and Linderoth, 2010; Awa, Ukoha and Igwe, 2017). The results of multidimensional research are also relevant for research areas dealing with the strategies for digital transformation and the integration of technologies into the organizational context (Matt, Hess and Benlian, 2015; Hertzum *et al.*, 2018). Similar to acceptance models, implementation models and strategies are usually based on a 1:1 view. An extension of this by means of a multidimensional view can help to improve implementation strategies.

Practical Relevance

Organizations need to digitize processes in order to change and increase the productivity and ability of their own employees to work through increasingly digital technology (Henriette, Feki and Boughzala, 2016). According to a quantitative research report by Gartner (Rayner, 2014) 47% of the organizations included in the survey are planning to change their IT structures by 2020 and migrate to cloud-based applications. Since cloud-based SaaS offerings give companies the ability to select a CCS from a variety of software solutions (e.g. Sedera et al., 2016; Sanhae et al., 2018; Walther et al., 2018), the question arises as to how employees select systems and which criteria play a role in the selection process. From the perspective of system developers, it is important to know how to get users to migrate to a new system even though they are already using an alternative system (Kim *et al.*, 2011; Stieglitz *et al.*, 2018). At the same time, developers want to find out how to prevent users from migrating to a competing service (Stieglitz *et al.*, 2014). For the providers of such ISs, each user is potentially of (monetary) value that must be maintained and not lost (Ma, Kesten and Mukhopadhyay, 2009).

1.2 Research Questions and Objectives

The aim of this dissertation is to examine the user-system relationship in a multidimensional 1:n situation where the presence of competing services determines the intention to use a system. As a research objective, this thesis focusses on CCSs in the

context of organizations, where the choice of IT is up to the user. Organizational 'cultures', where users are free to choose a particular CSS appear, for example, in organizations such as higher education (e.g. Wilms et al., 2016) or in small- and medium-sized organizations, where the users are usually not constrained to use a specific IT. In this dissertation, the multidimensional influence will be considered from three perspectives: technical, behavioural and environmental. The consideration of these three perspectives, which is of particular relevance in a multidimensional context, is based on the technological-personal-environmental (TPE) framework developed by Jiang, Chen and Lai (2010). While in IS research, organizational IS acceptance is traditionally explained on the basis of the technological-organizational-environmental (TOE) framework by Tornatzky and Fleischer (1990), this categorization fails to take sufficient account of individual behavioural patterns. Especially in a multidimensional situation, where the individual has to choose from a set of different IS solutions, the personal perspective, which is represented by the behavioural perspective in this work, is of fundamental relevance. The TPE framework offers this specific focus in which the decision is made by the individual, not by the organization. The TPE framework offers a more suitable foundation as it considers the influencing perspectives in a situation where the decision is made by the individual and not by the organization. In this regard, organizational factors such as internal regulations and organizational culture are covered by the environmental perspective, since these factors are part of the individual's work environment. The three perspectives are described in the following paragraphs.

Technical Perspective

The absence of multidimensionality in classical adoption research is not an unknown issue and has been mentioned in previous studies. For example, Kim, Chan and Gupta (2007) and Kim, Jeon and Choi (2011) mentioned that individuals typically play a dual role in IT acceptance, where they evaluate the IS from a technological perspective and from a more consumer-oriented perspective. In this regard, the authors criticize that both perspectives have primarily been addressed from a one-dimensional view guided by classical adoption theories (Kim, Chan and Gupta, 2007; Kim, Jeon and Choi, 2011). This argument has also been supported in recent work by Sedera et al. (2016), who criticize the one-dimensionality of classical acceptance models. According to Kim, Chan and Gupta (2007), the technical perspective is characterized by decision-making based on a technical evaluation of the IS. This evaluation is based, in turn, on perceived technical characteristics (such as perceived usefulness or perceived performance) and personal

prior experiences (such as satisfaction). A technical evaluation takes place, for example, if the user has already gained initial experience with a system and evaluates characteristics such as usefulness or performance. Yet, 1:n relationships have further been addressed through users' switching behaviour, where a user switches from a specific system A to a specific system B (e.g. Bhattacherjee and Park, 2014; Goode, 2015; Wu, Vassileva and Zhao, 2017; Xu et al., 2017). Although switching behaviour falls under the definition of multidimensionality, previous theories on switching behaviour are essentially based on isolated adoption theories. All these theories focus on the perceived benefits of the new alternative and only consider the impact of the former system through the measurement of dissatisfaction (Bhattacherjee and Park, 2014), low satisfaction (Park and Ryoo, 2013; Venkatesh, Thong and Xu, 2016) and narrow scope of use (Park and Ryoo, 2013).

In line with the insights of Kim, Chan and Gupta (2007), the author argues that switching behaviour has to be evaluated in a comparative way, where a comparison between both systems takes places as a result of which the user decides to which system he or she will switch. At the same time, not only the comparison between systems A and B should be considered, but also the influence of alternative systems on this switch. Based on the Behavioral Investment Theory (BIT) from social psychology (Rusbult, 1980), the author argues that the presence of alternative systems has the potential to terminate the relationship between the user and the current system and to increase the switching intentions (Wilms, Stieglitz and Müller, 2018). A user who, for example, already has a relationship to a similar system, or who has a pool of alternative systems at his disposal, will consider this relationship in his decision-making process.

In this dissertation, the adoption and the switching process will be considered against the background that the availability of alternative services influences the adoption decision of the user. The thesis goes beyond the given one-dimensional perspective of previous adoption models and takes a multidimensional perspective. This results in the first research question:

RQ1: *How can multidimensionality be examined from a technical perspective in the context of CSS acceptance in organizations?*

Behavioural Perspective

Research on user acceptance has traditionally been grounded on the principles of value maximization and rational decision-making (Jeyaraj, Rottman and Lacity, 2006). In this manner, Kim et al. (2007, 2011) argue that, besides a technical perspective, users evaluate systems from a more behavioural, consumer-driven perspective. Hence, users are consumers who select systems according to personal purposes and also bear the responsibility of their usage decision (Kim et al., 2007; 2011). As consumers, individuals evaluate systems from a rational economic perspective, which is typically characterized by the value assessment of the target (Zeithaml, 1988; Kim, Chan and Gupta, 2007; Kim, Jeon and Choi, 2011). Based on this logic, Kim et al. (2007, 2011) expects users who act as consumers to make rational choices by using the alternative with the highest perceived value. Such value is based on individual weightings and may therefore vary among individuals.

However, in contrast to the work of Kim et al. (2007, 2011), the author argues that a decision in which the user chooses from two or more alternatives is not always in favour of the alternative with the highest perceived value. Hence, this dissertation refers to the prospect theory of (Kahneman and Tversky, 1979), where individuals tend to prefer the less uncertain option, even if the evaluation of the alternative is higher (Kahneman and Tversky, 1979). Adapted to the context of multidimensional IS usage behaviour, this means that during the decision-making process, where a user evaluates the usage of an alternative IS to conduct work-specific tasks, the outcome may be in favour of an alternative which has been less valued if the user feels uncertainty. Therefore, in a multidimensional context, an alternatively available system is not simply selected based on technical advantages (e.g. higher security, higher performance, higher capacity). Rather, the system is also considered from a behavioural perspective, where the outcome is not always in favour of the system that has been evaluated as better, especially if several circumstances cause uncertainty. Therefore, the second research question of this work is:

RQ2: *How can multidimensionality be examined from a behavioural perspective in the context of CSS acceptance in organizations?*

Environmental Perspective

Various studies argue that systems must always be evaluated in the context of their environment (Tornatzky and Fleischer, 1990; Bradford, Earp and Grabski, 2014; Asirvatham *et al.*, 2018). Traditionally, the environment has always been considered in relation to organizational structures (Bradford, Earp and Grabski, 2014). Thus, the environmental perspective focusses on the multidimensional impact of classical environmental characteristics, such as technical support and infrastructure regulations, but also on the impact of organizational characteristics, such as internal regulations and processes (e.g. Bradford, Earp and Grabski, 2014).

Noting the specific research gap, the research object is organizations where the decision, as to which system to use to complete a task, lies with the employee. In a multidimensional decision scenario, the environmental factors play a decisive role, since a selected CSS is always evaluated against the background of the environmental variables. In terms of the multidimensionality of the environment, this work focuses specifically on work processes and infrastructures that can influence the implementation of alternating technologies. Hence, this work relates to the definition of Hanseth and Lundberg (2001) who describe environmental impact as work-oriented infrastructures. They state that 'work-oriented infrastructures are shared resources for a community; the different components of an infrastructure are integrated through standardised interfaces; they are open in the sense that there is no strict limit between what is included in the infrastructure and what is not, and who can use it and for which purpose or function; and they are heterogeneous, consisting of different kinds of components—human as well as technological' (2001, p. 455). According to the definition of work-oriented infrastructures, it is argued that, in an organization, technology such as a CCS is perceived as part of an overall ecosystem within the framework of suitable hardware infrastructures. Within this ecosystem, the CCS coexists with the hardware, as well as with other systems, and may depend on them. However, based on further assumptions of, for example, Stieglitz et al. (2014), it is assumed that the fit of each technology in the context of organizational ecosystems is determined through the quality criteria defined by Pipek and Wulf (2009). The criteria measure, for example, the interconnectivity and visibility of a new technology in the context of the given work-oriented infrastructure, and they provide a means to assess how well the technology fits into the organizational ecosystem.

Hence, it is deduced that a system must always be evaluated against the background of the existing infrastructure, in addition to a technical and a behavioural perspective. In the context of a multidimensional setting, we therefore assume that existing and alternative CSSs are always evaluated against the background of infrastructure compatibility.

The third research question is, therefore, as follows:

RQ3: *How can multidimensionality be examined from an environmental perspective in the context of CSS acceptance in organizations?*

The three research questions address perspectives the user can have towards a system. The following are considered: a technical perspective in which system characteristics and experiences have an influence on the user's decision; a behavioural perspective in which the user views the system from an economic perspective; and an infrastructure perspective in which the system is viewed in the context of an organizational working environment. In the context of a multidimensional usage process, the perception of a CSS that exists alongside a number of alternative CSSs is different from each perspective. Answering the research questions can be of help in the future to better understand the selection of CCS employees in an organizational context. A deeper understanding not only helps researchers to understand the usage process from a broader perspective, but also helps organizations to better understand the acceptance of their own implementations and the behaviour of their employees.

The following subsection presents the research articles that are part of this cumulative dissertation.

1.3 List of Publications

This PhD thesis is a 'thesis by publication', which is a compilation of nine research articles published in various national and international journals and conference proceedings, including the International Conference on Information Systems (ICIS), Hawaii International Conference on System Sciences (HICSS), Americas Conference on Information Systems (AMCIS), Information Systems Management, and HDM – Praxis der Wirtschaftsinformatik. Additional articles that are included are currently being considered for publication by the Communications of the Association for Information Systems, and the International Journal of Innovation Management. These research articles represent the scientific work of four years of research begun in 2015. Each publication

emphasises a specific aspect of the different perspectives of the multidimensional adoption process. Eight articles are written in English, and one is written in German. Co-authors of the published articles are located at the University of Duisburg-Essen and the Freie Universität of Berlin.

Table 1 provides a comprehensive overview of the published research articles that comprise this thesis. Each row presents a paper and is subdivided into title, publication year, authors and outlet (name of the journal or conference proceedings) and the type of outlet in which the article was published (Journal = JNL; Conference = CNF). Furthermore, Table 1 contains the Verband der Hochschullehrer für Betriebswirtschaft (VHB) Jourqual 3 (2015) rankings1.

Table 1. List of Publications

#	Publication		Type	VHB JQ3
1	Title: Authors: Year: Outlet:	Feeling Safe on a Fluffy Cloud – How Cloud Security and Commitment Affect Users' Switching Intention Wilms, Konstantin L. Stieglitz, Stefan Müller, Benedikt 2018 *International Conference on Information Systems*	CNF (Full Research Paper)	A
2	Title: Authors: Year: Outlet:	Between Termination and Adoption – The Ex-Users' Valley Stieglitz, Stefan Wilms, Konstantin L. Vogl, Raimund Rudolph, Dominik 2018 *International Conference on Information Systems*	CNF (Short Paper)	A
3	Title: Authors: Year: Outlet:	Understanding User Migration to Cloud Computing Infrastructures in Higher Education Stieglitz, Stefan Meske, Christian Wilms, Konstantin L. Vogl, Raimund Rudolph, Dominik 2019 (submitted - 2nd revision) Communications of the Association for Information Systems	JNL	C
4	Title:	Do Researchers Dream of Research Data Management?	CNF (Full	C

[1] https://vhbonline.org/vhb4you/jourqual/vhb-jourqual-3/teilrating-wi/

	Authors: Year: Outlet:	Wilms, Konstantin L. Stieglitz, Stefan Buchholz, Alina Vogl, Raimund Rudolph, Dominik 2018 *Hawaii International Conference on System Sciences*	Research Paper)	
5	Title: Authors: Year: Outlet:	Open Data in Higher Education – What Prevents Researchers from Sharing Research Data? Wilms, Konstantin L. Brenger, Bela López, Ania Rehwald, Stephanie 2018 *International Conference on Information Systems*	CNF (Short Paper)	A
6	Title: Authors: Year: Outlet:	A Value-Based Perspective on Supporting and Hindering Factors for Research Data Management Wilms, Konstantin L. Stieglitz, Stefan Ross, Björn Meske, Christian 2019 (submitted) *International Journal of Information Management*	JNL	C
7	Title: Authors: Year: Outlet:	Understanding the Utilitarian Value of Enterprise Social Networks and Its Role for Use Continuance – A Digital Infrastructure Perspective Meske, Christian Wilms, Konstantin L. Stieglitz, Stefan 2019 *Information Systems Management*	JNL	C
8	Title: Authors: Year: Outlet:	Digital Transformation in Higher Education – New Cohorts, New Requirements? Wilms, Konstantin L. Meske, Christian Stieglitz, Stefan Decker, Hannah Fröhlich, Lena Jendrosch, Nadine Schaulies, Sarah Vogl, Raimund Rudolph, Dominik 2017 Americas Conference on Information Systems	CNF (Full Research Paper)	D
9	Title:	Wissensaustausch in Unternehmen: Wahrnehmung von Enterprise Social Software als Tool für den Austausch von sicherheitsrelevantem Wissen.	JNL	D

	Authors:	Wilms, Konstantin L. Brachten, Florian Stieglitz, Stefan Berthéle, Davina		
	Year:	2019		
	Outlet:	*HMD Praxis der Wirtschaftsinformatik.*		

2 Research Background

In the following, it will be shown how the consideration of a multidimensional perspective distinguishes itself from the one-dimensional perspective and how multidimensionality has already been investigated into previous research. Chapter 2.1 gives an explanation of the importance of a multidimensional perspective and provides an overview of previous studies that have investigated the influence of alternative systems in the organizational CCS context. In chapter 2.2, the role of switching intentions in the context of multidimensional CCS utilization is presented.

2.1 Multidimensionality through the Presence of Alternatives

Traditional acceptance models, such as TAM and UTAUT, have established themselves over the years and are highly present in IS research (Asirvatham et al., 2018; Barrane, Karuranga and Poulin, 2018). Despite frequent and repeated criticism over time (e.g. best fit bias, Jeyaraj, Rottman and Lacity [2006], pro-adopter bias, Rogers [2010] or Cartesian worldview paradigm, Riemer and Johnston [2011]), these models, with their simplicity and modularity, as well as the strong predictive power of the conditional constructs, have proven their value up to the current time. However, there is an ongoing discussion that criticizes a research paradigm according to which the models usually place the individual in a 1:1 context with the system where the user is given the choice to use or not use the system (Kim, Jeon and Choi, 2011; Sedera *et al.*, 2016; Walther *et al.*, 2018). Due to the massive growth of SaaS solutions, where the user has the choice to quickly switch between different systems without spending much time or money, the 1:1 researchers are calling for a change in the current course of acceptance research (Walther *et al.*, 2018). In this regard, Sedera et al. (2016) criticize that:

[..] experimental or casual acceptance, in isolation, may not lead to regular incorporation into the user's tasks and cannot lead to long-term effects on the individual's behavior. At the highest point of acceptance, each user could select the right combination of systems, considering the relevant priorities and their knowledge and experience. (Sedera *et al.*, 2016)

Hence, Sedera et al. (2016) call for a shift in the current IS acceptance research to where a 1:n perspective is taken and where the acceptance process is viewed from a novel angle assuming that the user has the choice to use one or more systems. In this regard, we define multidimensionality as a 1:n perspective, where the acceptance to an IS is influenced by

the presence of an alternative IS. While the call for a multidimensional view is quite new in IS research, it already has been demonstrated in different contexts.

For example, Rusbult et al. (1989) used the so-called investment model to show that the attractiveness of alternative partners has an impact on the persistence of existing human relationships. This model shows that the greater number of attractive partners, the more likely an existing partnership is going to end. Jones et al. (2010) adopted this theory in the context of service offerings (e.g. hairstyling services) and assumed that, if less attractive alternatives are available, the repurchase intention of services such as hairstyling or banking services increases. While the negative impact on service repurchase intention could not be validated in the experiment, Jones et al. (2010) could show a significant interaction between attractiveness of alternative services and satisfaction and repurchase intentions.

In the context of organizational CSSs, there are only a few studies which measured the impact of alternative solutions on users' acceptance. Goode (2015), for example, hypothesized that the availability of alternative cloud-based CCSs has a moderating effect on users' switching intention. However, Goode's hypothesis could not be confirmed within the experiment. Based on former expectations of multidimensionality in IS, Yen and Hsu (2015) published a theoretical paper in which they hypothesized that the impact of alternative available services has an impact on the perceived value of the user from an behavioural viewpoint. Furthermore, the authors assumed that there will be gender differences, and that women are influenced by the presence of alternatives to a higher extent than men. Currently, there is no available publication confirming their theoretical assumptions.

Besides research dealing with the influence of available alternative ISs, research in this area has also dealt with the question of why and under which conditions users plan to switch from their current system to an alternative system. The next sections show the status quo of literature on IS switching in the field of cloud-based services.

2.2 Multidimensionality through IS Switching

The switch from one system to another is, according to the definition given in this work, a multidimensional utilization case. In order to better understand this switch of systems, it is first important to look at the different stages of the life cycles of a system.

The practice to measure IT usage through individuals' behavioural intention has a long tradition in IS adoption research, which can be partly ascribed to the groundwork of Ajzen and Fishbein (1980) (Jackson, Chow and Leitch, 1997; Oliveira and Martins, 2011). According to their TRA, behavioural intention is strongly related to the individual's actual behaviour, which can be measured in each individual's everyday life (Ajzen and Fishbein, 1980). Based on this logic, numerous publications have been published dealing not only with adoption behaviour (for a review see Williams *et al*., 2009), but also with continuance usage behaviour (for a review see Bhattacherjee & Lin, 2014) and IS termination (Maier *et al.*, 2015). Collectively, the three phases represent the life cycle of an IS as described by Furneaux and Wade (2010, 2011) and illustrated in Figure 1.

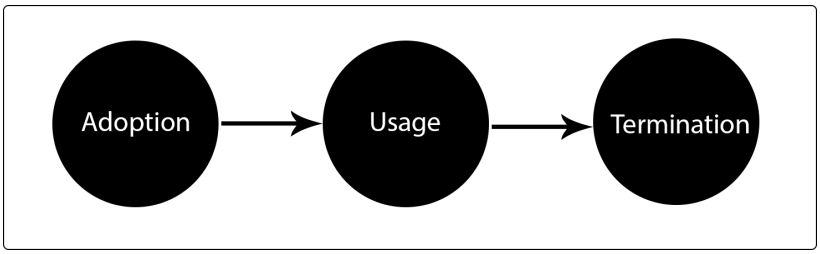

Figure 1. Life cycle of IS by Furneaux and Wade (2010, 2011). Illustration format adapted from Maier et al. (2015).

The successful adoption of an IS is followed by an examination of its continuous usage. Unlike the classic adoption phase, the usage phase (for example, the Information Systems Continuance Theory developed by Bhattacherjee and Lin, 2015) describes a state where IT executives no longer focus on the adoption of a new technology, but on the 'long-term or sustained use of an IT solution by individual users over a period of time' (p.1). The aim of continuance theories is to examine the determinants leading to users' continuing use of a system. Thus, IS continuance theories examine continuance intention and behaviour, and therefore rely on two principles: 'expectations of benefits from future usage' [measured by constructs such as perceived usefulness] and 'summative judgments of the outcomes of prior usage' [measured by constructs such as user satisfaction] (p. 1). To examine users' intention to continue the use of cloud storage technologies, different

approaches, such as the Task-technology Fit Theory (Yang & Lin, 2015) or the Principal-agent Theory (Trenz *et al.*, 2013), were used.

Based on the findings of Ajzen (2001), Turel (2015) assumes that users can have both continuance and discontinuance intention at the same time. Hence, discontinuance intention is not to be confused with a low continuance intention (as measured in the usage phase), as continuance and discontinuance intention do not share the same predictors and must therefore be treated separately (Turel, 2015). Users who plan to discontinue the use of an IS are located in the termination phase of the life cycle model. The termination phase is described by Maier et al. (2015) as the last sequence in the IS life cycle, and in particular, the phase in which a user decides to leave the system (Maier *et al.*, 2015). In this phase, the decision-making process is defined as 'the decision users make to quit the usage of a system and not go back to it' (Turel, 2015, p. 1). Recker defines discontinuance as a situation where the users 'continue carrying out a task but choose to do so without an information system that was in place to enact the task' (Recker, 2016, p. 2). Others define discontinuance as 'the cessation of the use of an organizational information system' (Furneaux and Wade, 2011, p. 2) and leave open whether other systems or workarounds are used alternatively. In this regard, Rogers (2003) distinguishes between two types of discontinuance, namely disenchantment and replacement:

- *Disenchantment discontinuance* is defined as a decision resulting from individuals' dissatisfaction with the performance of a technology (Rogers, 2003). Within literature, disenchantment discontinuance was measured by the level of discontinuance intention relating to users' intention to abandon an IS permanently without knowing specific switching intentions.

- *Replacement discontinuance* is defined as an individual's decision 'to reject an idea in order to adopt a better idea that supersedes it' (Rogers, 2003, p.187).

The theoretical concept of *replacement discontinuance* is strongly related to the principle of IS switching, where users decide to terminate the usage of a particular system and start using a new alternative. Switching between system A and system B involves two phases: the termination phase in system A and the adoption phase in system B (see Fig. 2).

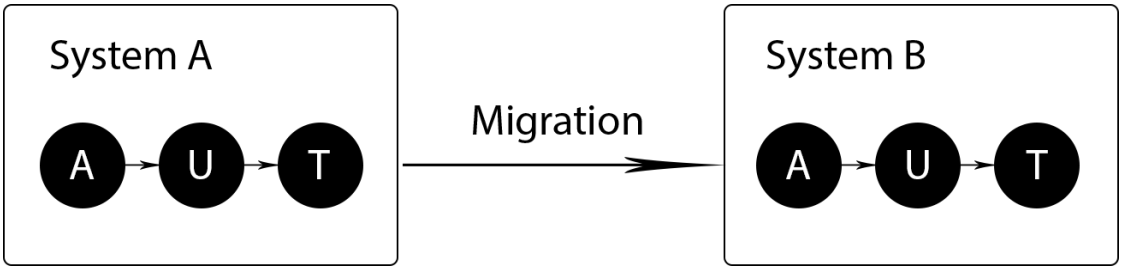

Figure 2. Migration as transition between two IS life cycles. A=Adoption, U=Usage, T=Termination.

3 Research Design

In this chapter, the research design of this thesis will be presented. Chapter 3.1 first describes the research strategy and contains information about the classification of the research papers. The papers are assigned to the corresponding research questions and possible overlaps are pointed out. In 3.2, the methodological background of the research articles is presented.

3.1 Research Strategy

The aim of this dissertation is to examine a multidimensionality perspective within the adoption process. To this end, three sub-perspectives (technical, behavioural, environmental) within the adoption process were identified, resulting in three central research questions. Hence, the dissertation consists of three parts, each addressing one of the three sub-perspectives' questions. During the research course, a total number of nine research papers were written, each addressing one or more perspectives at the same time. Table 2 gives an overview of the classification of the papers. Intersections among the three research questions are due to the strong interdependence and interconnectedness of the three perspectives, which partly influence each other. The analogy is therefore as follows: 'X' marks the main focus of the research paper, and '(x)' indicates whether the paper addresses one of the marked perspectives in addition to the main focus. Figure 3 displays the research course through the assignment of papers to the three research questions, RQ1–RQ3.

Table 2. Thematic Classification

Paper No.	Title	RQ1	RQ2	RQ3
P1	Feeling Safe on a Fluffy Cloud – How Cloud Security and Commitment Affect Users' Switching Intention	X	(x)	
P2	Between Termination and Adoption – The Ex-Users' Valley	X		
P3	Understanding User Migration to Cloud Computing Infrastructures in Higher Education	X	(x)	
P4	Do Researchers Dream of Research Data Management?	(x)	X	
P5	Open Data in Higher Education – What Prevents Researchers from Sharing Research Data?		X	
P6	A Value-Based Perspective on Supporting and Hindering Factors for Research Data Management.		X	(x)

P7	Wissensaustausch in Unternehmen: Wahrnehmung von Enterprise Social Software als Tool für den Austausch von sicherheitsrelevantem Wissen.		X	(x)
P8	Digital Transformation in Higher Education – New Cohorts, New Requirements?		(x)	X
P9	Understanding the Utilitarian Value of Enterprise Social Networks and Its Role for Use Continuance – A Digital Infrastructure Perspective.			X

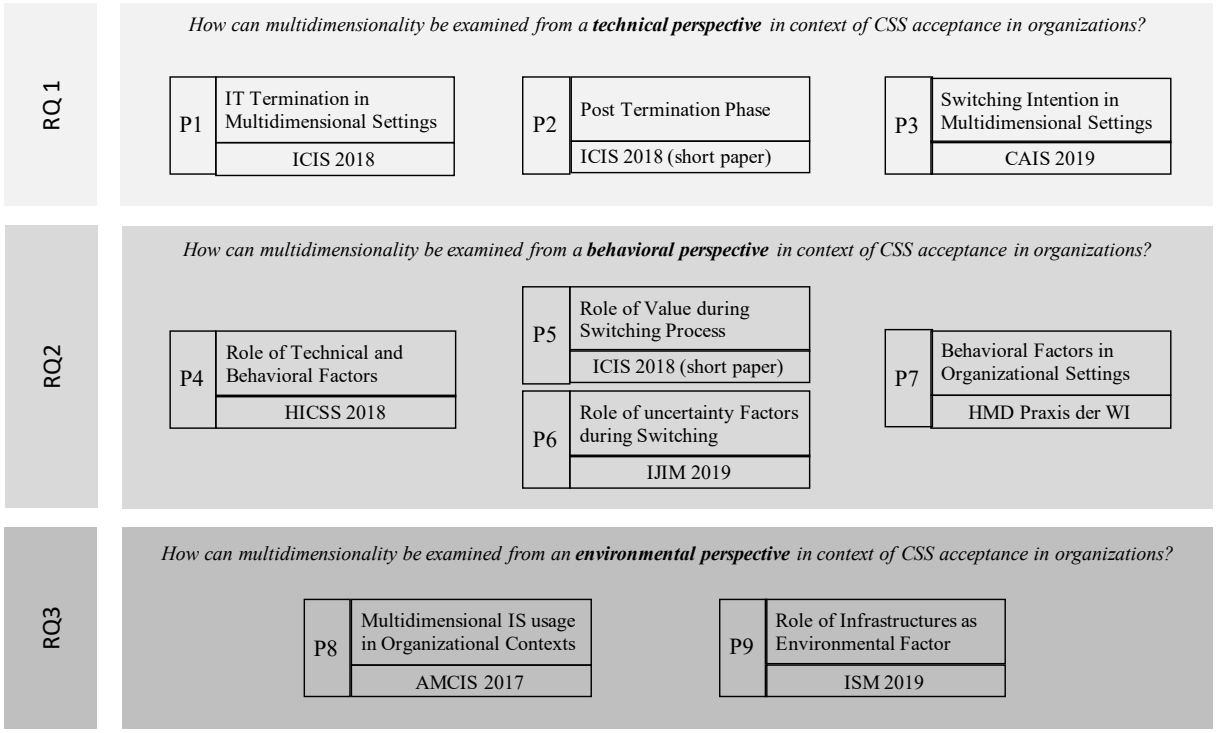

Figure 3. Overview of the work.

It can be observed from Figure 3, that the dissertation consists of three parts, each addressed by a specific research question. Each research question focusses on one of the three perspectives, from which multidimensionality in the context of organizational CCS selection is examined. RQ1 deals with the technical perspective of the multidimensional usage process. P1 examines how the presence of available alternative ISs impact users' decision to stay or not to stay within their current system. P2 examines the termination phase where the users decide to quit usage of their current system and identifies different characteristics in discontinuance behaviour. P3 examines the switching process in general and focusses on the relative valuing process, where the users evaluate a new alternative service with respect to their former services. P3 is also linked to RQ2, since both technical benefits and the principle of valuing are considered, which are related to users' behavioural perspective.

The second part examines which individual factors, in addition to technical factors and user experience, are involved in the switching process. Therefore, P4 attempts to identify behavioural drivers in a specific organizational CCS switching scenario and discusses the differences of the technical drivers. P5 and P6 use quantitative statistics to measure the impact of the valuing process and demonstrate what happens if the user has to take a decision under uncertainties. P7 discusses the consequences of the positive or negative outcome of the valuing process by analysing users' behaviour in a company.

In addition to technical and behavioural factors, the third part investigates the influence that the environment has on the evaluation of the systems. P8 is the first work published during this research course and identifies the consequences of an open culture, where users and employees are free to choose specific CCSs in organizations. Nevertheless, this work addresses RQ3 in particular, since it displays that users' decision-making is dependent on the environment which may include environmental determinants, as well as organizational requirements and culture. P9 is the most recent research paper, and it measures how the environment (in this case the infrastructural environment) has an impact on users' CCS relationships and which environmental infrastructural factors favour users' acceptance of a CSS.

3.2 Applied Research Methods

The adoption and diffusion of users in relation to an IS is strongly influenced by empirical quantitative techniques and survey research (Williams *et al.*, 2009; Wang, Duan and Fu, 2011). The advantages of the quantitative research method lie in the assessibility of regression models with which the influence of special predictors can be measured and evaluated (e.g. Davis, Bagozzi and Warshaw, 1989; Venkatesh and Brown, 2001). This technique has been primarily used to support research questions of social science (Myers, 1997). In order to increase the comparability of the results using the example of existing work that has so far primarily been quantitatively investigated, the main method applied within the articles for this dissertation is quantitative survey research. In this regard, six research papers rely on survey research. These papers (P1, P2, P3, P5, P6 and P9) present regression models in order to test the corresponding hypothesis. Besides quantitative research, this work uses descriptive research approaches since descriptive research focusses on specific and pre-defined research questions (Andrew *et al*. 2011) and is particularly useful to analyse and describe use cases where no particular hypotheses are

present. Thus, a descriptive research approach was used to explore the particular use case presented in P7.

One study uses a qualitative approach based on literature research applied by vom Brocke *et al.* (2009). This work, conducted in P4, was applied to the gap between RQ1 and RQ2 to first determine the differences in technical and behavioural factors and second, to identify existing research gaps and problems (vom Brocke *et al.*, 2015). P8 is based on a classic qualitative approach including interviews as the collection method in order to understand the existing problems and needs of users from the organizational perspective.

Table 3. Overview of Applied Research Methods

Paper No.	Research Approach	Applied Research Method	Data Collection Method
P1	Quantitative, descriptive research	Survey Research	Online Questionnaire
P2	Quantitative, descriptive research	Survey Research	Online Questionnaire
P3	Quantitative, descriptive research	Survey Research	Online Questionnaire
P4	Qualitative, descriptive research	Literature Research	Literature Review
P5	Quantitative, descriptive research	Survey Research	Online Questionnaire
P6	Quantitative, descriptive research	Survey Research	Online Questionnaire
P7	Quantitative, descriptive research	Survey Research	Online Questionnaire
P8	Qualitative, exploratory research	Case Study Research	Interviews
P9	Quantitative, descriptive research	Survey Research	Online Questionnaire

4 Research Results

This chapter presents the research findings concerning the three research questions. First, Chapter 4.1 provides an overview of the research results of each article. Chapter 4.2 provides a detailed report on the research results on the technical perspective. Chapter 4.3 presents the results regarding the behavioural perspective. Finally, Chapter 4.4 concludes with the research results referring to the environmental perspective. Since, in some cases, articles address multiple research questions, they have been arranged to form a logical transition to the corresponding research question. Since, in some cases, articles address multiple research questions, they have been arranged to form a logical transition to the corresponding research question and to next research question. According to the order of the research questions, the articles addressing the technical perspective are presented first. Next, the behavioural perspective will be addressed and finally the environmental perspective.

4.1 Overview of the Publication's Findings

In the following table, the research articles are summarized and classified regarding the respective research questions.

Table 4. Overview of the Logical Order of Research Publications

Research Question	Research Articles	Description
RQ 1 (technology perspective)	**P1:** Wilms, K., Stieglitz, S. and Müller, B. (2018). Feeling Safe on a Fluffy Cloud – How Cloud Security and Commitment Affect Users' Switching Intention. *International Conference on Information Systems* ***(ICIS)***.	Located between the usage and the termination phase of the IS life cycle, this work examines how the presence of attractive alternative CCSs impact users' intention to change the current CCS. The work shows that users have the potential to develop a strong attachment to their system, which can be influenced by the presence of alternative systems and their technical benefits.
	P2: Stieglitz, S., Wilms, K., Vogl, R. and Rudolph, D. (2018). Between Termination and Adoption – The Ex-Users' Valley. *International Conference on Information Systems* ***(ICIS)***.	This article focuses on the behaviour of users in the termination phase. The results show that users who have alternative services to choose from evaluate the technology differently than users who have no further adoption or switching intentions.

	P3: Stieglitz, S., Meske, C., Wilms, K., Vogl, R. and Rudolph, D. (2019 – submitted 2nd revision). Understanding User Migration to Cloud Computing Infrastructures in Higher Education. *Communications of the Association for Information Systems* ***(CAIS)***.	The paper focusses on the termination and adoption phase between two CCSs. IT criticizes earlier research approaches in which multidimensionality was evaluated only by a perceived advantage of new alternatives. The work provides a model in which the relative comparison between one or more systems is mapped.
RQ 2 (behavioural perspective)	**P4:** Wilms, K., Stieglitz, S., Buchholz, A., Vogl, R. and Rudolph, D. (2018). Do Researchers Dream of Research Data Management? *Hawaii International Conference on System Sciences* ***(HICSS)***.	This article addresses technical and behavioural barriers in research data management. The results show that technical innovations are not sufficient to influence the decision-making of individuals. In addition to technical innovations, it is necessary to address individual behavioural patterns in order to establish new work processes.
	P5: Wilms, K., Brenger, B., López, A. and Rehwald, S. (2018). Open Data in Higher Education – What Prevents Researchers from Sharing Research Data? *International Conference on Information Systems* ***(ICIS)***.	This work focuses on the behavioural barriers that may arise alongside technical barriers during the implementation of new work processes. Innovations demand new behavioural patterns and work routines from users. The work shows that the decision of individuals to adopt a certain way of working is not always based on value maximization.
	P6: Wilms, K., Stieglitz, S., Ross, B. and Meske, C. (2019 – submitted). A Value-Based Perspective on Supporting and Hindering Factors for Research Data Management. *International Journal of Information Management* ***(IJIM).***	Individuals who are about to change their behaviour, e.g. to favour an innovation, will also consider alternative behaviours before deciding. Even if the new behaviour turns out to be valuable in favour of an innovation, the supposedly rational decision to adopt can be refused through the influence of individual uncertainty factors.
	P7: Wilms, K., Brachten, F., Stieglitz, S. and Berthéle, D. (2019). Wissensaustausch in Unternehmen: Wahrnehmung von Enterprise Social Software als Tool für den Austausch von sicherheitsrelevantem Wissen. *HMD Praxis der Wirtschaftsinformatik.*	This work transfers the insights of the behavioural perspective into a practical context. It shows that systems are used only conditionally or partially as long as uncertainties exist on the behavioural level.
RQ 3 (environmental perspective)	**P8:** Wilms, K., Meske, C., Stieglitz, S., Decker, H., Fröhlich, L., Jendrosch, N., Schaulies, S., Vogl, R. and Rudolph, D. (2017). Digital Transformation in Higher Education – New Cohorts, New Requirements? *Americas Conference on Information Systems* ***(AMCIS)***.	This qualitative, explorative work examines the influence of multidimensionality in the context of digital transformation. The results show that technical innovations are driven by young people and can thus also change the perspectives of older generations.

	P9: Meske, C., Wilms, K., and Stieglitz, S. (2019). Understanding the Utilitarian Value of Enterprise Social Networks and Its Role for Use Continuance – A Digital Infrastructure Perspective. *Information Systems Management* ***(ISM)***.	Technical innovations should not only be considered as simple IT artefacts but also in the context of the work-oriented infrastructure. This paper describes the influence of the technical environment on the usage intention.

4.2 Multidimensionality from a Technical Perspective

To examine how multidimensionality can be viewed from a technical perspective in the context of CCS acceptance in organizations, P1–P3 investigated different scenarios in which the user has the choice among several CCSs. Based on the description of the technical perspective in Chapter 1.2, the ways users' evaluate current and alternative CCSs are measured through technical characteristics and are based on prior personal experiences.

The investigation of the technical perspective begins with the consideration of competing CSSs.

In this manner, P1 focussed on the usage and termination phase of CCS and examines if and how the presence of alternative services influences users' relationship to their current service. In P1, CCSs are represented by cloud storage services, which are potentially used in the organizational context for collaboration. The study initially determined which cloud storage service users primarily use and how possible switching intentions are influenced by the technical attractiveness of other services. P1 presents a research model which is based on Rusbult's Behavioral Investment Theory (Rusbult, 1980; see 1.2). The results of P1 show that the presence of alternative CCSs affects users' commitment as well as their intention to switch to an alternative CCS. Thus, the results confirm the assumption that the presence of more attractive technical alternatives may lead users to decide to leave the usage phase and move on to the termination phase. In P1, the switching intentions are initially defined as 'undirected switches', which means that the user first has the intention to abandon the current CCS without any idea of which alternative CCS to use next.

Aside from an 'undirected switch', a user can also have concrete plans about which alternative CCS should be used in the future. There may also be the intention that no CCS should be used anymore. The aim of P2 was to find out more about the different types of

post termination intentions and how the further decision impacts the perception of present technologies. In P2, user groups are therefore referred to as migrants (users with specific switching intentions) and dropouts (users with no further switching intentions) (see Figure 4). P2 shows the results of a quantitative study where the ex-users of a non-mandatory organizational cloud service were consulted. What the participants had in common was that they had not used the service within the last eight weeks. While 97 users had further switching intentions, 49 users were dropouts with no future switching intentions. The results show that users who leave a system without switching intentions differ significantly from users who leave a system with switching intentions, in terms of post-evaluation of the previous system. In this context, the dropouts rated both the technical characteristics and the overall experience with the former CCS more positively than the users who were already planning to use an alternative CCS. P2 argues that these results are caused through the presence of a dissonance effect that occurs when one has to choose from two or more behaviour alternatives. Accordingly, the evaluation of a system is retrospectively changed according to the behaviour of the user.

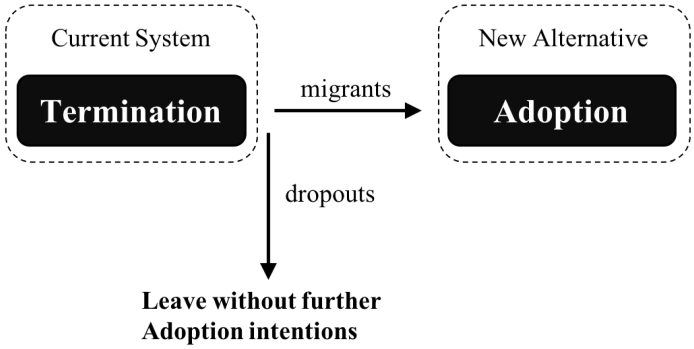

Figure 4. Categorization of IS termination users.

P3 examines the switching process where the user decides whether to switch from a particular system A to an alternative system B. Such a concept, where a user prefers a new technical alternative over a previous technical alternative, corresponds to the idea of multidimensionality, which is based on the belief that the presence of external systems influences user behaviour. However, traditional switching theories assume that the user's intention to switch to a new technical alternative is based on a previous dissatisfaction with the current technical solution. Hence, the switching process becomes linear: The user is dissatisfied with the current system and looks for a new system, which he or she evaluates independently of the old system. Based on this assumption, classical switching theories are based on adoption theories supplemented by termination components such as

low satisfaction with the current system (Park and Ryoo, 2013; Bhattacherjee and Park, 2014; Venkatesh, Thong and Xu, 2016). In P3, the technical advantages of the new system are therefore not considered in isolation but are dependent on the technical advantages of the old system. As a research objective, the study examines the switching intention of users between two cloud storage services, whereby the new alternative was designed from the organization to improve users' work processes. The results of P3 confirm the assumption that the intention to switch is influenced by a relative comparison. While the security of the new service was perceived as high, the direct comparison shows that the differences between both service alternatives in terms of advantages were not as significant as expected by the organization. This shows how important a multidimensional comparison is where both systems are compared to each other.

4.3 Multidimensionality from a Behavioural Perspective

In this chapter multidimensionality will be examined from a behavioural perspective in the context of CCS acceptance in organizations. First, to understand how behavioural determinants differ from technical determinants, article P4 is presented. In order to provide a better understanding of the differences, the article illustrates an example scenario which describes the introduction of guidelines for the correct research data management (RDM) at universities. RDM guidelines usually include recommendations to encourage researchers to adequately store, annotate, manage and share their research data. In order to comply with these recommendations, special technologies such as discipline-specific CCSs are usually necessary. In P4, both technical and behavioural determinants are highlighted, which have an influence on whether the researcher decides for or against the practice of RDM and, thus, for or against the work in an adequate CCS. Technical determinants refer to the technical characteristics of CCS, which are presumed by the employee to enforce the new directives. Behavioural barriers refer to the personal obstacles of employees. These obstacles are of an individual and non-technical nature. The added value of P4 is to show that these factors are clearly distinguished from each other. It turns out that, for example, factors that were initially considered to be technical factors can be behavioural factors. For example, the requirement to share data is not a technical barrier but a behavioural one in which the researcher sees no benefit in the action as a whole.

Based on these findings, the goal of P5 and P6 is to provide a model for quantitative measurement of the influence of behavioural barriers. The introduction of guidelines for RDM is likewise investigated in order to test and validate the model. In this example, behavioural barriers may occur if researchers see disadvantages in the implementation of RDM or fear that data will be misused. Also, doubting the feasibility or doubting one's own abilities can be obstacles. P5 examines how the intention to share research data is influenced by behavioural determinants. P6 provides an extended model of P5 and examines the influence of behavioural factors on the intention to execute the requirements of the guidelines through technological innovations. The underlying model outlines the influence that perceived advantages and disadvantages in such a decision-making process can have. The model shows that the decision-making process is influenced by the awareness of alternative behaviours, similar to switching scenarios. The advantages and disadvantages of new behaviour are weighed against alternative options. However, the outweighing of advantages is not the only crucial criterion for an individual to adopt a new behaviour. The research results show that, while researchers often see advantages in the new behaviour itself, the intention to adopt the new behaviour is often negatively influenced by so-called uncertainty factors. These factors describe the expected occurrence of negative effects that may occur through use. Examples of uncertainty factors mentioned in P5 and P6 refer to the loss and misuse of data that may potentially occur when data are offered for exchange in a cloud-based CSS.

While from the individual's point of view it would be a valuable decision to follow the regulations in the future and to adopt an adequate CSS to fulfil the tasks, the level of uncertainties seem to prevent them from adoption. The results of P5 and P6 show that a simple comparison and evaluation of the value are not sufficient to predict whether a user will choose an alternative service or not. P6 illustrates this effect with the example of an airplane traveller: 'Although passengers are aware that flying is time- and cost-efficient and the risk of falling is low, they may have fear of entering a plane, which ultimately prevents them from flying. This fear is not a disadvantage of air traffic, but a personal fear deeply rooted in the personality of the passenger' (P6, p.5).

These outcomes are also supported by the findings in P7. The paper illustrates a company that wants to motivate its employees to behave in a way that allows them to better share and visualize company-related knowledge. In this regard, the employees should use a CCS in which they have the possibility to share security-relevant knowledge for specific user groups. The results show that there is a high level of uncertainty among employees,

as it is not clear which consequences their interaction will entail. While the system is considered technically valuable, performing tasks in the system remains uncertain, which is why the system is not accepted by everyone.

The results of this section show that behavioural determinants exist regardless of technical determinants and have an influence on the adoption of technical artefacts. Behavioural decisions are of a multidimensional nature, since alternative actions are considered. Behavioural decisions are not always rational because they can be influenced by a variety of biases or psychological factors.

4.4 Multidimensionality from an Environmental Perspective

In this chapter multidimensionality will be examined from an environmental perspective in the context of CCS acceptance in organizations. While organizational impact as well as the environment, which is characterized as a work-oriented infrastructure, are both displayed by the environmental perspective, two research papers are presented that address their concerns.

P8 examines how organizational culture, where the employees are free to choose their CCS, affects users' decision-making. Since there has been little research in the field so far, an explorative qualitative method was used in P8 to determine how user decision-making takes place in this context, and which types of users can be identified. As a research object, the members of a university were interviewed, who are all in different stages of their academic careers. While all participants have a similar interest in work-related collaboration and communication, everyone has the free choice to choose a CCS. The participants stated that they try to select tools that correspond to their own values, such as data privacy, performance, hedonism and connectivity. However, while the participants stated that they select systems according to their individual preferences, not all were satisfied with their latest decision. Some participants stated that they had decided to use the university in-house CCS instead of a third-party CSS. While this CCS, provided by the university, often did not correspond to the personal values of the users, the users stated that they felt less uncertain when using in-house solutions than when using third-party systems.

P9 examines environmental influence. Environment is represented in this dissertation as work-oriented infrastructure. Infrastructure components define the technical environment in which a system operates (Pipek and Wulf, 2009). Based on the criteria for infrastructures by Pipek and Wulf (2009), five infrastructure components were identified: Perceived Adaptability (PA), Perceived (In)Visibility (PIV), Perceived Interconnectedness (PI), Perceived Versatility (PV) and Perceived Reflexivity (PR). The identified determinants serve as the basis for a new quantitative measurement model, which will be evaluated in the context of a specific Enterprise Social Network (ESN). Based on the theory of Wu *et al*. (2013) according to which systems serve as 'dual-purpose systems', the assumption of this work is that systems serve utilitarian as well as hedonic purposes. As being representative of utilitarian purpose, it mediates the relationship between environmental determinants and usage intention. As shown in P9 and in Figure 5, the infrastructure components PA, PIV, PI and PV significantly influence the perceived usefulness.

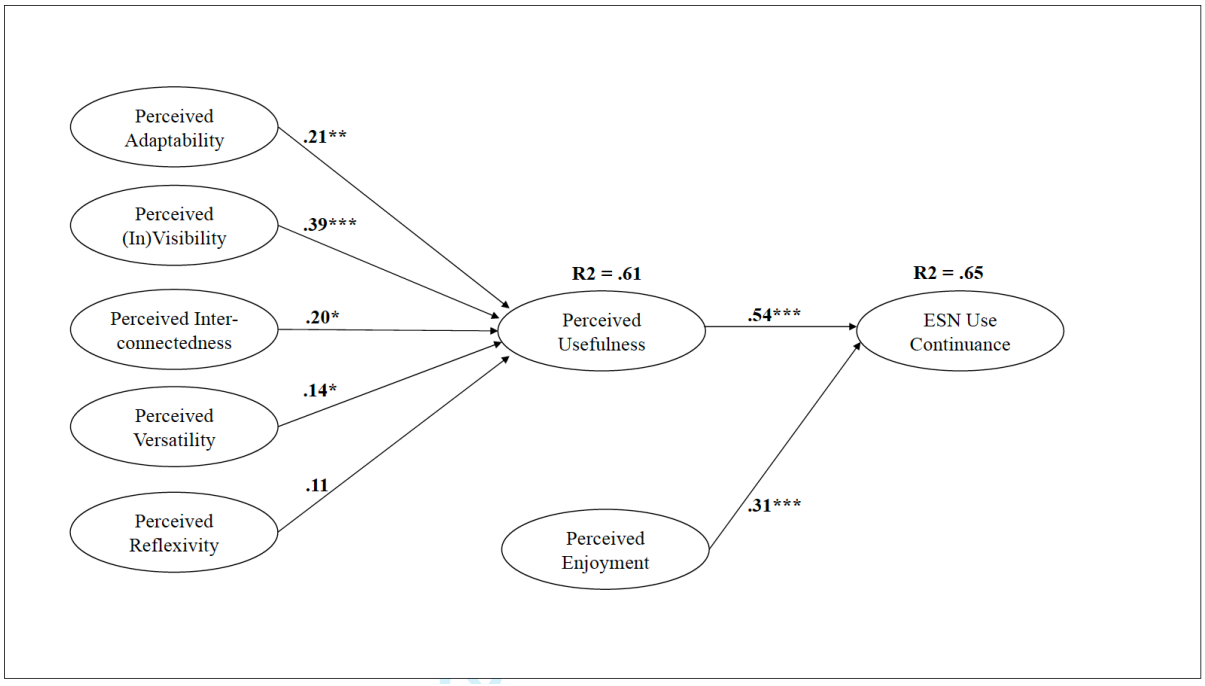

Figure 5. Structural equation model of the impact of work-oriented infrastructure criteria on perceived usefulness.

To illustrate the environmental perspective, P9 argues that systems such as ESN 'could be compared to a city with its own infrastructure, which is interconnected via highways with the infrastructure of other cities nearby. The user can hence perceive the ESN as a

digital (sub-infrastructure but also evaluate its interconnectedness with other systems' (P9, p.12). In the context of multidimensionality, the results show that the perceived usefulness of a CCS (such as an ESN) is heavily related to the work-oriented infrastructure and therefore to the environment. An alternative CCS that could be more beneficial in isolation might be evaluated as less useful if it does not fit into the work-oriented infrastructure. Thus, a simple selection by the most beneficial and most value fitting CCS might be counterproductive if the environmental impact is ignored.

5 Discussion

The results from the three research sections (technical perspective, behavioural perspective, environmental perspective) initially indicate that multidimensionality has a relevance on three levels of IS adoption and use within an organizational CCS-related context. In the following, it will be discussed how the results on the different levels can influence the previous understanding of IT adoption in IS research and how prevailing research paradigms may possibly be reconsidered in the future. The structure of this section is therefore as follows: In 5.1, the results of the technical perspective are first discussed; in 5.2, the results from the behavioural perspective; and in 5.3, the results from the environmental perspective.

5.1 Technical Perspective

First, the results will be considered in the context of the technical perspective. Based on this perspective, the multidimensional impact was observed in the context of the IS life cycle. Accordingly, a multidimensional influence could be observed in all three phases of the life cycle models of Furneaux and Wade (2010, 2011). While the traditional life cycle starts with the adoption phase, this work presumes that the users were already using at least one CSS. Thus, the investigation starts with the examination of the transition between the usage and termination phases.

P1 shows that, at the usage level, the presence of attractive alternatives could impact users' commitment to their current CCS. The paper offers clear evidence that the technical attractiveness of alternative services increases the user's intention to switch to an alternative service and from the usage phase to the termination phase. Together, P1 and P2 show that, within the termination phase, the user is faced with three termination alternatives: 1) direct system switch from system A to system B, 2) undirected system switch where the target system is still unknown and 3) dropout from the technology. The results of P2 show that users are influenced by dissonance, what leads them to evaluate their former system as less valuable if they are about to switch to a new alternative service. Users who decide to terminate the usage of the system and who have no further switching intentions evaluate the former system as more valuable compared to users who plan to switch. Compared to the previously described results in P1 and P2, P3 demonstrates how the former system could be taken into consideration when the user is evaluating a new alternative system. Hence, this step is located between the termination phase of system A and the adoption phase of the novel system B. In this regard, it can be assumed that

systems that have been abandoned in the past are also part of this decision-making process (P3).

The results clearly show how a multidimensional approach differs from an isolated 1:1 approach. While, in the 1:1 view previous system, utilization is not considered, in a 1:n view, consideration of a formerly used system has a clear impact on users' final decision-making. At the same time, the presence of alternative services can also have an influence on the discontinuance intention, an effect that has not been examined in 1:1 studies to date.

5.2 Behavioural Perspective

The investigation of the multidimensionality of the behavioural perspective also reveals new characteristics regarding the adoption and usage process of alternative services. While the technical perspective focuses on technical characteristics and experiences the user has towards the system, the behavioural perspective focuses on the consumer perspective. Based on this perspective, it is assumed that an individual decision depends on an individual weighting process and on the perception of uncertainties caused by the new behaviour. In the context of multidimensionality, this effect can be explained as follows: Individuals initially try to evaluate a new behaviour (e.g. using a new CCS to complete a task within the organization) on the basis of an individual weighting process. Based on the principle of value maximization, it is therefore assumed that the individual will accept the new behaviour if the advantages outweigh the disadvantages. However, the findings of the decision model presented in P5 and P6 show that the individual rejects the decision if the individual perceives a certain degree of uncertainty. In the example of the RDM introduction, such uncertainties arise, e.g. through the fear of data misuse or through the fear of losing control. Thus, the models presented in P5 and P6 show that valuing is not solely responsible for the outcome of the decision. A decision may initially be made in favour of a behaviour or a particular system, such as a CCS, but at the same time not be enforced if the decision is taken under uncertainty.

In the context of the given literature, such a behaviour could be explained by the results of a study by Featherman (2001), who found that negative feelings, which can be provoked through the perception of risky situations or actions, can lead to anxiety and uncertainty. While these negative states must be avoided from the point of view of an individual, it is expected that insecure persons tend to stay within the status quo (Ortoleva, 2010).

Here, the close connection between the behavioural and technical perspectives can be illustrated. While the weighting process takes place more on a technical level (e.g. P3), the outcome of the decision is not solely based on a positive value. These findings are supported by the conclusions in P7 and P8, which also highlight the practical consequences of such effects. Especially in P7, it becomes clear that uncertainties regarding the authorization levels can affect the behaviour of employees. While the system and the action are considered valuable, employees can feel uncertain about the permission levels of the files to be exchanged. Hence, they develop reluctant behaviour instead of using the system to complete their tasks. Looking at the three user types identified in P1 and P2, the perceived dissonance of the switcher explanations and the more positive evaluation of the dropouts and undirected switchers can also be explained. Both user groups could therefore be users who initially rated the value of alternative systems as high and therefore terminated the usage to their current service. In a direct comparison with a new alternative system, however, perceived uncertainties can lead to abandonment of the new system. The former system then appears more attractive again.

5.3 Environmental Perspective

The third perspective presented in this dissertation focusses on the environmental perspective. This perspective considers both organizational and environmental effects that have an influence on the multidimensional approach of multiple CCS adoption and usage. P8 confirms the findings of the previous work of P5 and P6, according to which users do not always choose the alternative with the highest value but try to avoid uncertainties. P8 shows that users perceive CCS solutions from third-party providers as technically suitable, as e.g. organizational in-house solutions, and see a higher value in them. At the same time, however, the degree of uncertainty in the use of alternative services is higher, which is why some users tend to use in-house solutions only, although these are not always state-of-the-art. These findings support an assumption from psychology that users tend to avoid uncertainty and instead remain within the status quo (Kim and Kankanhalli, 2009; Polites and Karahanna, 2012).

These results are supported by the results in P9 which show that the usefulness of a system also depends on the environmental factors. In this dissertation, environmental factors are regarded as work-oriented infrastructures. The description of environmental factors as work-oriented infrastructure goes back to the definition of Hanseth and Lundberg (2001,

p.455). Technical infrastructures are measured by the criteria of Pipek and Wulf (2009) which are also described as suitable by Stieglitz et al. (2014). The results show that a CCS that is considered against the background of a work-oriented infrastructure can therefore be evaluated as much more useful than a system that is evaluated purely on its technical value. The results show that the degree of integration of a CCS within the work-oriented infrastructure has a strong impact on the perceived usefulness of users. Thus, a CCS that integrates well into the organization's environment is perceived as more useful than one that does not. These results allow the assumption that CCSs that are not viewed against the background of work-oriented infrastructure are evaluated differently than CCSs that are viewed against the background of the environment. A CCS that is initially evaluated as high can therefore be perceived as less useful in the context of the organizational environment.

When selecting a CSS in an organizational context, it is therefore important to consider the specific CSS in the context of the work-oriented infrastructure. This is often not possible, as this can only happen when the CSS is actually used. This may cause uncertainty for the user. In order to avoid uncertainties, the user will remain within the status quo.

In the context of the technical and behavioural perspectives, it can be stated in summary that the freedom of choice of a CCS can lead to users becoming more unsatisfied with their current systems and developing switching intentions (technical perspective). This tends to happen when many high-quality alternatives exist. As soon as a switch is evaluated, the value of the current system is compared with the value of the new system. In addition to the value of a system, a switch is also associated with uncertainty. From the users' point of view, switching is a potential risk for which the loss of the status quo counts higher than the advantage of the new alternative (behavioural perspective). A potential risk, for example, is that the new CCS will not fit into the organization's environment. A CCS may not fit into a work-oriented infrastructure, regardless of its technical advantages. To avoid uncertainty, users opt against an alternative solution and opt for the status quo. These results give rise to various practical and scientific implications.

6 Conclusion

In the following section, implications for research and practice are derived from the research results (6.1 and 6.2). Furthermore, the limitations of this work are discussed in 6.3 and an outlook on future research topics is given (6.4).

6.1 Research Implications

From the perspective of IS research, the question of obstacles to the integration of new systems in the organizational context is central. Multidimensionality has so far only been considered in the context of individual switching scenarios, but not in the overall context of technical, behavioural and environmental perspectives. This dissertation initially shows that, in the specific context of organizational CCS selection, multidimensional influences can affect user decisions. In addition, the behavioural perspective shows that uncertainty factors significantly prevent the behaviour of potential switchers. These results can be interesting for research, especially when it comes to the integration and adoption of new systems in an organizational context. The same is also valid for research that deals with the switching and usage behaviour of users in general. Here, too, a research paradigm has emerged in recent decades, according to which a 1:n view is primarily considered. The work provides strong indications that the consideration of multidimensionality contributes to the explanation of adoption and usage intentions.

This work also provides several quantitative measurement models that can help to measure multidimensional influences. These models can be used in the future and adapted to the context. Thus, this paper makes a strong contribution to current research in the field of organizational adoption and utilization research.

6.2 Practical Implications

This work provides practical implications that can be relevant from an organization's point of view, as well as for third-party providers of CCS. Organizations that leave it up to their employees to decide which CCS should be selected for which task usually expect employees to act as rational consumers and make the optimal decision for completing a task. At the same time, organizations expect their employees to react flexibly to organizational recommendations and guidelines and to match their choices to the needs of the organization. For example, universities leave it to the researchers themselves to

decide which CCS to use, as long as, for example, the security of sensitive data is not compromised (Wilms *et al.*, 2016).

While the goal of this practice is to give the employee as much freedom as possible, organizations must be mindful to offer safe alternatives to employees. These can be recommendations but also in-house solutions. Users are not always willing to make decisions and try to avoid risks, especially in a professional context. The freedom to choose one's own system is a cost-intensive process in which the employee also bears responsibility.

However, multidimensionality is not only an important issue from the organization's point of view. Especially third-party providers whose goal is to integrate their own CCS solutions into organizations face several challenges. As the results of this dissertation show, the employees are aware of the technical advantages of the new solutions and are willing to deal with switching decisions. However, technical advantages and added value alone are not decisive for the successful adoption of alternative CCS. Third-party providers who want to successfully integrate CCS into companies must minimize the uncertainties of their potential users. Uncertainties identified in this work include fear of data misuse, fear of visualization and disclosure of security-related data, and fear of loss of control.

6.3 Limitations

Within the framework of the thesis, a limited perspective on the research object of multidimensionality in the context of organizations is provided. Only a small number of actual companies were considered, which were to some degree difficult to compare. For example, different criteria and framework conditions apply to universities than to enterprises. However, the aim of this dissertation was not to identify every facet of multidimensionality in the context of organizations, but to identify clear evidence for the importance of a multidimensional perception and to provide instruments for measurability. For this purpose, quantitative research approaches were primarily chosen according to the traditional research method of adoption research. For this reason, the work is subject to the classic restrictions of quantitative research. The models always represent only a part of reality and do not capture new insights beyond their own structure.

In addition to methodical limitations, there are also theoretical limitations. The work focuses on three specific perspectives from which the multidimensional influences are to be considered. While the three perspectives were derived from literature, there is also a large amount of other literature from which different perspectives can be derived or from which existing perspectives can be classified differently. For example, the organizational perspective, which is a central component in well-known frameworks such as TOE (Tornatzky and Fleischer, 1990), is only considered as part of the environmental perspective in this work. The results must therefore always be viewed against the background that the classification of the perspectives can vary**.**

The work is also subject to individual limitations of the related research projects P1–P9.

6.4 Further Research

IT adoption is a major field within IS research which has led to a large body of research during the last 30 years. While most studies are based on an isolated perspective, the core of this work consists of a multidimensional perspective. Here, the dissertation provides new insights that show how a multidimensional view can alter previous assumptions. The consideration of multidimensional influences is a current topic, which can be of great use at a time when innovations are catching up with each other and competing services are trying to outbid each other, especially when investigating switching behaviour. This view does not attack the classical view or try to disprove it, it is rather to be understood as an extension of existing belief patterns. This dissertation provides the first tools in the form of quantitative models that help to understand system usage from a multidimensional perspective.

Future studies should first address the limits of this work. The multidimensional perspective was examined only in a small group of selected but specific organizations. The models should be adapted and tested in the context of other types of organizations. New investigations can support or extend the results of this dissertation. At the same time, various uncertainty factors shown in this thesis are specific to the respective industry. The measurement models provided are therefore only conditionally suitable for alternative application contexts. Further research will be necessary in the future. A question for further exploration in this context could be this: How does uncertainty arise, and how can the fears that contribute to it be measured?

One limitation of this work is the focus on quantitative research methods. The quantitative models offer little space for explorative research in the field. In order to investigate new aspects of multidimensional effects in the usage context, future work should choose qualitative and explorative approaches to identify new multidimensional influences beyond the scope of this dissertation. For example, the perceived quality of the alternatives can be further delineated and investigated.

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Appendix

A Paper Included in This PhD Thesis

A.a P1: Feeling Safe on a Fluffy Cloud – How Cloud Security and Commitment Affect Users' Switching Intention

Fact Sheet of Publication P1

Title	Feeling Safe on a Fluffy Cloud – How Cloud Security and Commitment Affect Users' Switching Intention
Authors	Konstantin Wilms, Stefan Stieglitz, Benedikt Müller
Publication Type	Conference Paper
Publication Outlet	Proceedings of the 39th International Conference on Information Systems (ICIS 2018).
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Abstract

Why do users quit using an IT system? This paper focuses on the last sequence of the Information Systems lifecycle, namely the termination phase. The authors discuss the termination phase in the context of social-psychological findings on real world relationships where partners break up their ties. Different parameters are measured that influence users' 'relationships' to their cloud storage service within a quantitative online study. A model was adapted which links the quality of real world relationship to the IS context. Furthermore, a comparison of the adapted model and the newest findings of IT discontinuance took place. It is argued that commitment plays a significant role while forming break up intentions, and that attractiveness of alternative services seduces users to leave their current system. This paper contributes an important piece for an improved understanding of user behavior in the context of technology adoption.

Keywords: Cloud Computing, Switching Theory, Discontinuance, Investment Model

Introduction

Over the last decade, cloud computing emerged as one of the most popular technologies in Information Systems (IS) research and has been discussed as an important field of study for technology adoption research (Cline et al., 2008; Low, Chen and Wu, 2011). Today, the focus of both practitioners and researchers increasingly shifts from a pre-adoption to a post-adoption perspective, where IT executives no longer focus on the adoption of cloud computing, but on the managing of existing IT relationships (Schlagwein and Thorogood, 2014). While current research models merely focus on determinants from the context of continuance usage (e.g. Maier, Laumer, Eckhardt and Weitzel, 2012; H. Li and Liu, 2014; Vaezi, Mills, Chin and Zafar, 2016), discontinuance usage of an IS has been of minor interest (Maier et al. 2015; Turel 2015). IS discontinuance is described as "the intention users make to quit the usage of a system and not go back to it", and was misinterpreted as a low level of continuance intentions in existing research (Turel, 2015, p.1). According to Turel (2015), continuance and discontinuance intentions do not share the same predictors and should be treated separately.

Current research was majorly studied in form of switching scenarios, where a user migrates from a cloud service [A] to an alternative one [B] (e.g. Bhattacherjee and Park, 2014; Goode, 2015; Wu, Vassileva and Zhao, 2017). Yet, this perspective solely

considers the adoption of a new system rather than the termination of the old one (Bian *et al.*, 2015). These observations describe "directed switches", presupposing that users already gained experience with the new alternative. Currently, there exists a lack of an isolated view on the discontinuance process itself, which is not influenced by the adoption drivers of an alternative. A distinction is of high value, since switching scenarios from [A] to [B] are mostly accompanied by cognitive dissonance effects, where an old system [A] is rated worse than a new alternative [B] (e.g. Liu and Khalifa, 2003; Stieglitz *et al.*, 2018). To avoid any influence by dissonant-biases, an isolated view on the discontinuance drivers are necessary and of high interest for further research. Thus, this work aims to explain the drivers influencing users to form a migration intention towards an alternative system within the context of an "undirected switch", where users intend to switch without any alternatives in mind. Therefore, the following research question was generated:

RQ: Which factors determine users' migration intentions in context of cloud services during undirected switching processes?

IS research on continuance use emphasized the client provider relationship as well as the relationship of users to their IT department. Therefore, applying a relationship view constitutes a promising approach to investigate the behavior of users "looking for new relationships". By doing so, this work contributes to the understanding of why IT users may or may not form an intention to switch to an alternative system by adapting a relationship model from social psychology literature: we empirically tested research hypotheses in the context of cloud storage services by using the investment model of Rusbult (1980, 1983). An improved knowledge of users behavior contributes to cloud service providers who are interested to better understand users' needs to guarantee financial profit (Chiu and Huang, 2015). Moreover, the results are of high interest for decision makers in organizations due to the variety of options to choose from: It includes cases which deal with the introduction of new cloud service within an organization, expecting users to migrate from a used legacy system to a new one (e.g. Bhattacherjee and Park, 2014) as well as the phenomenon of "shadow IT" (Silic and Back, 2014), where users switch to unapproved systems.

Firstly, we review prior literature concerning switching behavior and set it into the context of current research on IS adoption. Secondly, literature regarding switching intentions in the context of cloud storage computing will be presented. Next, a model for determining users' commitment to information systems based on the investment model by Rusbult

(1980, 1983) will be presented. Further, an explanation of the research methodology as well as a discussion of the results and their implications, including their potential for further research, will be given. Lastly, the conclusion will be outlined.

Theoretical Background

Adoption, Usage and Termination

Information Systems research has a long history in examining technology acceptance and usage(-intentions) of systems (Jackson, Chow and Leitch, 1997; Oliveira and Martins, 2011). Based on the Theory of Planned Behavior (TPB) (Fishbein and Ajzen, 1975; Ajzen, 1985), plenty of theories modelling the adoption of technologies were developed. The most prominent ones constitute the Technology Acceptance Model (TAM) (Davis, Bagozzi and Warshaw, 1989), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003). Both include descriptions of the rationale behind a user's adoption-behavior by determining user's intention to use a system. In addition, TAM and UTAUT include actual system use as an additional scale beyond the mere intention to use a system. Yet, both theories missed out on examinations concerning the continuous usage of a system, which further led to Information Technology Continuance theory (e.g. Bhattacherjee and Lin, 2015). Technology Continuance theory examined continuance intention as well as actual continuance behavior, relying on two pillars (Bhattacherjee and Lin, 2015, p. 1): "expectations of benefits from future usage" (measured by constructs like perceived usefulness), and "summative judgments of the outcomes of prior usage" (measured by constructs like user satisfaction). The phenomenon of IT continuance was examined in various contexts like mobile data applications (Chen, Meservy and Gillenson, 2012), online gaming frequency (Li *et al.*, 2015), or health caring platforms (Lehto and Oinas-Kukkonen, 2015).

While IT continuance deals with the "long-term or sustained use of an IT by individual users over a period of time" (Bhattacherjee and Lin, 2015, p. 1), this work examines IT usage continuance from a different perspective. Rather than asking whether users continue to work with a given system, the present study explains the users' reasons and the point of time to abandon – or "break up" with – certain systems in favor of existing alternatives. Hence, we focus on the concept of IS termination/discontinuance which represents a separate step within the IS lifecycle as described by Furneaux and Wade (2010, 2011a): based on the progression from birth to death, the IS lifecycle starts with

the adoption process, proceeds to the usage process (IS continuance), and ends with the termination phase where users develop discontinuous usage intentions (Maier *et al.*, 2015; Turel, 2015). Yet, there does not exist any universally accepted definition of IS discontinuance. On the one hand researchers use IS discontinuance to describe situations where users "continue carrying out a task but choose to do so without an information system that was in place to enact the task" (Recker, 2016, p. 2), while on the other hand researchers define it as "the cessation of the use of an organizational information system" (Furneaux and Wade, 2011, p. 2), without clarifying whether another system is chosen to carry out the task.

Looking at the adoption of new systems, the abandonment of new IT is known as 'user resistance', focusing on usage inhibitors (e.g. Cenfetelli and Schwarz, 2011) as described within the Status Quo Bias Theory (Samuelson and Zeckhauser, 1988; Kim and Kankanhalli, 2009). Within the post-adoption process, discontinuance was solely researched in context of switching scenarios. So far, discontinuance through replacement by another system was described as migration or switching behavior, and is mostly examined in migration theory (Bhattacherjee and Park, 2014; Chang, Liu and Chen, 2014). Bhattacherjee and Park (2014) developed a theoretical model of cloud computing migration which relies on pull factors, mooring factors, and push factors to explain user's migration intention by extending the theory of human migration (Lee, 1966). Pull factors, like relative usefulness or expected omnipresence, attract users to cloud services. Mooring factors, like switching cost or security concerns, keep them from migrating. Push factors, like dissatisfaction with the client IT, influence the intention to migrate. Table 1 offers an overview of the different perspectives.

Bian et al. (2015) characterized two factors which positively impact users' intention to cease the usage of cloud service structures, called structure shortcomings. They are described as existing shortcomings concerning the functionality and support costs, which are defined as "the costs of supporting ongoing operation of an existing information structure within an organization" (Bian et al., 2015, p.7). An isolated perspective has been researched in the context of social network services (SNS). Therefore, recent literature mainly focused on measuring the impact of stress factors' which determine users discontinuance intentions. Zhang *et al.* (2016) demonstrated that users' discontinuance intention was influenced by a high level of (dis)satisfaction as well as a high level of social network fatigue. Hence, (dis)satisfaction mediates the influence of system feature overload (Zhang *et al.*, 2016). Maier *et al.* (2015) indicated that determinants causing

stress influence the intention to leave a social media system, and therefore directly influence the discontinuance behavior. In context of TPB, Turel (2016) stated that guilt, as a self-reflective moral emotion influencing cognition, is associated with discontinuance behavior.

	No Previous Usage	**Existing Usage**
Positive Attitude	Adoption *(e.g. TAM, UTAUT)*	Continuance *(e.g. Expectancy Confirmation Model)*
Negative Attitude	Resistance *(e.g. Status Quo Bias Theory)*	Discontinuance/Migration/Switching *(e.g. Migration Theory)*

Table 1. Perspectives on technology adoption and IS Termination

IS Discontinuance in Context of Cloud Computing

Cloud services became a trending topic since enterprises as well as private consumers started to adopt them (Gebauer *et al.*, 2015). Areas which experience a high amount of adoption amongst businesses and private users are cloud storage, enterprise file sync and share providers (Gupta, Seetharaman and Raj, 2013), enabling users to store their files within a cloud service while simultaneously including the possibility to access their files from any place. Apart from offering users anywhere access to their data, cloud storage services enable users to share and collaborate on files, including backup functionalities, file versioning, or text recognition for scanned documents (Zhang, Cheng and Boutaba, 2010). However, organizations and users hold concerns regarding cloud services, primarily in terms of security and privacy aspects (Katzan, 2010; Bellovin, 2011; Li *et al.*, 2012). Since trust constitutes an influential factor concerning successful adoption (Wang and Benbasat, 2005), organizations and users need to trust in system security to protect their data against hacking attempts, data loss, corruption and leakage of data (Müller *et al.*, 2011). Other concerns include the mining, leveraging, or selling of customer data through cloud providers (Lin and Deng, 2010).

Bhattacherjee and Park (2014) indicated that perceived security concerns have a major impact on the quality evaluation of alternative cloud storage services. They found that high perceived security concerns prevent users from migrating to a specific cloud storage service. Simultaneously, risk concerns are drivers which cause users to leave a cloud storage service to migrate to a less risky alternative (Wu, Vassileva and Zhao, 2017). As Xu et al. (2017) showed, the intention to switch services has a strong influence on the

actual behavior of users. Users with the intention to use another service will discontinue the use of the current service. Therefore, migration intention is used as an indicator of whether users leave a cloud service or not (Park and Ryoo, 2013; Bhattacherjee and Park, 2014; Goode, 2015; Xu *et al.*, 2017). However, discontinuance does not constitute the basic requirement of the migration process since parallel usage is possible.

Investment Model

The Investment Model was introduced as a social psychology theory by Rusbult (1980, 1983). It emerged from interdependence theory, and examines the influencing factors leading to persisting a relationship between two partners or – in contrast – leading to the termination of said relationship (Rusbult, 1980, 1983). According to the Investment Model, there exist four determinants affecting the state of the relationship: (1) Commitment directly affects the probability of the continuation. This in turn is driven by (2) the satisfaction with the relationship, (3) the quality of the alternatives, and (4) the investment size.

Satisfaction level refers to negative and positive experiences within the relationship, and the extent to which a partner fulfills the other individuals' important needs regarding romance, sexuality, and emotions. The higher the satisfaction, the stronger the commitment. Quality of the alternatives refers to the possible alternatives of an existing relationship. Potential alternatives are evaluated like the satisfaction level, i.e. by examining whether needs could be fulfilled by alternative relationships. The better the quality of the alternatives, the weaker the commitment to the current one. Investments relate to the resources which were already invested within the relationship, and therefore would be lost when terminating the relationship. Hence, these constitute obstacles to end the relationship. Investments are intrinsic or extrinsic: within the original Investment Model, extrinsic investments include common possessions, such as a shared apartment, whereas intrinsic investments include concepts like time and emotions. The higher the investments, the more likely is a strong commitment.

Yet, not all variables need to be highly scored to achieve a solid commitment. An individual might hold a strong commitment due to high investments and a high level of satisfaction, albeit better alternatives exist. Rusbult (1980, 1983) distinguishes between dependency and commitment: dependency describes the degree to which a person needs the relationship, while commitment describes the subjective perception of the dependency. By applying the Investment Model on the context of cloud storage systems,

it needs be stated that it was applied in other contexts before: Rusbult (1980, 1983) investigated the determinants of job satisfaction, job commitment, and employee turnover through the lens of the Investment Model, while Hatcher *et al.* (1992) applied it to college student attrition.

Model development

Leaning on Rusbult's (1980,1983) Investment Model, this section describes the hypotheses developed by adapting the relationship aspect to the context of technology adoption. Users' intention to switch to an alternative cloud storage service (CSS) constitutes the dependent variable, while the Investment Model is explained through the factors satisfaction, investment, and quality of alternatives. Commitment constitutes the mediation. Moreover, security is a major aspect in current cloud research, and has been demonstrated to be an influential predictor for switching behavior. According to Stieglitz *et al.* (2014), security assessment plays a significant role in assessing the quality of cloud services. The latent construct security of alternatives was added to the model, since the perceived security of a cloud service might hold an influence on the perceived quality of the alternative service. Both constructs, the quality of alternatives and the security of alternatives are assumed to directly positively influence the intention to switch to an alternative CSS. Commitment is assumed to negatively influence users' intention. The assumptions lead to the research model shown in figure 1.

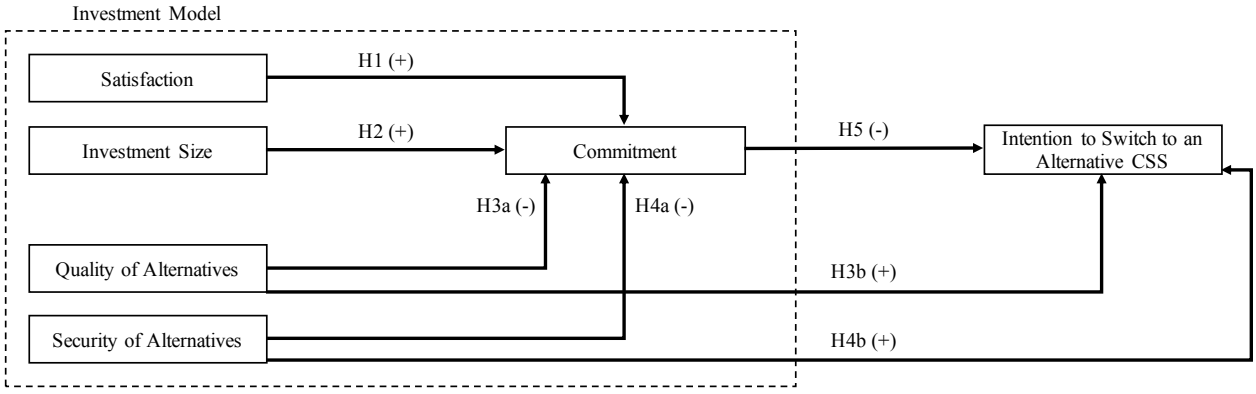

Figure 1. The research model.

In the following, the constructs determining the commitment to a system are outlined, and the relationships among these constructs as well as their impact on the dependent variable

are hypothesized. All constructs used in this model are defined and presented in Appendix A.

Satisfaction

Satisfaction constitutes a strong driver in relationships, reflecting the amount of positive and negative experiences. According to the Investment Model, satisfaction directly influences individuals' commitment to a relationship (Rusbult, 1980, 1983). This relationship can be applied to the connection between a customer and a company, where customer loyalty is based on customer satisfaction (Heskett *et al.*, 2008). As demonstrated in different marketing research contexts, dissatisfaction reduces loyalty toward a company and leads to the termination the relationship (Feinberg, 2001). Antón, Camarero and Carrero (2007) argue that a customer with a low satisfaction towards a company does no longer experience the same positive feelings that primordially lead to commitment. Since cloud services constitute software products hosted by private companies, perspectives from marketing research are adopted to the context of cloud computing. Hence, it is argued that users with a low satisfaction are expected to hold a lower commitment towards the cloud provider. It is therefore assumed that satisfaction influences the commitment to a system:

H1: Satisfaction positively influences the commitment to a cloud storage service.

Investment Size

Individuals tend to improve their partnership by investing resources. Resources are represented e.g. by monetary goods as well as non-monetary goods like time, effort, convenience cost, and psychological factors (Zeithaml, 1988). Psychological factors include frustration, discomfort, or annoyance (Bender, 1964). According to the Investment Model, the perceived amount of invested resources is directly related to the commitment (Rusbult, 1980, 1983). This effect is explained by individuals' perception: invested resources are lost if the relationship ends. The described relation between investment and commitment is known in market and IS research, where a customer invests time and effort to interact with a business partner (e.g. service provider) (Sung and Campbell, 2009). Benefits are gained through the invested time and effort within the business relationship: a customer becomes more familiar with the IT system of a service provider. Those benefits hold a positive impact on the commitment (Adamson, Chan and

Handford, 2003). Therefore, it can be expected that the commitment to a service provider is strengthened by previous investments.

Within IS research, this effect is known as sunk cost effect, describing a tendency where decision makers continuously invest resources in an IS relationship once an initial commitment was made (Arkes and Blumer, 1985). This effect is related to the prospect theory (Kahneman and Tversky, 1979), whereby individuals are more deterred by costs than attracted by benefits (Arkes and Blumer, 1985). It is therefore hypothesized that:

H2: Investment size positively influences the commitment to a cloud storage service.

Most cloud services are based on a freemium model (Katzan, 2010), where individuals use the service free of charge with certain restrictions like a small amount of storage capacity. They receive more storage capacity if they invest money. Apart from the monetary investment, users invest non-monetary resources like time and effort to upload and organize their data. Thus, there is a considerable reason to believe that the more a user invested into their cloud storage service, the higher the commitment.

Quality of alternatives

According to the Investment Model, quality of alternatives refers to the perceived desirability of the best available alternative. Regarding human relationships, quality of alternatives describes how an individuals' needs could be fulfilled in an alternate relationship. If individuals hold a relationship in which their needs are fully satisfied, quality of alternatives would be low, while the commitment to the current relationship is strengthened (Rusbult, Martz and Agnew, 1998). Otherwise, individuals consider the alternatives as superior, and lower the commitment to their current relationship. In the context of IS, it is common that there exist alternative solutions that can differ in quality (e.g. in context of cloud computing). Therefore, individual system preferences are influenced by the comparison with other systems (Fu, 2011). If a user is aware of a more superior alternative, the commitment between the current system and the user will be weakened (Fu, 2011; Sung & Campbell, 2009). In addition, the Interdependence Theory stated that the dependence of a relationship is higher if the number of alternatives remains small (Rusbult, Martz and Agnew, 1998).

Since there exist many different cloud storage services with different feature sets and cost structures, users have plenty of options to choose from. It is reasonable to assume that the

quality of alternatives influences users' commitment towards their current cloud storage service. According to the findings of Sung and Campbell (2009), and Fu (2011), it is assumed that the commitment to the cloud service provider decreases if users are aware of more attractive alternatives. Simultaneously, it is assumed that users not only find the alternative system more attractive, but decide to switch to the new service. Thus, the quality of alternatives has a direct effect on the intention to switch. In this regard, the following hypotheses are concluded:

H3a: Quality of alternatives negatively influences the commitment to a cloud storage service.

H3b: Quality of alternatives positively influences the intention to switch to an alternative cloud storage service.

Security of alternatives

Besides the quality of alternatives, the security of a cloud service has a strong impact on the valuing process of alternative cloud solutions. Literature on cloud computing suggests that the reduction of risk perception increases users' willingness to use new technologies (Gefen, Karahanna and Straub, 2003). Additionally, security concerns constitute discouraging cloud migration behaviors (Subashini & Kavitha, 2011). Subashini and Kavitha (2011) indicated that users who were concerned about a cloud service's security level are less likely to adopt the service, since the storage of information within a cloud storage service leads to a loss of control over the data (Meske *et al.*, 2014). Since recent data protection scandals weakened users' trust in several cloud providers (Puthal *et al.*, 2015), it is expected that security concerns influence the intention to adopt those services. Existing differences between the current cloud service and an alternate one in terms of data protection standards influence user's decision making (Meske *et al.*, 2014).

Since system security constitutes an important factor of the systems' overall quality, it is expected that users' security concerns are reflected in their perception of a service's quality. However, since quality of alternatives encompasses more aspects related to a user's needs (e.g. in terms of functionality), perceived security of alternatives is included as a separate construct which is expected to influence the commitment (negatively) as well as the intention to switch to an alternative system (positively). Thus, it is assumed that:

H4a: Security of alternatives negatively influences the commitment to a cloud storage service.

H4b: Security of alternatives positively influences the intention to switch to an alternative cloud storage service.

Commitment

Commitment is described as a psychological force that holds individuals and organizations in line of behavior, and binds them to a course of action (Kiesler, 1971; Staw, 1976). Commitment leads to difficulties regarding the change of a specific behavior, affecting the persistence of individuals' behavior (Salancik, 1977). Commitment was identified as a key factor in relationship marketing (Morgan and Hunt, 1994). Bejou and Palmer (1998) showed that service mistakes have different effects on different customers regarding their level of commitment. Customers with a high degree of commitment are more forgiving than customers with a low degree. In addition, the commitment has a positive effect on the quality of the relationship (Palmatier *et al.*, 2007). Chakravarty, Feinberg and Rhee (2004) demonstrated that a high degree of commitment between a customer and a service provider lowers the probability that the customer changes to an alternative service.

Within IS, users' commitment is defined as the degree of psychological attachment to a system (van der Heijden, 2012), indicating a strong influence on the behavioral intention to use a system (Li *et al.*, 2012). In context of the Investment Model, the commitment level directly influences the probability of relationship persistence. While Malhotra and Galletta (2005) indicated that commitment has a positive impact on the intention to continuously use an IT service, there does not exist any study which tested the impact on discontinuous migration intention. Based on existing research, it is assumed that high commitment implies that users stick with the system, while a low commitment raises the probability of discontinuance. Thus, it is assumed that:

H5: Commitment to a system negatively influences the intention to break up with a cloud storage service.

Research design

An empirical study based on a quantitative online survey was conducted to test our hypotheses. The following section describes the development of measurements as well as the survey construction and data collection procedures.

All measurement instruments used in this study were adapted from existing measures. The items were measured on a 5-point Likert scale. The instruments were translated into German since existing measures were published in English language. Afterwards, all items were translated and retranslated by two native English speakers. Since deviations did not occur, it was assumed that no translation biases affected the instruments. The following constructs were used to test the hypotheses: The satisfaction construct was measured by the satisfaction scale adapted from Bhattacherjee (2001). Investment size, quality of alternatives, and commitment were measured using adapted scales from Rusbult et al. (1998). Intention to switch to an alternative CSS was measured by the 3-item scale of intention to migrate by Bhattacherjee and Park (2014). Perceived security of alternatives was measured by the scale of Pavlou, Liang and Xue (2006). Procedures to assure the precise measurement of constructs were applied.

Firstly, the adapted instruments were reviewed and discussed by five IS academics, resulting in minor wording changes. Secondly, construct validity and comprehensibility were assured using five raters and an open sorting procedure (Moore and Benbasat, 1991). The preliminary instruments were tested in a pilot study with 120 participants, separated within two independent pretests. Within the first pretest (n = 40), respondents were asked to give feedback concerning the item composition, wording, and length (Moore and Benbasat, 1991). Afterwards, all instruments were shortened and refined. The reshaped items were used in the second pretest (n = 80), where participants were asked to give feedback on the instructions, survey length, and other aspects. Based on these results, a factor analysis was conducted to test the adapted constructs for reliability. The constructs and items are shown in Appendix A.

The survey was conducted online between October and November 2016. There existed two conditions to participate: 1) the participants were using cloud storage services and 2) participants had full authority to decide whether to use a service or not. The second condition was necessary to clarify that users did not choose their cloud-service as a matter of organizational policy. The survey was spread among different forums, student

newsgroups, and social media platforms to reach an acceptable number of participants. Additionally, interest groups related to cloud computing within business social networks were targeted. As an incentive for participation, 20€ gift certificates were randomly awarded to five respondents. The survey started by asking the participants which cloud storage service they mostly use. All questions were automatically adapted to refer to this service. Overall, 136 completed responses were collected (response rate: 24%), whereof four responses were excluded because of invalid responses, low completion times, or no cloud service usage. Gender was nearly equally distributed since 59 (44,7%) of the participants were female. Participants' average age was 29,90 (range: 18-62). 45 of the participants were students (34,10%), whereas 69 were full-time workers (52,30%). 125 (94,70%) participants indicated that they had at least a high school degree or higher. Table 2 shows the demographic results of the data sample.

Gender		Age					
Male	Female	<20	20-29	30-39	40-49	50-59	>60
73	59	8	72	34	10	7	1

Use of Cloud Storage			Primary Cloud Storage Service					
Private	Professional	Both	Amazon	Dropbox	Google	iCloud	OneDrive	Other
76	13	43	2	67	34	15	10	4

Table 2. Sample characteristics (n=132)

Results

To validate our research model, it was transferred into a structural equation model (SEM) (Chin, 1998). Due to the small sample size (less than 500) and the lack of fulfillment of a multivariate normal distribution, PLS software with bootstrapping technique and SmartPLS 3.2.7 was used (see Hair, Ringle and Sarstedt, 2011). The PLS method is a composite-based approach to SEM which aims at maximizing the explained variance of dependent constructs in the path model (e.g. Hair, Ringle and Sarstedt, 2011), and is suitable for small sample sizes by showing a high robustness (Ringle, Wende and Becker, 2014). All hypothesized constructs were modeled as reflective measures of their respective indicators.

Measurement model

The reflective measurement model was assessed by estimating reliability and convergent and discriminant validity (see table 3). Reliability was assessed since the composite reliability (CR) of all constructs was above the threshold of .70 (Fornell and Larcker, 1981). All constructs reached a Cronbach's Alpha above the recommended threshold of .70 (Nunnally and Bernstein, 1994). Convergent validity was assumed since the average variance extracted (AVE) for each construct exceeded the threshold of 0.50 (Fornell and Larcker, 1981). Discriminant validity was tested by comparing the square root of AVE for each construct with the bivariate correlations of each measured construct (Fornell and Larcker, 1981), and was assumed to be higher on the square root of AVE than inter-factor correlations. The scores can be seen in Table 3. A further analysis of the cross-loadings indicated that the measured constructs are empirically distinguishable (all cross-loadings between construct items were lower than .40).

Variables	CR	AVE	α	1	2	3	4	5	6
(1) Intention to Break Up	.93	.82	.89	.91					
(2) Satisfaction	.88	.72	.80	-.22	.85				
(3) Investment Size	.94	.77	.93	-.01	.42	.88			
(4) Quality of Alternatives	.92	.79	.87	.55	-.09	-.12	.89		
(5) Commitment	.93	.78	.91	-.31	.72	.46	-.17	.88	
(6) Security of Alternatives	.89	.80	.75	.53	.00	-.11	.48	-.19	.89

Table 3. Reliability and Validity Measurements. CR = composite reliability, AVE = average variance extracted, α = cronbach's alpha. Bold numbers on the diagonal are the square root of the AVE

Before testing the hypotheses, it was assured that the measurement was not influenced by the common method bias (CMB). To alleviate concerns about CMB, multicollinearity was tested using the inner variance inflations (VIF), resulting in values between 1.00 and 3.00, which is lower than the suggested maximum values of 3.30 (Kock, 2015). Therefore, the data set was not affected by the CMB. Regarding the cloud storage usage (see table.2), we observed a heterogeneous distribution of the sample. While 76 participants used cloud storages for private use only, 43 indicated that they use cloud storage services for private and business purposes. A small number of 13 participants use cloud storages for business purpose only. To avoid a bias caused by different usage scenarios, post hoc analyses were carried out to exclude or control interference effects with

private/business/private+business usage. An ANOVA tested whether the populations differ concerning the presented information in the individual constructs. All data were not significant (p>.05), which indicates that the cloud storage usage had no influence on the results.

Structural Model

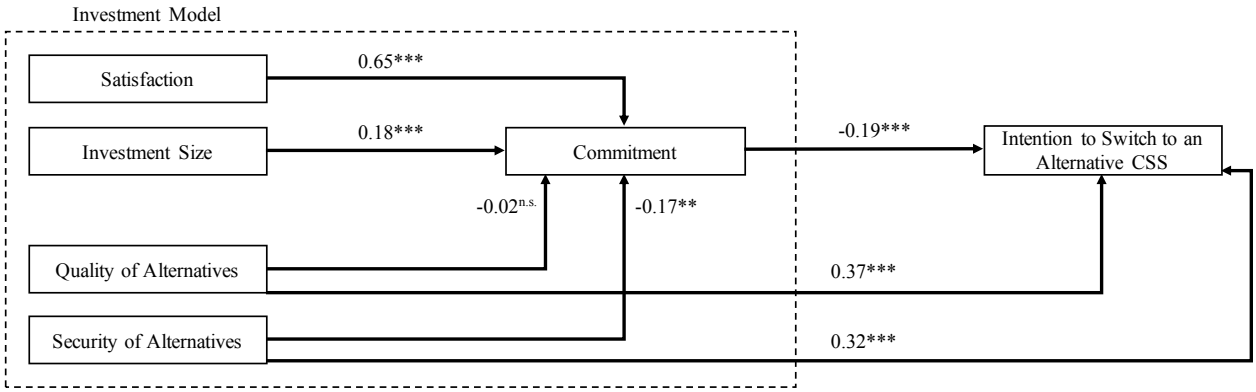

Figure 2. Research model (n=132). *p ≤ 0.05; **p≤ 0.01; ***p ≤ 0.005; n.s.= not significant.

Overall, the model explained 58% (R^2 = .577, adjusted R^2 = 0.564) of the variance of commitment. Additionally, 43% (R^2 = .430, adjusted R^2 = 0.416) of the variance of the intention to switch were explained (see Figure 2). The relational factor satisfaction showed a positive effect on the commitment (β =.649, p ≤ 0.001) as expected in Hypothesis 1. Investment size positively influenced commitment (β =.164, p ≤ 0.004), supporting Hypothesis 2. Hypothesis 3a was not supported, since solely a weak non-significant effect of the quality of alternatives was measured (β = -.015, p = .834). Hence, Hypotheses 3b was supported since quality of alternatives included a strong positive effect on the intention to break up (β = .369, p ≤ 0.001). Furthermore, a strong path coefficient between the perceived security of alternatives and the commitment was measured (β =-.166, p ≤ 0.017). Additionally, the security of alternatives included a positive effect on the intention (β = .317, p ≤ 0.001). Hence, Hypotheses 4a and 4b were supported. Commitment had a significant negative influence on the intention (β = -.186, p = .005). Thus, Hypothesis 5 was supported as well.

Furthermore, the predictive relevance of the model by application of the Stone-Geisser test, indicating how well the data were reproduced by the PLS model, was analyzed. The

Q^2 values for commitment (Q^2 = .415) as well as intention to switch (Q^2 = .326) were positive, indicating a high level of predictive relevance (Fornell and Bookstein, 1982).

Discussion and Implications

Our work successfully adapted the Investment Model of Rusbult (1980, 1983) to the IS context, indicating that commitment as central construct of the Investment Model can be used to predict the intention of IS users to switch to an alternative system. The commitment construct was successfully applied to the context of cloud storage services and was explained through three of the four applied constructs: Along with the security of alternatives, satisfaction and investment size accounted for nearly 58% of the variance in commitment. In this regard, security of alternatives showed to be a successful predictor that has a negative impact on commitment. In turn, satisfaction had the highest positive effect on the dependent variable, followed by investment size. These findings are supported by previous studies indicating that satisfaction constitutes a powerful predictor for IS discontinuance (Zhang *et al.*, 2016) as well as IS migration (Goode, 2015; Xu *et al.*, 2017). Additionally, research focusing on investments as inhibitors of switching behavior supports these findings (Park and Ryoo, 2013). Referencing the categorization provided by migration theory (Lee, 1966; Bhattacherjee and Park, 2014), satisfaction and investment size (and in turn commitment) can be considered as mooring factors, keeping users within the borders of an IS.

As expected, security of alternatives and quality of alternatives do not serve as mooring factors, since they do not affect user's commitment positively. While a high level of security of alternatives reduces user's commitment to the CSS, quality of alternatives indicated a small negative, yet not significant impact on the commitment. These findings are quite interesting, since they indicate that security concerns have a major impact on the quality of the relationship a user holds with a cloud service and concerning users' feelings towards the relationship. Albeit security concerns constitute a CSS related determinant which shows its impact within a cloud related context, these results are quite valuable. The presence of an alternative CSS with a high level of security features might impact users' commitment to their currently used but less secure CSS. Yet, our results indicate that the non-significant impact of the quality of alternatives, or in other words the attractiveness of alternative services, does not impact the commitment of users' present cloud solution. Therefore, the availability of cloud storage services which appear superior to the user in terms of quality and attractiveness does not affect the relationship

with the current service. Unlike commitment, the intention to switch to an alternative CSS is directly influenced by the quality of alternatives. The more attractive other solutions appear, the higher the probability that users intend to migrate to an alternative service. Vice versa, situations of low quality or no alternatives decrease users' intention to switch. These results go in line with existing research in the context of social network services, where it was demonstrated that the attractiveness of alternative services has a positive impact on users' switching behavior (e.g. Hou *et al.*, 2014; Liu *et al.*, 2016). Our works' unique contribution constitutes the finding that attractiveness of other services does not directly influence users' service commitment. This finding becomes even more interesting since quality of alternatives does directly negatively influence users' commitment. Still, there exists no explanation for this circumstance, which therefore should be addressed in future research investigations. An explanation for the missing correlation between quality of alternatives and commitment is that in context of cloud computing users do not develop emotional bonds to their storage providers, leading to cloud services as exchangeable goods which do not enable social cognitive biases. Yet, there exists a broad mass of research dealing with brand loyalty of users: Google, Apple, or Amazon evoke emotional feelings in users which strengthens the commitment to its services and products (Guo, Y., Barnes, S., & Le-Nguyen, 2015). In context of cloud computing, one might expect that an Apple supporter sticks to iCloud, whereas a Google supporter is highly committed to the offerings of GoogleDrive.

Overall, these findings indicate the importance for cloud service providers to keep up with the market to appear attractive to avoid switching intentions among users. However, a mere focus on users' commitment (driven by satisfaction and investment) is not sufficient. As part of the commitment, satisfaction plays a subordinate role in the decision-making process, while the security of alternative systems plays an important role in a user's decision-making process. The perceived level of security in alternative systems showed to be a highly determining factor for switching intention, which goes along with findings of Bhattacherjee and Park (2014). While quality and security of alternatives drive users' intention to switch, the commitment serves as a hindering factor, lowering the intention to switch to an alternative CSS, and strengthening the relationship between users and their current cloud storage service. In summary, the discussed findings suggest that within situations of high competitiveness, users are more likely to look for new alternatives than in situations with limited alternatives (in terms of attractiveness and security), regardless of the level of commitment.

The model developed within this work explained most of the variance of the dependent constructs commitment and intention to switch, indicating a high prediction power. Hence, this model can be replicated within a similar context in future research. To evaluate the generalizability of the model, it needs to be adapted in future work with diverse contexts. Current topics of interest in IS research, where users' status towards the system or service are of high relevance, can be found in the context of social network services (e.g. Hou *et al.*, 2014; Liu *et al.*, 2016), enterprise social network services (Meske *et al.*, 2015, 2017), creativity support systems (Potthoff *et al.*, 2018), and academia and higher education (Wilms *et al.*, 2016, 2017, 2018). Additionally, boundary conditions need to be adjusted. Given the nature of the constructs used to explain commitment, it is expected that satisfaction, investment, and quality of alternatives explain the intention to switch a service for IS in general. This works' goal to introduce a novel viewpoint from a different research context (relationship perspective from social psychology) was proven to be promising. The aim to extend the IS lifecycle through a model that looks on discontinuance was reached, contributing to the provision of solutions for the identified gap in current IS research.

Measuring the intention to switch to an alternative service, the focus within our work was set to the constructs expected to be most relevant by literature. Yet, different factors than those examined within this study might be relevant. Given that the purpose of this study was to postulate and test a preliminary model of IS commitment as well as its relevance to a rarely addressed stage of the IS lifecycle, a limited number of predictors were chosen. We are convinced that the termination phase of an IS needs more attention within IS research. Future research should explore additional predictors to expand the scope and explanatory power of this termination paradigm.

Limitation and Further Research

This work addressed the determinants strengthening and weakening users' relationship towards information systems. To answer this question, a literature review was conducted, and a model explaining the switching intention was constructed and tested. The derived hypotheses were tested based on the results of a survey among 132 cloud service users.

However, our work has some limitations: While the current data sample is unsuitable for further analysis using the covariance-based SEM method instead of PLS, future research should consider running CB-SEM, since applying PLS to test SEM models was found to

be problematic (Rönkkö, McIntosh and Antonakis, 2015). Another limitation constitutes the comparison of human and IS relationships: an assumption inherent to the Investment Model is the monogamous behavior of humans, where a new relationship requires an existing relationship to end. Yet, this not always the case within the IS context: studies indicated that users turn out to be 'polyamorous', using multiple services at a time (Alzain *et al.*, 2014). Therefore, it is not possible to predict whether an existing relationship will be terminated or continued in a parallel usage scenario. However, it is assumed that the intention to switch commendably predicts the switching behavior, where a user decreases the use of the current CSS in order to increase the use of a new alternative CSS (e.g. Xu *et al.*, 2017). Overall, it is stated that migration is seen as a combination of discontinuance and acceptance drivers (Bian *et al.*, 2015). To measure a systems' termination degree is difficult, since users usually reduce the use of an IS little by little, but do not necessarily terminate the relationship at one go (i.e. delete the existing account of the current service before switching). For further research on this field, we recommend a longitude measurement in which the switching process is observed over a period. Hence, it could be observed, how users' initial commitment to a CSS changes after the user has started to use a new alternative. The Investment Model presumes that persons hold a free choice regarding their partner, which is applicable for private IT, yet, it is not the case for professional IT users being limited to the IT solutions offered by their organization (42 of respondents indicated that they use a cloud storage service either professionally, or both privately and professionally). Although the post hoc analyses do not provide any indication that our results are influenced by the different kinds of use, further investigations should be carried out. Nevertheless, future studies should examine whether the groups differ from each other. Within future works, changes within the model could be made regarding the evaluation of the quality and attractiveness of a CSS: while security was identified as a core aspect of cloud computing, it could be further differentiated; for instance, services advertise with specific features designed to give users a stronger sense of security. These features are likely to have an impact on the perception of potential users and should be addressed in further extensions.

Several implications for IS research arise from this works' findings: Firstly, after identifying the termination phase as an underrepresented sequence of the IS lifecycle, a new perspective of termination behavior where users plan to switch from their current IS as they are attracted by more than one alternative was introduced. Secondly, the psychological model on relationship commitment was adapted to the IS context,

introducing the constructs commitment, quality of alternatives, and investment size, which were tested for reliability and validity. Finally, a novel generalizable model to measure users' switching intention was introduced.

This study constitutes a suitable starting point for further research. It is planned to conduct larger studies to validate this works' model on a larger database. Ultimately, future studies need to differentiate explicitly between private contexts and business contexts.

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A.b P2: Between Termination and Adoption - The Ex-Users' Valley

Fact Sheet of Publication P2

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Abstract

Although there exists a lot of research dealing with the adaptation and continuous usage of information systems, the final phase of the IS lifecycle, namely the termination phase, has solely received little attention up to now. Thus, scant attention was paid to scenarios where users showed discontinuous usage behavior and decided to stop the usage of an IS. While present IS research sees IS termination as a part of the switching process where a user ends the usage of a system and migrates to a new alternative, this work argues that IS termination and IS switching need to be viewed as separate actions. In this regard, a preliminary survey was conducted examining the post-evaluation behavior of 146 ex-users of a university cloud service. Results of this research-in-progress work indicate that IT discontinuance as part of the migration process cannot be equalized with discontinuance as part of the termination process, where users have no further migration intentions. Moreover, results show that users migrating to a new alternative cloud service develop dissonance, and therefore evaluate low on their former system.

Introduction

These days, Information Systems (IS) research looks back on extensive work dealing with the question why individuals use a specific system. Based on various theories and models, such as the Theory of Planned Behavior (TPB) (Ajzen 1985), or the Technology Acceptance Model (TAM) (Davis et al. 1989), numerous research articles examined users' initial adoption intentions (Williams et al. 2009), as well as continuous usage intentions (Bhattacherjee and Lin 2015; Lankton and Mcknight 2012). While adoption and continuous usage represent the first two phases of the IS lifecycle, the third phase which represents the termination of an IS has been neglected so far (Maier et al. 2015; Turel 2015). IS termination was majorly studied in switching scenarios, e.g. regarding cloud services, where a user migrates from a cloud service to an alternative one (e.g. Bhattacherjee and Park 2014; Goode 2015; Wu et al. 2017). It was demonstrated that users prefer to quit (terminate) the usage of their current cloud service, and migrate to an alternative one if the expected usefulness of the new alternative is high, while the satisfaction with the current service remains low (Bhattacherjee and Park 2014).

Yet, this perspective presupposes that users already gained experience with the new alternative. In addition, this perspective solely considers the adoption of a new system without any regard to the termination of the old one (Bian et al. 2015). However, there

exist cases where users want to separate themselves from technologies without any intention of using an alternative system (Rogers 2003). Therefore, research started to focus on users' discontinuance intentions (Maier et al. 2015; Recker 2016; Zhang et al. 2016). While research on IS discontinuance tries to cover both user groups who plan to leave an IS, namely those who want to switch, and those who want to quit ultimately, there exists no research which examines both groups separately. Yet, a separate consideration is necessary: Users who ultimately plan to leave their cloud service set different demands on the technology than users who switch to an alternative cloud service. Since there does not exist any research indicating whether both user groups differ from each other (e.g. in terms of reasons for the termination), or whether they share the same predictors, this work compares the reasoning of both groups during the termination process. This research-in-progress work analyses the differences between users who leave a cloud service and hold on an alternative solution (migrants), and users who leave a cloud service without any intention of switching to an alternative (dropouts).

Cloud services are well suited for this works' investigation since users have the possibility to choose from a variety of services which differ in functions and features. Moreover, cloud services as research objects were used in several switching and discontinuance studies before (Bhattacherjee and Park 2014; Bian et al. 2015; Walther et al. 2015). It is quite important to address the needs and requirements of both specific user groups (migrants and dropouts) for cloud service providers and IT executives, since users constitute a key asset for financial profitability (Botta et al. 2016). Another case where emigrating users cause harm constitutes cloud computing in higher education (HE), where the storage, management, and provision of research data are of high relevance.

Therefore, this research-in-progress work focuses on the competitive sector of cloud services in HE, and determines the differences between the user groups "migrants" and "dropouts". Results of this research-in-progress work contribute to the existing research gap of discontinuance and switching research, and serve as a basis for future research investigations. Hence, this works' results offer practical contributions for cloud-service providers as well as IT executives in HE by offering a new perspective concerning the needs of a previously neglected user group.

This work is structured as follows: at first, a theoretical background of IS termination and IS switching will be explained. Next, the executed study will be presented. Finally, research implications will be discussed, and further research processes will be presented.

Theoretical Background

Background on IS Discontinuance

To understand the phenomenon of IS discontinuance, it is necessary to understand its role within the IS lifecycle. The IS lifecycle consists of three phases: 1) Adoption, 2) Usage (IS continuance), and 3) Termination (IS discontinuance) (see Fig. 1) (Maier et al., 2015). Based on the Theory of Planned Behavior (Ajzen 1985; Fishbein and Ajzen 1975), various theories indicating the adoption of technologies were developed. The description of the rationale behind users' adoption behaviors were foregrounded by determining individuals' usage intention by integrating the Technology Acceptance Model (TAM) (Davis et al. 1989), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003). Both, TAM and UTAUT, include actual system usage as an additional scale beyond the mere intention to use a system.

Although IS continuance has been analyzed in diverse studies (e.g. Bhattacherjee, 2001a; Deng et al., 2010; Flavian et al., 2006; Thong et al., 2006), research on IS discontinuance was mostly ignored. One reason for this shortcoming constitutes a widespread misunderstanding within previous research where IS discontinuance has been misinterpreted as a low level of IS continuance intention (Turel 2015). Still, IS discontinuance is defined as "the cessation of the use of an organizational information system" (Furneaux and Wade 2011), and therefore should be separately treated from IS continuance (Turel, 2015). Ajzen (2001) stated that individuals hold on IS continuance intentions while making plans to terminate the usage (Ajzen 2001). Since the decision to leave a system is based on previous experiences, the termination process should be treated as a separate step within the IS lifecycle (Ewusi-Mensah and Przasnyski 1991; Furneaux and Wade 2010, 2011).

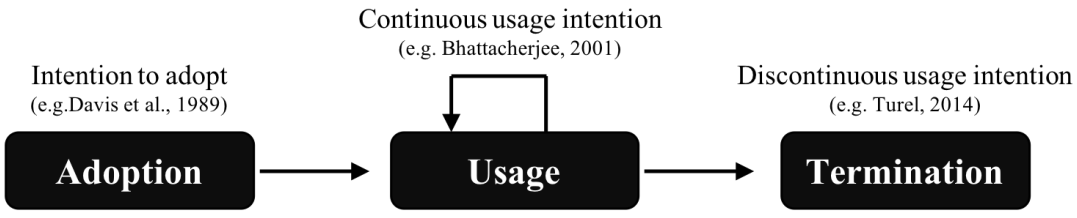

Figure 1. Lifecycle from an IS adoption perspective adapted from Maier et al. (2015).

Maier et al. (2015) emphasized that the termination phase of an IS lifecycle is characterized by avoidance of an abandoned system, and an active devotion towards an alternative system. A system which does not fulfill the required functions leads to users who migrate towards another system, albeit the new system does not satisfy their usability needs (Davis et al. 1989). According to Ravindran et al. (2014), there exist three types of discontinuous behavior: 1) short breaks, where users avoid to use a system for a specific period of time, 2) controlled activity, where users reduce their activities within the IS, and 3) suspend behavior, where users stop the IS usage temporarily or permanently. Another definition is provided by Rogers (2003), who distinguishes between two types of discontinuance, namely *replacement* and *disenchantment. Replacement discontinuance* describes an individual's decision "to reject an idea in order to adopt a better idea that supersedes it" (Rogers, 2003, p.187), and constitutes the equivalent of "migrants". *Disenchantment discontinuance* is defined as a decision resulting from individuals' dissatisfaction with a technologies' performance. Hence, the definition fits the description of the "dropout" group. According to Rogers (2003), "dropouts" are represented by laggards, i.e. later adopters of high age who are mostly linked to close peers.

Background on IS Migration

Prior research concerning IS switching described the migration process as a symbiotic state of IS termination and IS adoption, where a user terminates the usage of a system and immediately adopts a new one (Bhattacherjee and Park 2014) (see Fig. 2). The most prominent theory to explain users switching intention constitutes the Push-Pull-Mooring (PPM) framework (Chang et al. 2014). The frameworks' idea is based on three types of factors, namely push, pull, and mooring factors. The PMM implicates that discontinuance drivers are explained through push factors which are defined as "negative factors at the origin that push an individual away" (Chang et al. 2014). Push factors affecting IS switching are low evaluation of the system quality (Hou et al. 2014; Wu et al. 2017), as well as an overall low level of satisfaction with the system itself (Bhattacherjee and Park 2014; Chang et al. 2014). It was demonstrated that push factors determine users' switching intentions in cases where users simultaneously adopted a new system, yet, there exists no knowledge about the impact of push factors when no parallel adoption process takes place. Unlike push factors, pull factors are described as positive factors attracting users to a new system (Chang et al. 2014). Moreover, mooring factors explain the determinants that facilitate or inhibit a switching decision, e.g. switching and sunk costs (Chang et al. 2014).

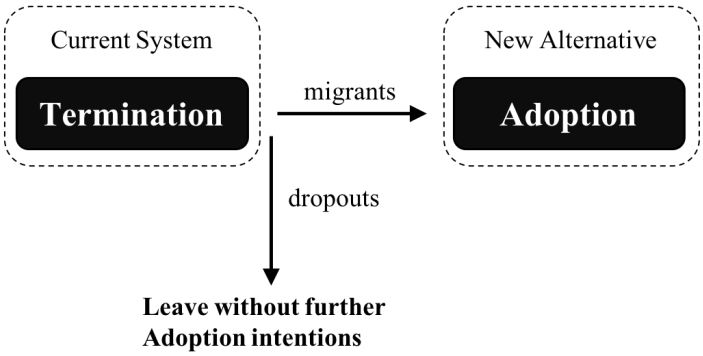

Figure 2. Decision making after IS Termination. Migrants are represented by users who migrate to an alternative IS; Dropouts are represented by users who have no further migration/adoption intentions.

Method & Results

To examine the differences between discontinuance user groups, a quantitative survey was published online between April 2017 and April 2018. The aim of this study was to analyze the influencing factors leading to users' discontinuous behavior. In the context of cloud computing in higher education, the user group of the cloud-service "sciebo" was examined. Sciebo is a cloud service founded in 2014, which is available for students and staff of universities and research institutions in Germany. Currently, members of 28 universities have free access to the service, which provides free storage capacity (30 GB for each user per default with the opportunity to increase to 2 TB for staff), as well as increased privacy standards (separated infrastructure, solely accessible for members). Momentarily, there exist around 110.000 (April 2018) members with an educational background using sciebo. To examine whether there are differences between the two user groups "migrants" and "dropouts" (see fig.2), the survey was first sent to all "non-active-users" of sciebo. Non-active-users were defined as users who did not access sciebo within the last eight weeks, excluding those who's IT termination was based on leaving the research institution by using a filter criteria. Participants were recruited via E-Mail, which resulted in an overall sample size of n=365. To find out whether users were less active (e.g. users who use the service as a repository, but solely have infrequently access) or actual ex-users who knowingly terminated the usage, descriptive filter questions were used, resulting in an overall data set of 146 samples of ex-users. Descriptive data analysis showed that 49% of the participants were male (n=72), and 39% were female (n=57). 12% (n=17) of the participants did not answer the gender-question. The average age was

M=32.43, range (18-65). 57.5% of the participants were students (n=84) and 39% employees (n=57). Five participants gave no answer regarding their membership.

Participants were asked whether they use an alternative cloud solution or if they are planning to do so. Users who used or planned to use an alternative system were defined as "migrants" (n=97). Users who indicated that they neither use any alternative cloud solution, nor plan to do so were defined as "dropouts" (n=49). To analyze users' post-evaluation on sciebo, users were asked about the impact of determining factors related to the service's quality and overall satisfaction (push factors). The constructs were chosen by incorporating variables from earlier discontinuance studies: The variables for service quality were derived from Spiller et al. (2007) and included the four service factors Reliability of Service, Easy Access to Support, Usability, and Variety of Features. Satisfaction was derived from Liu et al. (2016). The measurements were translated into German language. To check for translation bias, a back-translation technique was employed. All items were measured on a 5-point Likert scale (5 = "Strongly Agree" – 1 = "Strongly Disagree"). The collected data of both groups were compared by independent-sample t-tests. As can be seen in table 1, there exists a significant difference ($p \leqq .05$) between all four system quality factors and satisfaction.

Construct	**Group**	**Mean**	**SD**	**F**	**p-value**	**T**
Reliability of Service	migrants	3.00	1.49	4.11	.045	5.30
	dropout	4.36	1.29			
Easy Access to Support	migrants	2.92	1.38	6.23	.013	6.46
	dropout	4.40	1.04			
Usability	migrants	2.79	1.37	10.35	.002	7.71
	dropout	4.47	.96			
Variety of Features	migrants	2.65	1.19	7.33	0.08	9.40
	dropout	4.47	.89			

Satisfaction	migrants	3.26	1.33	19.00	0.00	-5.05
	dropout	4.36	.87			

Table 1. Results of the online survey.

Discussion & Implications

Within IS research, there exists a general assumption that users who leave a system have further migration intentions per default (Bhattacherjee and Park 2014; Maier et al. 2015). As shown within this work, the correctness of this assumption is questionable: users with migration intentions significantly differ in terms of system evaluation from users leaving without any migration intentions. Users with migration intentions value their former cloud service significantly less positive in terms of system quality and overall satisfaction than users leaving the system without any former migration intentions. Since current research on IS termination perceived IS discontinuance as a major part of the migration process (Chang et al. 2014; Goode 2015; Kim et al. 2011), the presented results are of high importance, indicating a backlog of current research.

In the following, this works' results are discussed to get a deeper understanding of the findings and their contribution to current IS research and cloud providers. Participants of the "migrant" group share a low satisfaction and a low evaluation on system quality, while "dropouts" are more satisfied with sciebo, rating service quality higher than "migrants" do. A low satisfaction, as well as a low evaluation of service quality were shown to serve as push factors during the switching process. While a low evaluation of the migrant-group on both determinants is in line with former research results, the positive evaluation of the dropout-group regarding both determinants is novel. Overall, the findings indicate the existence of an "under evaluation effect", where users with an intention to switch to an alternative service evaluate the former system less positive than those with no further switching intentions. This effect can be explained by the social dissonance theory (Festinger 1957), which assumes that incompatible beliefs and behaviors of an individual lead to internal conflicts: Individuals, whose beliefs are in contrast to their behavior, are highly motivated to reduce the occurring dissonance by either changing their beliefs, or ignoring information facilitating the dissonance (Ye and Potter 2011). Hence, a user who decided to switch to an alternative system experiences cognitive dissonance whenever

their pre-acceptance expectation is higher than the perceived performance after acceptance (Karahanna et al. 1999). According to the social dissonance theory, the usage of an alternative system change users' perspective on the former system to avoid dissonance by using a cognitive reevaluation: the former system is evaluated lower than the new alternative.

Yet, the evaluation process of the dropout group seemed to be different. Satisfaction and service quality were evaluated higher than the average of 2.5. Albeit the results indicate to be contrary to the former behavior of the dropout group (quitting the cloud service), there are diverse explanations for this behavior. Firstly, an important determinant in higher education constitutes the evaluation of security quality: Cloud storages are said to be less secure than local backups (Bhattacherjee and Park 2014; Wilms, S. Stieglitz, et al. 2018). In context of higher education security plays an important role since researchers are expected to be motivated to protect their research data (Wilms et al. 2016, 2017; Wilms, Brenger, et al. 2018; Wilms, Stefan Stieglitz, et al. 2018). Hence, researchers are more likely to terminate the usage of a cloud storage service and return to internal storage solutions (Bhattacherjee and Park 2014). Secondly, social factors, like the presence of peer groups or the perceived critical mass, constitute strong drivers (Walther et al. 2015). Users tend to discontinue organizational cloud services which are not capable to satisfy their needs within the organization, although the system quality and overall satisfaction are rated high. Another explanation for the emigrant behavior of dropouts constitutes the evolving value proposition of users over time. Thus, a usage scenario is conceivable in which a user solely uses a service temporarily to complete a specific task one time only: this might be a user who needs to share a specific large amount of data solely once. Once the task is completed, the user might not feel the need to use the service anytime again. This might be the reason why dropouts evaluated sciebo positively while terminating the usage. The service was perceived as satisfactory indeed, yet it simply was no longer needed.

Our results are specifically of high interest for cloud providers/operators: it is of importance to find an explanation for the (non-)usage behavior of users. If user's evaluation is influenced by possible biases (e.g. dissonance), the actual reasons are misinterpreted. Another relevant aspect is the distinction between switchers and dropouts: it can be assumed that a switcher generally requires the technology, but migrated to a competing service due to better service offerings. Dropouts could be users who are reluctant to use the technology. Therefore, one can assume that switchers could be

recovered by improved service offerings (e.g. more storage capacity), while dropouts need to be convinced of the technology itself. Yet, dropouts who used the technology solely temporarily to complete one task could be easily recovered since they do not refuse the technology due to psychological reasons and are not affected by negative biases.

Ultimately, the study contained limitations. The number of considered measured factors is limited. Therefore, future research needs to add further determinants, e.g. social influence or privacy concerns. In addition, it should be considered that migrating to another system might not be possible within HE and other organizations due to existing IT policies. Moreover, the construct of switching intention should be tested (e.g. as moderator) within a new study to determine the constructs explanatory power in terms of discontinuance decisions. Finally, the context of cloud services in HE makes it difficult to generalize the results for related information systems.

Conclusion

This works' analysis indicated huge differences between the user groups. While IS discontinuance was measured by switching intention in prior research, this work offers a solid argumentation towards a reconsideration of this practice for future studies. This works' findings indicate that solely a small part of the IS discontinuances group is affected by switching intentions. The presence of two IS termination groups is especially useful for cloud providers: While migrants can be regained by increased service quality, dropout users hold different requirements regarding a possible re-use of the service. Hence, to regain ex-users, providers need to focus on the requirements of both user groups. The authors hope that this work motivates researchers to carry on research on IS discontinuance to increase the body of knowledge.

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A.c P3: Understanding User Migration to Cloud Computing Infrastructures in Higher Education

Fact Sheet of Publication P3

Title	Understanding User Migration to Cloud Computing Infrastructures in Higher Education
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Abstract

Cloud computing is said to support services that increase work productivity and simultaneously lower costs in organizations. Companies already use professional cloud solutions. However, institutes of higher education, including universities, remain hesitant about adopting it. The 'NSA scandal' and similar revelations led to a sharp decline in trust (especially in Europe) in commercial cloud service providers like Dropbox and Google. Organizations, including universities, have realized the dangers of data leaks from commercial cloud storage services and started to build their own cloud infrastructures to prevent employees and researchers from storing data outside their organization's boundaries. In this study we examine the concept of a "university cloud computing infrastructure" (UCCI) and present comprehensive empirical results regarding factors that influence the users' intention to migrate from commercial cloud storage to a UCCI. In this context, we investigated a UCCI for up to 500,000 users in Germany, using an explanatory switching study with over 5,000 participants. Our findings show that the intention to migrate is significantly influenced by the valuing process, where the users compare the former cloud solution with the UCCI. In this respect, perceived data security is the most influential factor in increasing the value of a UCCI. In addition, the results show that dissatisfaction with the current cloud solution has a strong impact on the evaluation of the UCCI. Our study presents the first research model relating to switching intentions. It excludes parallel usage after the switch and considers the relative value. Furthermore, we present valuable recommendations for managing a UCCI focused on data storage and sharing in a higher educational context, and add theoretical contributions to the research on migration behavior.

Keywords: *cloud service, infrastructure, migration, university, higher education*

Introduction

In recent years, the importance of cloud computing for private and business purposes has increased enormously. Researchers have claimed that cloud storage services have the ability to increase the overall efficiency and effectiveness of collaboration, personal information management, and knowledge transfer (Barrett, Davidson and Vargo, 2015; Naldi and Mastroeni, 2016; Nambisan *et al.*, 2017; Wright, Roberts and Wilson, 2017). Concerning the educational context, where the storage, management, and provision of

sensitive research data are of great relevance, cloud services function as highly flexible environments where resources are accessed, saved, retrieved, and shared with no apparent limitations (Gonzalez-Martínez, Bote-Lorenzo, Omez-Sanchez, & Cano-Parra, 2015; Hew, Latifah, & Kadir, 2016). Hence, a growing number of scientists and researchers are adopting cloud storage services which, for instance, allow users to store research data remotely, and synchronize and share data across multiple (mobile) devices (Armbrust *et al.*, 2010; Avram, 2014). Simultaneously, recent research has indicated that cloud services are not appropriate for the processing of research data (Zhang, Cheng and Boutaba, 2010; Abaker *et al.*, 2014). Profit-oriented companies like Dropbox, Google, Microsoft, and Amazon have their primary legal entities in the US, yet provide cloud services globally. Owing to scandals such as the 'NSA (National Security Agency) spying affair', politicians' and society's trust in commercial IT's integrity has suffered a significant decline (Brown, Massey, & Ward, 2016; Puthal, Sahoo, Mishra, & Swain, 2015; Söllner, Hoffmann, & Leimeister, 2016). To date, no international legislation exists to ensure the protection of data. National laws are rarely comparable with each other and may even be contradictory on a global level, causing concern for institutions, such as universities and other research institutions, which hold an abundance of sensitive data.

Despite the risks of cloud technology, literature shows that the acceptance and adoption of profit-oriented third-party services within the academic community is on the rise (MacMillan, 2009; Wanjiku, 2009; Kshetri, 2010). Employees and students self-organize cloud usage due to the absence of an appropriate IT strategy (Gonzalez-Martínez *et al.*, 2015). To counteract the trend of researchers migrating to profit-oriented cloud services, research institutions have started to build their own cloud infrastructures to prevent sensitive data from being outsourced to non-national servers and thus falling outside the scope of regional data protection regulations (Stieglitz *et al.*, 2014). These "university cloud computing infrastructures" (UCCIs) are said to be beneficial in contributing to an efficient research environment while simultaneously addressing data privacy and security issues (Dikaiakos *et al.*, 2009). UCCIs refer to in-house cloud infrastructures that are used by universities to store, exchange, or publish sensitive research data. Typically, the entire infrastructure is managed and administered by the university. Although there is a general assumption that in-house cloud infrastructure supports researchers and students in meeting national and intercontinental data security requirements, and in storing data within the boundaries of the university (Meske et al., 2014; Stieglitz et al., 2014), no practical research yet exists to support this assumption.

From a theoretical perspective, switching and migration models describe phenomena where users decide to switch from a current to a new, possibly more suitable, infrastructure. Nevertheless, existing switching models are primarily based on constructs derived from adoption theories (for example, TAM, UTAUT), and the information systems continuance theory (Bhattacherjee, 2001a). Hence, recent research indicates that users who see a benefit in a new alternative while being dissatisfied with the current one are more likely to migrate from the old system to the new one (Bhattacherjee and Park, 2014). Unfortunately, these approaches not only fail to consider increased privacy features such as switching drivers but exclude the phenomenon of parallel usage. In addition, there is so far no evidence to show whether dissatisfied users value the new alternative more highly or merely consider it to be the "lesser evil". Consequently, such models are not suitable for determining whether security concerns constitute sufficient reason for university members to store data in a UCCI. Furthermore, they are not suitable for discovering whether or why researchers decide against parallel usage.

To overcome this research gap, we present a novel migration model that addresses the users' decision process when choosing between an existing system and a new alternative. To this end, the decision to switch a system permanently is described by the relative comparison (relative value) of two systems. In addition, we measure the impact of perceived data security during the migration process. Our study is the first to provide comprehensive empirical data concerning the demand for a cloud storage solution within an educational context and, moreover, to consider migration behavior when choosing between alternatives. Data was collected as part of a large-scale project called "Sciebo" (an abbreviation of "science box"). The project aims to provide a cloud storage infrastructure for up to 500,000 users (students and employees) from various German universities. An explanatory migration study with 5,064 respondents was conducted in order to investigate switching behavior on the basis of migration theory. The remainder of the paper proceeds as follows: within the next section, an overview of related work and a theoretical background concerning cloud computing in higher education are provided. In addition we provide an overview of the current research relating to IT adoption, system continuance, termination, and switching, in order to place the research subject of this study within the context of current IS literature. In Chapter 3, migration theory is introduced as the fundamental theory from which we derive corresponding hypotheses. In section 4, our research design is explained. Thereafter, the results of the adoption study are presented in section 5 and, in section 6, we discuss our findings regarding the factors

that influence switching intention. In addition, in the Limitations section, an overview of future work and its implications for research and practice are presented.

Literature Review

Cloud computing has been the subject of numerous research studies in recent years, particularly in the IS field where the implementation of cloud services in companies is a key issue. Yang and Tate (2012) provided an overview of the literature in this field and classified the relevant issues into four categories which an enormous number of subsequent papers have built upon: for example, technological issues (Simić et al., 2012; Sommerville, 2013; Long, Zhao and Chen, 2014; Rasheed, 2014; Yang, Jacob and Raghunathan, 2015), business issues (Stankov, Datsenka and Kurbel, 2012; Djemame et al., 2013; Loske, Widjaja and Buxmann, 2013; Morgan and Conboy, 2013; Walterbusch, Martens and Teuteberg, 2013; Wang and He, 2014; Battleson et al., 2016; Naldi and Mastroeni, 2016), the conceptualization of cloud computing (Ovadia, 2013; Shi, Lee and Whinston, 2016; Sun, Fang and Zou, 2016), and domains and applications (Clohessy and Acton, 2013; Khan *et al.*, 2013; Quick and Choo, 2014). This study does not repeat the basic principles of cloud computing. Instead, we concentrate on the implementation of cloud computing in the context of higher education.

Cloud computing in higher education

The US National Institute of Standards and Technology (NIST) defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell and Grance, 2009). In the context of universities, cloud computing can be understood as a new work-oriented infrastructure for students, employees, and scholars. Hanseth and Lundberg (2001) state that:

"work-oriented infrastructures are shared resources for a community; the different components of an infrastructure are integrated through standardized interfaces; they are open in the sense that there is no strict limit between what is included in the infrastructure and what is not, and who can use it and for which purpose or function; and they are heterogeneous, consisting of different kinds of components — human as well as technological".

Cloud computing potentially provides a wide range of possibilities and service offerings, and cloud-based storage services have gained increased acceptance among private and business users (Gebauer *et al.*, 2015). These cloud-based storage services or service providers (for example, Dropbox, GoogleDrive) enable users to store their files within a cloud and access the files from any location via computers or mobile devices (Gupta, Seetharaman and Raj, 2013). Aside from worldwide and ubiquitous access to data, these services allow users to share and collaborate on files, as well as to use backup functionalities and text recognition for scanned documents (Zhang et al., 2010). As a consequence, cloud storage computing has not only proven to be an efficient technology for private and organizational applications but has become increasingly relevant in the context of higher education (Stieglitz *et al.*, 2014).

Several publications already focus on the use of cloud storage computing in higher education. The early works of Currie (2008), Brown (2009), Wheeler and Waggener (2009), Bristow et al. (2010), Ercan (2010), and Katzan (2010b) call for the use of cloud based infrastructure in higher education due to its inherent advantages, which Armbrust et al. (2009) present as follows: (1) the illusion it provides of infinite, on-demand computing resources, (2) the elimination of the need for potential higher education customers to make an upfront commitment and, finally, (3) the possibility that users may have to pay to use computing resources which they need for only a short period of time. While discussing the motivation for using cloud storage services, these studies focus on cost savings, reflecting the financial crisis at the time of writing. Other authors concentrate on the elements necessary for the secure and effective use of cloud technology, such as identity management and security services (Suess and Morooney, 2009). According to Truong and Dustdar (2011), cloud technology improves the sharing of research results and data, as well as the collaboration with other researchers and scientific groups. Moreover, cloud computing supports the process of creating reproducible research findings, and reduces the operation, management, and resource costs (Truong and Dustdar, 2011). Gonzalez-Martínez et al. (2015) summarized the benefits and facilities of educational cloud computing as the wealth of online applications that support education, the flexible creation of learning environments, mobile learning, and data access. As investments in IT lead to efficiency gains within higher education (Hatzakis, Lycett and Serrano, 2007; Pang *et al.*, 2014), cloud technologies play a significant role in future cost savings on hardware and software.

Despite the potential of cloud based IT, obstacles exist that reduce the overall acceptance of cloud storage technologies in the context of academia. These barriers are based on the poorly defined security provisions of external service providers (Katzan, 2010a; Bellovin, 2011; Li and Chang, 2012). Since trust is an influential factor affecting the successful adoption of cloud services (Arpaci, 2016; Stieninger and Erskine, 2018), researchers and research institutions need to be able to trust providers' ability to secure data against hacking attempts, data loss, and leakage of data (Müller *et al.*, 2011). Besides perceived privacy and security, the location of legal jurisdiction and data storage are important determinants influencing the trust in external cloud providers (Duranti and Rogers, 2012; Arpaci, 2016). Consequently, Rong, Nguyen and Jaatun (2013) recommended service level agreements and holistic mechanisms to ensure security and accountability in the cloud. In addition to security and privacy concerns, other concerns that affect the use of external cloud technologies in higher education include the mining, leveraging, or selling of users' data by external cloud providers (Lin and Deng, 2010b) as well as vendor lock-in, licensing, and price model issues (Pang *et al.*, 2014; Arpaci, 2016). UCCIs are defined as university cloud services whose infrastructure is managed within the borders of universities (Stieglitz *et al.*, 2014), and are characterized by strict user management, with only university members permitted to upload, store, and manage data (Meske *et al.*, 2014). Nevertheless, it does not eliminate the risk that data may be made publicly available or exchanged with non-university members, since national data protection laws may be inadequate or conflict with regulations in the country where the respective server is located (Öksüz *et al.*, 2015).This study raises the question of whether UCCIs are perceived as a viable alternative to public cloud services.

Adoption, continuance and migration

In this chapter, we place the subject of our research in the context of relevant IS research findings. Information systems research has a long history of examining the determinants that lead to the adoption and distribution of IT based innovations (Jackson, Chow and Leitch, 1997; Oliveira and Martins, 2011). Based on the theory of planned behavior (TPB) (Fishbein and Ajzen, 1975; Ajzen, 1985), and the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980), many theories modelling the adoption of technologies were developed and tested. The technology acceptance model (TAM) (Davis, Bagozzi and Warshaw, 1989) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh *et al.*, 2003) constitute the most widely accepted models for predicting users' adoption of new technology. These models explain the rationale behind users' adoption

behavior by determining individuals' behavior when deciding to adopt an innovation. Several studies have already used modified adoption models to predict the determinants behind users' adoption intention in the context of cloud computing: extended versions of the TAM were used to examine users' initial intentions in using a cloud storage service in a higher education context (Burda and Teuteberg, 2014, 2015; Arpaci, 2016). In the context of cloud technology, IS researchers have increasingly moved from a pre-adoption to a post-adoption perspective.

Unlike classic adoption models, the post-adoption perspective (for example, the information systems continuance theory developed by Bhattacherjee and Lin, 2015) describes a state where IT executives no longer focus on the adoption of a new technology, but on the "long-term or sustained use of an IT solution by individual users over a period of time" (Bhattacherjee and Lin, 2015). The aim of post adoption models is to examine the determinants leading to users' continuing use of a system. Thus, information systems continuance theories examine continuance intention and behavior, and therefore rely on two principles (Bhattacherjee and Lin, 2015): "expectations of benefits from future usage" (measured by constructs such as perceived usefulness) and "summative judgments of the outcomes of prior usage" (measured by constructs such as user satisfaction). To examine users' intention to continue the use of cloud storage technologies, different approaches, such as the task-technology fit theory (Yang & Lin, 2015), or the principal-agent theory (Trenz *et al.*, 2013), were used.

Following from research on pre- and post-adoption behavior, a third research stream has been developed in recent years, dealing with the final phase of IT use: the termination phase. The termination phase is described by Maier et al. (2015) as the last sequence in the life cycle of system usage, in particular the stage at which a user decides to abandon the system (Maier *et al.*, 2015). The decision-making process during this stage is defined as "the decision users make to quit the usage of a system and not go back to it" (Turel, 2015, p.1). According to Turel (2015), the discontinuance intention should not be confused with a low level of continuance intention (as measured during the classic post-adoption phase), since continuance and discontinuance do not share the same predictors and must therefore be treated separately (Turel, 2015). This assertion relies on the work of Ajzen (2001), who determined that individuals hold continuance intentions while simultaneously planning to terminate the use of technology (Ajzen, 2001). Thus, IS termination is represented as a separated step within the IS lifecycle described by Maier et al. (2015), which comprises the three stages of "adoption", "continuance", and

"termination". However, there is no universally accepted definition of discontinuance. While some researchers use it to describe situations where users "continue carrying out a task but choose to do so without an information system that was in place to enact the task" (Recker, 2016), others purely define it as "the cessation of the use of an organizational information system" (Furneaux and Wade, 2011), leaving open whether other systems or workarounds might be chosen to carry out the task originally enacted by the system. Rogers (2003) distinguishes between two types of discontinuance, namely disenchantment and replacement.

> *Disenchantment discontinuance* is defined as a decision resulting from individuals' dissatisfaction with the performance of a technology (Rogers, 2003). Within literature, disenchantment discontinuance was measured by the level of discontinuance intention relating to users' intention to abandon an information system permanently without knowing specific switching intentions.
>
> *Replacement discontinuance* is defined as an individual's decision "to reject an idea in order to adopt a better idea that supersedes it" (Rogers, 2003, p.187).

The definition of replacement discontinuance is congruent with the definition of migration or switching, which is defined as "a permanent or semi-permanent change of residence" (Everett S Lee, 1966), where the "customers [..] will not come back" (Reichheld and Sasser, 1990). Migration requires a decision against the use of a current system and a decision for the use of a new alternative system. In order to investigate the switching behavior, it is therefore necessary to consider both decisions; the decision to terminate the current system and the decision to adopt an alternative.

Within the following chapter, models of switching behavior in the context of cloud storage services are presented. The study shows that current models do not take adequate account of privacy, and primarily focus on the adoption of a new system but neglect the decision-making process that users must undergo when choosing between different alternatives.

IS migration in cloud storage computing

Existing studies have already dealt with the switching and migration behavior of users in the context of cloud storage computing (see Table 1). The literature shows that earlier works focused mainly on switching from classic client-hosted platforms to cloud storage

platforms, thus describing a cross-technology switch. Cross-technology switches refer to switches where users decide to use a new type of technology rather than an earlier one. Goode (2015), Wu, Vassileva and Zhao (2017), and Xu et al. (2017) were the first to examine the inter-technology switch between two cloud storage services. Unlike a cross-technology switch, users did not adopt a new technology, but decided to switch between two forms of the same technology. While cross-technology changes are determined by classic pre-adoption factors, such as perceived usefulness (Venkatesh, Thong and Xu, 2016), perceived ease of use (Ying Ho, 2012), expected omnipresence (Park and Ryoo, 2013), and social influence (Wu, 2016), switches between two cloud services are affected more by service quality and trust (Goode, 2015). However, all these determinants refer to an adoption approach in which the user perceives the new system as suitable on the basis of perceived advantages.

The termination determinants for the former system have so far been measured by dissatisfaction (Bhattacherjee, 2001a), low satisfaction (Park and Ryoo, 2013; Venkatesh, Thong and Xu, 2016), and narrow scope of use (Park and Ryoo, 2013). While the termination determinants are intended to measure the influencing factors behind the behavior relating to discontinuance of the former system, the studies predominantly measure the direct influence on the switching intention. Although a negative view of the current system influences a switch to a new system, it remains unclear whether the users terminate the usage of the former system completely and whether they rate the new alternative more highly than the current one. Hence, the disadvantages of the former alternative do not necessarily have to be the advantages of the new alternative and vice versa. In order to find out whether the user judges the new alternative to be more suitable, a relative comparison between the systems must first take place. Bhattacherjee and Park (2014) included the construct of relative usefulness in the context of cross-technology switches, making a comparison between local data storage IT and cloud-based storage IT. While the results showed that relative usefulness has an impact in cross-technological switches, no similar comparisons have yet been made in relation to inter-technology switches.

Although security constitutes the most important influencing factor concerning UCCIs in recent research, only one model has considered security as a construct. Bhattacherjee and Park (2014) considered the shift from classic IT systems towards public cloud services in the context of higher education (Bhattacherjee and Park, 2014): users of classic offline storage were mainly attracted by the perceived usefulness and omnipresence of cloud

storage. However, switching costs and security concerns hinder users from switching to a cloud based solution (Bhattacherjee and Park, 2014). Within their model, Bhattacherjee and Park (2014) considered privacy as a construct, but their construct only addressed users' mistrust of the cloud technology. Nevertheless, this study was the first to address the importance and necessity of cloud services within higher education, in addition to considering security as a major influencing factor. Wu, Vassileva and Zhao (2017) examined users' perception of risk with regard to government cloud services, as opposed to non-government ones, resulting in perceived risk being seen as an influencing factor during a switch. While perceived risk was presented as a second order construct pushing the users away from the current cloud service, the impact of privacy risk was not sufficiently considered.

Table 1. Overview of existing studies on switching in the context of cloud storage services.

Source	Context	Predictors (Enablers)	Predictors (Inhibitors)
Bhattacherjee and Park (2014)	Cross-technology switch	Relative usefulness Expected omnipresence Dissatisfaction with client IT	Switching cost Security concerns
Goode (2015)	Switch between two cloud (storage) platforms	Service satisfaction Service quality Switching attitude	Availability of alternatives
Park and Ryoo (2013)	Cross-technology switch	Omnipresence Collaboration support	Satisfaction with incumbent IT Scope of use of incumbent IT
Wu, Vassileva and Zhao (2017)	Switch between two cloud (storage) platforms	Perceived risk Transfer of trust Critical mass	Switching cost Favorable social norm regarding the substitute
(Ying Ho and Xu, 2012)	Cross-technology switch	Perceived service superiority Perceived technology radicalness	Perceived ease of use Perceived monetary value
(Xu *et al.*, 2017)	Switch between two cloud (storage) platforms		Satisfaction with current service Switching cost Perceived usefulness of current service

Theoretical Background: Migration Theory and Derived Hypotheses

In order to investigate these shortcomings in switching theory and to examine the impact of data security on the users' intention to abandon the commercial cloud service for a UCCI, a proper research model has been developed. For this purpose, relevant parameters were first determined and a suitable research theory selected to provide a scientific foundation.

When setting up a UCCI, there are three specific target groups that could be considered relevant. Firstly, most of the potential users, employees as well as students, may already use commercial cloud services such as Dropbox, Google Drive, or similar for work related purposes. Furthermore, there are some users who have no cloud service experience at all, but may have experience of storing data on different local storage solutions and devices, albeit non-cloud-based ones. For both of these groups, a UCCI may be perceived as an adequate (cloud-based) alternative for storing data. A third possible user group includes those who already use a specific UCCI to store research data; for example, universities' own server infrastructures or discipline-specific repositories. So far, technology acceptance and adoption theories, such as the technology adoption model (TAM; Davis, Bagozzi and Warshaw, 1989) or the unified theory of acceptance and use of technology (UTAUT: Venkatesh et al., 2003), have proved to be suitable for obtaining insights into the use intentions of cross-technology adopters; those who switch from local storage solutions to cloud-based solutions. However, when examining a switch within a technology, from a cloud storage service A to an alternative cloud storage service B, these models are only suitable to a limited extent. In this case, it is necessary to find out which factors cause a switch between two platforms of the same technology, since users have already decided in favor of the technology (Rogers, 2003).

Migration theory (Everett S Lee, 1966) provides a relevant approach for considering the availability of alternative systems that serve the same purpose, which we have applied to our research. Migration theory was originally developed to explain the temporary or permanent movement of people from one geographic location to another (Clark, 1986). It is a standard model for interpreting human migration and consists of push, pull, and mooring factors. Push factors include negative situational aspects that cause a desire to leave the current location without having a definite destination in mind, while the desirable pull factors of a particular destination can initiate a move, regardless of the evaluation of the current location (Everett S Lee, 1966). If both push and pull factors exist, people tend to migrate. However, mooring factors such as potentially high

migration costs represent factors that prevent and constrain movement despite the existence of push and pull factors.

The observable outcome of migration-related activities is termed “switching behavior”. This concept has been extensively used in market research to analyze and explain the choice of, and the switching between, products (Peng, Zhao and Zhu, 2014; Nykänen *et al.*, 2015; Chuang and Tai, 2016). However, migration theory is also increasingly present in top-tier IS journals to explain the adoption of, and switching between, available systems and services, such as online brokerage services (Chen and Hitt, 2002), social network sites (Zengyan, Yinping and Lim, 2009), mobile digital services (Ranganathan, Seo and Babad, 2006), or cloud services (Greta L Polites and Karahanna, 2012). As Lee (1966) has pointed out, there is probably no chance of identifying the exact set of factors that motivate or prevent migration, since these depend on many individual and contextual factors. In this study, we focus on switches within a specific technology, where a user switches, or does not switch, from a previous cloud service to a UCCI. The study presents and tests hypotheses regarding push, pull, and mooring factors to increase understanding of UCCI switching behavior. In contrast to previous studies, in this work we try to grasp the intention to switch a system permanently. The decision is based on a relative comparison, which mediates the different migration factors and the intention.

Pull factors

In this study, pull factors are defined as cloud-related factors that attract researchers and students to a UCCI. According to Rogers’ diffusion of innovations theory (Rogers, 1962; Rogers, 2003), which implies that the relative advantages of an innovation will increase the probability of its adoption, we assume that, if the UCCI is expected to have more advantages than the currently-used commercial cloud storage solution, the target group is more likely to migrate without any intention to use the former cloud solution in parallel. Compared to commercial cloud-based storage solutions with adequate storage volume, a UCCI can provide an advantage because more, or even all, individual projects and related data may be stored in one physical place (Stieglitz *et al.*, 2014). Such utilitarian, technological features increase the users’ effectiveness and efficiency, and lead to a perceived usefulness that encourages individuals to believe that the adoption of a certain technology will increase their performance in achieving a certain goal. This predictor has been validated in different studies among students, as well as in workplace contexts

(Venkatesh and Brown, 2001; Li *et al.*, 2011; Hsieh *et al.*, 2012), for various technologies and is one of the most widely used predictors of IS adoption.

Previous studies have shown that relative usefulness can serve as a pull factor during the switching process if the new alternative is perceived as more useful than the earlier one. In this regard, relative usefulness is also an important influencing factor that plays a central role in the overall evaluation of the new alternative. As recent studies by Kim, Chan and Gupta (2007) have shown, users judge the value of new technology to be higher if it is perceived as more useful than current technology. In addition to a direct influence on the switching intention, we assume that relative usefulness also has an impact on the relative value of the UCCI. Thus, we expect that the value of a UCCI is significantly influenced by its relative usefulness. In consequence, we hypothesize as follows:

- **Hypothesis 1a:** Relative usefulness is positively related to the users' intention to migrate to a UCCI.

- **Hypothesis 1b:** Relative usefulness is positively related to the users' assessment of the relative value of a UCCI.

Many researchers see commercial cloud computing services as a threat to privacy, because sensitive research data is held by a third party. The transfer of data to third parties is usually a concern, especially in the case of personal data or data involving company information. Various national or intercontinental data protection regulations (for example, Europe's General Data Protection Regulation since 2018) prohibit the transfer of personal data to third parties, including the storage of data on servers that are hosted externally (Wilms, Stieglitz, *et al.*, 2018b). In addition, past data protection violations and mass surveillance scandals have decreased trust in commercial cloud service providers (Puthal *et al.*, 2015). Existing literature expects such data protection issues to be a security concern for cloud services (Subashini and Kavitha, 2011; De Capitani *et al.*, 2015). Subashini and Kavitha (2011) and Bhattacherjee & Park (2014) suggest that security concerns are a mooring factor that can prevent switching behavior if the new service is evaluated as less trustworthy, even if it provides a higher degree of usefulness relative to the existing system. Nevertheless, it can be assumed that the majority of researchers use cloud services despite such security concerns, not least because little is known about alternative scientific storage services (Zhang, Zhao, Lu, & Yang, 2016). However, an on-campus UCCI can be seen as a commercially independent cloud storage alternative where

the storage of (personal) research data does not conflict with existing data protection regulations. As a result, in this study we expect data security to be a valuable feature of a UCCI and therefore a pull factor which increases users' willingness to migrate to a UCCI.

At the same time, privacy is an important unique selling point of a UCCI, which should clearly distinguish its services from commercial services. Researchers may have many reasons for switching to a UCCI. For example many researchers work on third-party funded projects whose prerequisites for payment are linked to the availability and accessibility of the research data (Wilms, Stieglitz, *et al.*, 2018b). While a UCCI could initially be perceived as a "lesser evil" by researchers, their opinion of cloud services could still remain low. However, at the same time, we assume that data security is a high priority for researchers, who are in a user group with a particularly high demand for data privacy (Meske *et al.*, 2014). Therefore, a researcher should consider a UCCI to be more valuable as a means of data storage than a commercial cloud storage platform. Hence, we hypothesize as follows:

- **Hypothesis 2a:** Perceived data security is positively related to the users' intention to switch to a UCCI.

- **Hypothesis 2b:** Perceived data security is positively related to the users' assessment of the relative value of a UCCI.

In contexts where IS usage is not mandatory and alternative solutions are easily accessible, the exogenous influence on individuals is limited. In such scenarios, and additional to rational considerations such as relative usefulness, IS researchers have shown that emotions, symbolic values, and enjoyment can also have a strong impact on adoption and use behavior (Arbore, Soscia, & Bagozzi, 2014; Davis, Bagozzi, & Warshaw, 1992; Igbaria, Parasuraman, & Baroudi, 1996; Stein, Newell, Wagner, & Galliers, 2015; Teo, Lim, & Lai, 1999; van der Heijden, 2012; Veiga, Keupp, Floyd, & Kellermanns, 2014; Wang & Scheepers, 2012). The implementation of a UCCI represents such a scenario in which use is voluntary and potential users have access to existing alternatives. Hence, we assume that a user's intention to switch to a UCCI is also influenced by the related positive emotions that may be experienced when using the system. This not only includes expected positive experiences due to user-friendliness (Zhang & Zhang, 2006) but also those related to the effect of an increased connectedness with other researchers or students through the infrastructure (Dickinger, Arami and

Meyer, 2008; Kügler, Lübbert and Smolnik, 2015). Unlike commercial cloud storage services, where users need to know each other in order to connect, users of a UCCI can identify other university members directly in the system and exchange and jointly work on data within the university's boundaries. This makes a UCCI much more attractive for processing research and educational data than a commercial cloud storage service (Stieglitz *et al.*, 2014).

Emotional value is generated when individuals "experience immediate pleasure or joy from using a technology and perceive any activity involving the technology to be personally enjoyable in its own right aside from the instrumental value of the technology" (Kim et al., 2007). Hence, emotional value represents the extent to which the activity (using an IT system) is perceived as enjoyable by the individual, apart from any performance consequences that may occur (Davis, Bagozzi and Warshaw, 1992). In terms of IT evaluation, we therefore expect that perceived enjoyment will directly impact the relative value of UCCI. We therefore hypothesize as follows:

- **Hypothesis 3a:** Perceived enjoyment is positively related to the users' intention to switch to a UCCI.

- **Hypothesis 3b:** Perceived enjoyment is positively related to the users' assessment of the relative value of a UCCI.

Mooring factor: switching costs

Mooring factors are understood as constraining factors that have an inhibiting influence on the decision to migrate, even though push and pull factors exist (Greta L Polites and Karahanna, 2012; Matt, Hess and Heinz, 2015). In this study, 'switching costs' refer to procedural costs that, for instance, result from customizing the new cloud service and migrating all files, and to psychological costs (Jones, Mothersbaugh and Beatty, 2000, 2002) that are related to learning about all the available features of the new cloud service and how to use them properly. Switching costs are mooring factors which impact the users' evaluation. This assumption is based on the concept of status quo bias which describes a mental state where a person is strongly bound to his or her usual behavior and resists any changes (Samuelson and Zeckhauser, 1988b). This bias occurs when users have to evaluate costs due to the fact that changing the current behavior means leaving the current reference point and thereby changing the status quo. To justify the decision to maintain the status quo, the individual will evaluate the alternative as less valuable than

the current solution which represents the status quo. This effect can be explained by the social dissonance theory of Festinger (1957), which assumes that incompatible beliefs and behaviors held by an individual create internal conflicts: individuals whose beliefs contradict their behavior are highly motivated to reduce the resulting dissonance by changing their beliefs or ignoring the information facilitating the dissonance (Ye and Potter, 2011). Thus, it is expected that SQB has a strong impact on the relationship between the switching costs and the relative value. It is therefore hypothesized:

- **Hypothesis 4:** Users' switching costs are negatively related to the users' assessment of the relative value of a UCCI.

Push factor: dissatisfaction with current storage solutions

Migration theory posits that dissatisfaction with a current situation stimulates behavior which leads to situational change. In the original context, dissatisfaction might, for example, be related to environmental factors such as drought and the resulting undersupply of food, high crime rates and similar (Everett S Lee, 1966). In the context of this study, dissatisfaction relates to undesirable experiences with the current IT system. According to Bhattacherjee and Park (2014), dissatisfaction "is an affect representing users' overall evaluative response to their prior first-hand experience with IT usage" and is related to the expectation-confirmation model (ECM) of IT continuance research which posits that dissatisfied users are more likely to switch to another system. In our study, dissatisfaction with current storage solutions therefore represents a factor that affects users positively in terms of relative UCCI evaluation. These assumptions result in the following hypothesis:

- **Hypothesis 5:** Users' dissatisfaction with the incumbent storage solution is positively related to the users' assessment of the relative value of a UCCI.

Value of a storage service: relative value of a UCCI

Value is defined as a trans-situational goal varying in importance and serving as a guiding principle in an individual's life (Schwartz, 1994). Therefore, value is defined as the perceived benefits and disadvantages of a new situation relative to a specific reference point (Kahneman and Tversky 1979). In the case of an evaluation process in the context of IS, for example, the current system is the reference point which is compared with a new alternative (Kim et al., 2007). Value directly influences an individual's behavior and

decision-making (Gutman, 1997). Every time an individual rates the value of a switch as low, he or she develops greater resistance towards a possible switch (Kim & Kankanhalli, 2009). In the case of a high value assessment, an individual is less likely to resist the switch (Sirdeshmukh et al., 2002). The positive and significant influence of value on the migration decision has already been demonstrated in several studies (Chiu, Wang, Fang, & Huang, 2014; Kim et al., 2007). Thus it is hypothesized:

- **Hypothesis 6:** Users' relative evaluation of a UCCI is positively related to their intention to switch to a UCCI.

Social factors

Researchers and students generally have unrestricted control over their data, which is why the use of a UCCI is typically voluntary. However, there may be social pressure to use a UCCI if colleagues or lecturers make their data available exclusively via the UCCI. In line with classical IS adoption theories (Venkatesh *et al.*, 2003), the normative aspects of social influence are also considered in this study. Therefore, we hypothesize:

- **Hypothesis 7a:** Social influence is positively related to the users' intention to migrate to a UCCI.

A crucial advantage of cloud storage services is the ease of sharing data with other users over the Internet (Hadi, 2015). This feature is especially useful when collaborative work takes place in groups (Fabian, Ermakova and Junghanns, 2015). However, in consequence, a potential lock-in effect can arise when other group members continue to use the earlier system and files therefore cannot be shared with them. As a result, people may only switch to the new system if they perceive that its user population has reached a critical mass (that is, by realizing that friends or colleagues have started to use such a service or by obtaining information about the total number of users) (Sarker, Valacich and Sarker, 2005). This phenomenon has already been observed in the context of, for example, knowledge management systems (Wang, Meister, & Gray, 2013), social media adoption (Sledgianowski and Kulviwat, 2009), mobile instant messaging adoption (Li, Chau, & Lou, 2005; Yoon, Jeong, & Rolland, 2015), and communication technology adoption in general (Van Slyke *et al.*, 2007). In the case of a UCCI, we assume that the same effect takes place: if a student or employee evaluates a UCCI's user population as insufficient, the UCCI may not be adopted and used. Hence, we hypothesize:

- **Hypothesis 7b:** Perceived critical mass is positively related to the users' intention to migrate to the institutional cloud storage service or Sciebo.

A summary of the research model is shown in the following Figure 1.

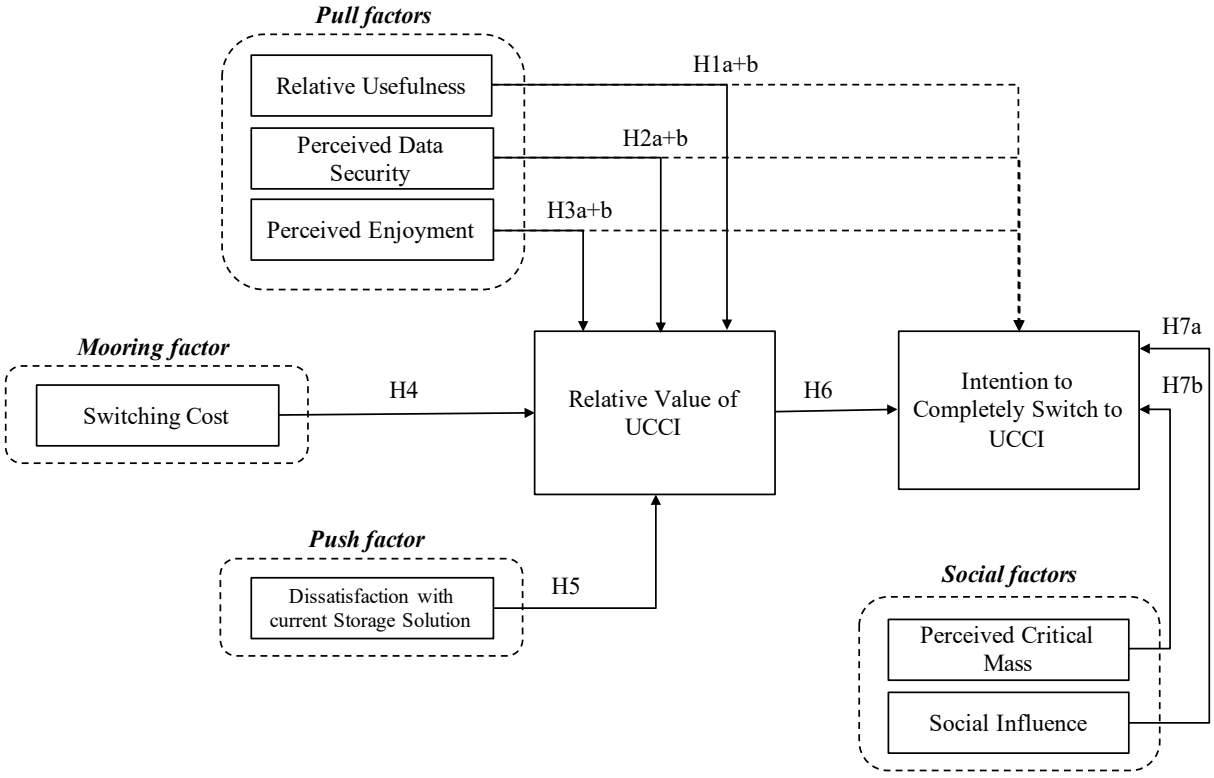

Figure 1. Migration model

Research Design

The operational model

In this research, we first transformed the theoretical models described in the previous chapter and illustrated in Figure 1 into a testable and operational statistical model. For each of the dimensions mentioned in the theoretical models, we chose a specific scale, consisting of several items (see description of the instruments below), as the basis for a structural equation model (SEM) with latent variables. In order to collect the data necessary for testing the research model, we decided to test our hypotheses using a quantitative online survey.

All items of the survey were measured using a 5-point Likert scale. The original English instruments were translated into the German language. To control for translation bias, two native speakers retranslated the items back into English and checked for variations. To test the hypotheses, we used the following constructs: the scale for "relative usefulness" was adapted from Hsieh et al. (2012). "Perceived data security concerns" were measured using the scale of Bhattacherjee and Park (2014). "Perceived enjoyment" was measured using the scale of van der Heijden (2004). "Social influence" was measured using the scale of Venkatesh et al. (2003). The construct of "switching costs" was adapted from Jones et al. (2002). "Critical mass" was adapted from Lou et al. (2000). "Dissatisfaction" with the current storage solution was adapted by using a reverse-coded version of Bhattacherjee's (2001) satisfaction scale. "Relative value" was measured on a 4-item scale adapted from Choudhury & Karahanna (2008) and Karahanna, Ahuja, Srite, & Galvin (2002). We adapted Bhattacherjee's (2001) construct to test for a user's "intention to migrate". All of the adapted instruments were reviewed and pretested by 10 IS professionals and three communication experts, which resulted in minor changes in wording. The final list of items for each construct reflects the feedback received and is provided in Appendix A.

Subject

To answer the research questions and to find out more about the migration behavior of commercial cloud users in adopting a UCCI, we first had to find a suitable application context. Thus, we decided to focus on the migration context of Sciebo, which is one of the largest UCCIs in Germany. The Sciebo project, a cooperatively run 'institutional cloud storage service' for researchers and students, went live on February 2, 2015 and has around 120,000 registered users (as of October 1, 2018). The service was developed with the aim of contributing to different study and work domains in higher education, thus supporting learning, collaboration, coordination, and administration. The UCCI allows users to store files remotely and to synchronize them across multiple devices such as smartphones and tablets. The service is free for all members of participating institutions and provides registered users with a storage capacity of 30GB, which can be increased if necessary. Furthermore, the users can share and distribute files amongst themselves, within and between participating institutions.

In order to develop a better understanding of the migration process in the context of Sciebo, we identified three user groups: 1) Agnostics: those who do not use cloud services

at all and store their data on local devices, 2) Non-UCCI Cloud Users: those who already use other cloud storage technologies instead of a UCCI to store their research data, and 3) UCCI Users: those who already use Sciebo or another UCCI (for example, a discipline specific repository) to store their research data.

In order to discover whether the privacy features of a UCCI are sufficient to win back "lost" users and persuade them to store their sensitive data within the boundaries of the university again, the study focuses on the second user group. To this end, the switching intentions of the Non-UCCI Cloud Users were investigated. We assumed that this group was the most appropriate to study because the users had already gained experience in storing research data in commercial cloud storage systems.

In order to ensure that all respondents in the Non-UCCI Cloud Users group had the same understanding of Sciebo (for example, regarding the perceived data security or the perceived usefulness of the UCCI), we explained the service to them in detail and we then asked them to familiarize themselves with the service. We provided the respondents with information about the exclusive advantages of the service and they were also introduced to the graphical user interface of Sciebo. Thus, we could assume that all respondents were familiar with the service. We also had to ensure that users were using cloud services with similar intentions. Users who use cloud storage exclusively for private purposes may have other requirements of a cloud system than users who also store university-related data in cloud storage. For this reason, respondents were informed in advance that the survey referred specifically to the storage of research data and data related to activities generated within the context of academia.

The survey was conducted from December 1–13, 2015. At that point in time, 25 institutions (mostly universities) were participating in the Sciebo project. The participants were recruited primarily from institution-wide e-mail lists. Hence, the survey link was distributed via email to all members of the 25 participating research institutions. In addition, the survey link was distributed via the Sciebo project's own Facebook page (which had about 630 followers at the time the research took place). Overall 5,068 completed surveys were received. The mean age of the final sample was 24.97 years (SD = 7.15). The sample included 2,013 (40 percent) women. Most of the participants (93 percent) were students.

To control the data for outliers, we tested for Mahalanobis and Cook's distances by measuring intention as an independent variable. For the Mahalanobis distance, we

excluded all samples with a probability lower than .001 (Warren, Smith and Cybenko, 2011). Additionally, Cook's distance was measured and depicted as scatterplots (Angiulli and Fassetti, 2007). In this case, no extreme outliers were found and the analyses were therefore performed with all the subjects. All outliers were excluded, resulting in a final sample set of n = 5,030. Table 2 shows the demographic characteristics of the data sample.

Table 2. Sample demographic characteristics (n=5,030)

Gender			Age					
Male	Female		<20	20-29	30-39	40-49	50-59	>60
3,001	2,029		476	3,876	513	95	52	18
Job			Commercial Cloud Storage Service (multiple usage possible)					
Students	Researcher/ Employees	Professors	Amazon	Dropbox	Google	iCloud	OneDrive	Other
4,676	326	28	104	4,169	1,184	1,337	921	313

Data Analysis and Results

Measurement model

Standard statistical procedures were carried out using SPSS version 23 and AMOS version 24. To evaluate the model of migration theory the structural equation modelling (SEM) technique was used. First, confirmatory factor analysis (CFA) was computed to check the properties of the measurement scales. All of our hypothesized constructs were modelled as reflective measures.

For the evaluation of model fits, we applied standard criteria (Hu and Bentler, 1999): The overall model fit was assessed based on a chi-square goodness-of-fit test, comparative fit indices (CFI/TLI; values above 0.90 indicate a good fit, values above 0.95 an excellent fit), root mean square error of approximation (RMSEA; values below 0.08 indicate an acceptable fit, values below 0.05 an excellent fit; p-close-value should be above 0.5.), and standardized root mean square residual (SRMR; values below 0.08 indicate good fit with the data). The estimation of our model resulted in good to excellent fit parameters (CFI = .952; TLI = .941; RMSEA = .047 with a 90 percent confidence interval; SRMR = .0463). The χ^2 test was significant with χ^2 = 3,507.946, $p < 0.001$. While the high χ^2 value can be explained by the enormous sample size (Bentler & Bonnet, 1980; Browne & Mels,

1992), the overall model fits meet the standard requirements for CB-SEM studies (Bollen, 1989; Browne et al., 1992; Homburg & Baumgartner, 1995; Hu & Bentler, 1999).

To ensure the reliability as well as the validity of each measured construct, we computed a measurement model to examine the item reliability and the construct validity including convergent validity and discriminant validity. Before testing the hypotheses, we ensured that the measurement was not influenced by common method bias (CMB). To alleviate concerns about CMB, multicollinearity was tested using inner variance inflations (VIF), resulting in values between 1.00 and 3.00, which is lower than the suggested maximum values of 3.30 (Kock, 2015). Therefore, the data set was not affected by CMB.

In summary, we achieved acceptable model fitness and further assessed the measurement model for construct reliability and validity. First, reliability was assessed, which is given if the composite reliability (CR) is above 0.7 (Fornell & Larcker, 1981). The CR coefficient differs from the Cronbach's Alpha, which also has a recommended threshold of 0.7 (Hair et al, 1998), since it takes the actual factor loadings into account instead of assuming that each item is equally weighted in determining the composite (Peterson & Kim, 2013). Except for critical mass, the values for the CR coefficient were above 0.7 (see Table 2). Since the value for critical mass was close to the threshold, we did not exclude this construct. Secondly, convergent validity was given, since the average variance extracted (AVE) for each construct exceeded the threshold of 0.5 (Fornell et al, 1981). Thirdly, discriminant validity was tested by comparing the square root of AVE for each construct with the bivariate correlations of each measured construct (Fornell et al, 1981). We could assume discriminant validity on the basis of the square root of AVE being greater than any inter-factor correlation (see Table 3).

Table 3. Discriminant validity measurement

Variables	CR	AVE	1	2	3	4	5	6	7	8	9
(1) Relative usefulness	.82	.61	.78								
(2) Perceived data security	.83	.62	.24***	.79							
(3) Perceived enjoyment	.82	.60	.51***	.37***	.78						
(4) Switching cost	.82	.54	-.06***	-.06	-.16***	.74					

Table 3. Discriminant validity measurement

(5) Dissatisfaction	.86	.75	-.30***	-.14***	-.10***	.17***	.87				
(6) Relative value	.83	.54	-.22***	-.22	-.18***	.37	.45***	.74			
(7) Social influence	.85	.66	.40***	.15***	.46***	-.04**	-.18***	-.08***	.82		
(8) Perceived critical mass	.70	.50	.41***	.05**	.42***	-.13***	-.15***	-.12***	.55***	.71	
(9) Intention to switch	.84	.64	.57***	.41***	.58***	-.25***	-.33***	-.38***	.43***	.47***	.80
CR = composite reliability; AVE= average variance extracted; Values of covariance and the square root of AVE value for the corresponding construct on the diagonal.											

Structural model results

Our model explained more than 60 percent (R^2 = .66) of the variance in users' intention to migrate to Sciebo and more than 40 percent (R^2 = .41) of relative value. Table 4 and Figure 2 summarize the results. A detailed description of the estimates is listed in Appendix B. Overall, 8 out of 11 hypotheses were confirmed.

Table 4. Main effects model

Predictor	Standardized Beta	S.E.	t-value	p-value
Relative usefulness → Intention	.22	.01	19.54	0.000
Perceived data security → Intention	.19	.01	18.81	0.000
Perceived enjoyment → Intention	.24	.02	20.20	0.000
Social influence → Intention	.01	.01	1.35	0.178
Perceived critical mass → Intention	.26	.02	22.44	0.000
Value of Sciebo → Intention	.37	.02	-24.54	0.000
Relative usefulness → Value	.06	.01	-3.83	0.000
Perceived data security → Value	.16	.01	-12.90	0.000
Perceived enjoyment → Value	.01	.01	-0.60	0.547
Dissatisfaction with current storage solution → Value	.41	.01	35.20	0.000

Table 4. Main effects model

Switching cost → Value	-.33	.01	30.69	0.000

Pull factors

- Hypothesis 1a (Relative usefulness → Intention): the model showed that this is a strong factor in explaining migration behavior; therefore, this hypothesis was confirmed.

- Hypothesis 1b (Relative usefulness → Value): although a significant correlation was identified, the influence of the two variables on each other was small (<=.1). Thus, H1b could not be confirmed.

- Hypothesis 2a (Perceived data security → Intention): this hypothesis was confirmed, showing that data security is an important factor for migration from a commercial cloud service to a UCCI.

- Hypothesis 2b (Perceived data security → Value): this hypothesis was confirmed, showing that data security is an important factor for the relative value of a UCCI.

- Hypothesis 3a (Perceived enjoyment → Intention): here, we found the strongest significant positive effect, thus confirming the hypothesis.

- Hypothesis 3b (Perceived enjoyment → Value): here we found the weakest significant relationship. Since the B was below the threshold of .1, the hypothesis was refuted.

Mooring factor

- Hypothesis 4 (Switching costs → Value): the hypothesis was confirmed by a negative and significant path coefficient.

Push factor

- Hypothesis 5 (Dissatisfaction with current storage solution → Value): the hypothesis was confirmed by a positive and significant path coefficient.

Relative Value of a UCCI

- Hypothesis 6 (Relative value →-> Intention): the hypothesis was confirmed by a positive and significant path coefficient.

Social factors

- Hypothesis 7a (Social influence → Intention): contrary to expectations, we could not confirm the hypothesis that social influence is an important driver of migration to a UCCI.

Hypothesis 7b (Critical mass → Intention): the data confirmed that critical mass is a significant factor for migration behavior.

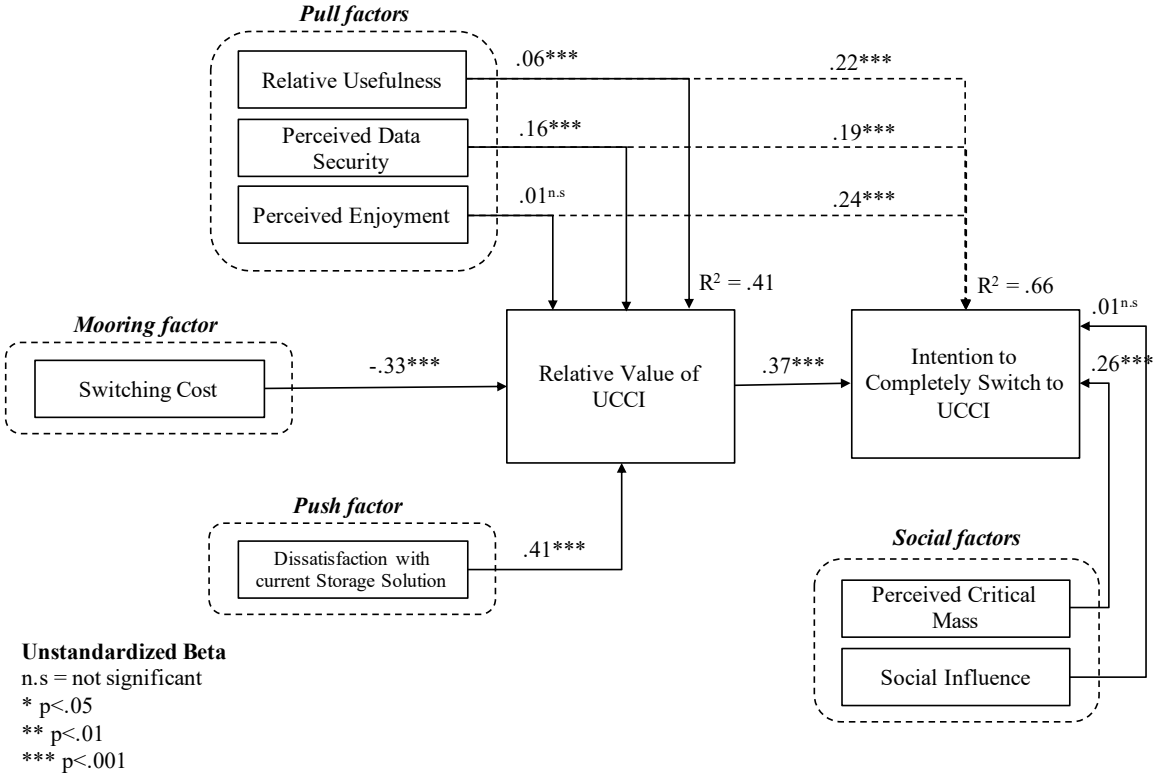

Figure 2. Research model results

Discussion and Limitations

In our study, we applied migration theory to an examination of users' switching intention in the context of higher education cloud storage systems. In contrast to other studies in this area, we did not rely on the pull factors identified in classic adoption theories, but considered that switching decisions are determined by a value assessment. We based our study on an extended model of Ye and Potter's (2011) migration theory, to better explain users' intention to migrate from commercial cloud storage services to a UCCI for the storage of sensitive research data within the boundaries of universities. Our adoption model supported ten out of eleven hypotheses.

Discussion

In the following sections we discuss the most important implications of our research regarding the users' migration and adoption behavior and the management of such an infrastructure. In contrast to previous studies, this paper looks at the switching process in the context of cloud storage services, not only from an extended adoption perspective but by considering the entire decision-making process by which a user decides for a new system and against an earlier system. Thus, side effects such as parallel usage were excluded and the switch was considered as an isolated decision process. In order to challenge the perspective shift in current switching theory, this study first presents an overview of existing literature dealing with the switching between and within cloud storage technologies. The study provides a unique model as well as a unique data set and the results make an important contribution to existing switching research in the context of cloud technologies. In addition, the results are valuable for organizations that aim to build their own cloud infrastructures in order to prevent the digital migration of their employees (for example, to shadow IT or public cloud storage). The study of UCCIs displays 1) relevant factors that are important for the recovery of "lost" users and 2) the extent to which the "security" argument is sufficient as a unique selling point in convincing employees to return. In the following section, the results are examined and critically discussed.

First of all, our results show that the pull factors have two distinct expressions. While the three pull factors (relative usefulness, perceived security, and perceived enjoyment) have a direct influence on the switching intention, perceived security is the only factor that has a measurable influence on the relative value of a UCCI. Relative usefulness is the only pull factor that not only measures the perceived advantages of a UCCI but also compares a UCCI service with an existing cloud storage service. In this case, the construct compares

the usefulness of the commercial cloud service with the usefulness of the UCCI. The results show that users who consider a UCCI to be more useful have a higher likelihood of switching to a UCCI. At the same time, the influence of relative usefulness on the relative value of a UCCI is minimal and below the threshold of .1, which is why the hypothesis was rejected. Hence, the usefulness of a UCCI seems to have a significant but extremely small influence. The results can initially be interpreted in such a way that usefulness is perceived as a strong switching influence, but it does not reflect the actual value of the system. This at first sounds contradictory; however, it might be explained by the fact that Sciebo makes 30GB storage capacity available to users. The amount of storage capacity on Sciebo surpasses the offerings of commercial cloud services, encouraging users to switch. The additional storage capacity therefore might increase the attractiveness of the service offering but, from a technical point of view, it does not increase the value of Sciebo. Another explanation is related to the representation of the UCCI Sciebo, which does not try to compete with other services in terms of usefulness but rather aims to derive added value from an increase in data security. This assertion is supported by the results, which show that perceived security is a primary factor in the value creation process.

The impact of perceived security on both the relative value of a UCCI and the intention to switch is a major finding of this research. One of the basic research questions of this study was whether the security dimension is important enough for the researchers to consider the UCCI as valuable and start switching back to using the UCCI instead of commercial cloud alternatives. The results are the first empirical proof of previous assumptions (Meske *et al.*, 2014; Stieglitz *et al.*, 2014) which proclaimed that IT security is an important factor in keeping researchers within organizational boundaries. At first, this correlation may seem paradoxical: Sciebo is a relatively small-sized infrastructure run by a university consortium in Germany, whereas commercial providers are usually run by organizations that enjoy significantly greater financial resources. Consequently, companies such as Google, Dropbox, and Amazon invest much more heavily in data protection and infrastructure security. Hence, it seems paradoxical that users consider Sciebo to be more secure in terms of data protection than commercial cloud storage services. In order to resolve this contradiction, one must first point out the particular national circumstances in Germany. Data leak scandals such as the NSA scandal of 2014 have had a lasting impact on user trust. Moreover, reports about common practices of companies that admit to using algorithms to partly monitor data and to read it for

advertising purposes are potential reasons for the decline in users' trust in the storage services. We therefore assumed that for users, data security is not only a measure of the level of IT security and encryption but of the confidence that the data will be treated confidentially by the provider and will not be read or shared.

As the third relevant pull factor, perceived enjoyment turned out to be the strongest factor supporting switching intention. In general, other studies have shown that pleasure has become an important factor for employees and other individuals in using a system; however, it is a new and relevant insight that pleasurable aspects are also strong drivers for migration behavior. This supports our approach in analyzing adoption behavior, not by observing an isolated system, but by considering the environment and competing systems more intensively. This is especially important since the perception of different factors regarding a system might change if the competing systems were redesigned.

In addition to pull factors, a mooring factor was examined which, as a possible "anchor" factor, might ensure that users keep using the existing system even though the UCCI is more suitable. As the results show, switching costs seemed to be a highly influential factor during the value assessment process. The results support the assumption that the user does not ignore the risks associated with the switch. The risk of having to invest an unexpected amount of time and effort in setting up the new cloud storage facility represents a high degree of uncertainty for the user. This effect can also be explained by the SQB, a behavior pattern that occurs when an individual avoids a switch due to uncertainty (Samuelson and Zeckhauser, 1988b). This bias often occurs when users have to evaluate costs, due to the fact that changing the current behavior means leaving the current reference point and therefore changing the status quo. SQB has been identified in IT related contexts in which users had to switch from their former IT system (Kim & Kankanhalli, 2009; Polites & Karahanna, 2012a).

We next consider the results for the push factor dissatisfaction. While past studies have always regarded dissatisfaction with the current system as the main driver of switching to an alternative IT system, those studies in the past failed to provide concrete evidence as to whether dissatisfaction with the earlier system also increases the value of the new system. A high level of dissatisfaction with the current system therefore does not necessarily presuppose a high level of satisfaction with the new alternative. Thus, there may be cases in which the user chooses only the "lesser evil" with regard to a switch. This study shows for the first time how dissatisfaction correlates with the evaluation of the

new alternative. Although a UCCI differs from commercial services in only a few characteristics, dissatisfied users evaluate it significantly higher than do users who are less dissatisfied. This effect can also be explained by dissonance theory. Users who are dissatisfied with their current circumstances will rate the value of alternative circumstances more highly. Adapted to the context of cloud services, this implies that users who are dissatisfied with their current system will rate an alternative system more highly to justify their dissatisfaction.

Finally, we have to deal with the question of the extent to which the relative value is a suitable measure of switching behavior. The results indicate the high impact of the relative value construct on the intention to switch. While past studies are based on adoption theories and measure the direct influence on the switching intention, this study is the first to measure the actual value assessment process, and therefore the relative comparison of the platforms the user chooses between.

While the results indicate that Sciebo is quite attractive for users in terms of security and usefulness, it seems that the more satisfied the user is with the current solution, the more unlikely he or she is to migrate to an alternate solution. Interestingly, these findings could be related to the well-known prospect theory of Kahneman and Tversky (1979) and the work of Kim et al. (2007) who examined user IT migration from a value-based perspective. Switching to a new solution always means a change in the status quo, even if the earlier system is not abandoned. A change in the status quo can be disturbing because, in view of status quo bias, a change from how things are is initially experienced as a loss (Kahneman et al, 1979). Consistent with prospect theory, the user will focus on the loss more than the actual gains which, from a value-based perspective, explains the behavior of users who do not migrate to Sciebo even if they are dissatisfied with their current solution.

This study is therefore distinguished from previous research in two important respects:

1. Classical switching studies do not yet consider the relative improvement of a system compared to an earlier system. Thus, they unintentionally convert themselves into modified adoption studies, but disregard the fact that, with a complete switch, the earlier system is abandoned and the new one is accepted as an alternative. Thus, value assessment takes place, with the advantages and disadvantages of the new alternative being weighed against the disadvantages of the earlier solution when the user makes a decision.

2. Often switching intention is only measured as "migration" intention, which is related to adoption intention. Although these constructs measure the change from system A to system B, they do not exclude parallel use. This study is the first to attempt to exclude parallel use, and the results can thus be differentiated from studies where parallel use was not excluded. Here the "switch" factors are often more meaningful, since the users do not have to make any “either/or” decisions and therefore take fewer risks when adopting a new system.

In addition to factors that depend on system design, we considered social aspects such as critical mass and social influence. Our investigation shows that, in contrast to our hypothesis, social influence does not influence switching intention. The fact that social influence has no direct significant influence on the intention to switch implies that the researchers and students who want to use Sciebo are free in their decision making and not influenced by third parties such as lecturers or supervisors. This result fits in with the observations of this study, in which Sciebo is offered by all participating universities as a voluntary service and is not a pre-requisite for participation in courses or work. However, the result can be partly explained by considering the specifics of the target group of students who are typically not part of the organization structure or hierarchy, with the result that social pressure or recommendations from other people at the university might not influence them strongly. Moreover, as the analysis of the system data shows, only a small proportion of the academic community has adopted the UCCI, thereby limiting the impact of social influence.

Critical mass, on the other hand, showed a highly significant influence on migration intention. Critical mass has been under-represented in the literature as an influencing factor, but is particularly relevant in the context of newly implemented systems. Especially in the context of research data, where collaboration and data exchange are highly relevant, it is important that a system can reach many people. Particularly in inter-organizational structures, a high number of users is not only a measure of the system’s adoption but can also create a sense of togetherness. When building a strong internal cloud structure that presumes to compete with international players, a high number of users can indicate success.

Limitations

Even though this is, to our knowledge, one of the largest samples that has been used for a study on migration and switching behavior, it must still be taken into account that the

specific context of the project cannot be transferred to other contexts without caution. The data we used was self-reported and we are aware that this type of data cannot be independently verified and that respondents might behave differently than they have stated. It can also be assumed that specific cultural and country factors come into play; for example, data security and privacy being of great concern and intensively discussed in Germany. Therefore, it can be assumed that students as well as university staff in Germany might be more sensitive to this topic than individuals in other countries. However, as a consequence of the NSA affair, data security and privacy issues have become increasingly important in most countries, thus making the results of this study more widely applicable.

Furthermore, it should be noted that in our model we have relied on a limited number of influencing factors. As the literature review of this paper shows, the most diverse and individual factors can have an influence on whether a user changes a system or not. We can expect that, in further studies, other factors will be identified or the model used in this study will be adapted and extended by other researchers. In addition, the driving factors behind switching decisions can be dynamic. For example, when the study took place, researchers and cloud services were not affected by the GDPR, which was announced in May 2018. The introduction of such a regulation can potentially fundamentally change individual parameters. Depending on the conditions, this may also result in geographical and cultural influences.

Another specific facet of the data sample is the predominance of student participants. Unlike employees and researchers, this group may have a different understanding of data security and privacy. They might not consider university-related research data to be worth protecting.

However, the group of researchers and employees is also diverse and, depending on discipline and understanding, there may be a different relationship to data and security. For example, medical scientists may consider the protection of personal data to be far more relevant than other researchers whose research data is obtained from accessible sources (Kim and Zhang, 2015). As Wilms et al. (2018) point out, there are various guidelines and requirements (for example, with regard to ethics) across the scientific disciplines as to how data must be stored and what criteria the storage locations must meet. In addition to technical barriers, there are also individual barriers that prevent researchers from storing their data within the reach of the university. The fear of data

misuse and robbery leads many researchers to store their data locally, but potentially also on servers that are not accessible to the university.

We provided detailed information about the Sciebo infrastructure to the survey participants. Even though this is an established procedure in research, we cannot be sure that each respondent studied or understood this information. Also, the perceived enjoyment and perceived usefulness, as well as other factors, might have been influenced by the marketing activities of the universities. However, this does not affect the findings about migration behavior as the outcome of our research.

Finally, we need to take a critical look at our data set. In our study we do not probe deeply into possible bias effects that may occur, for example, due to the diversity of respondents (in terms of age, sex, occupation, and similar); thus, these possible influences should not be overlooked. However, in view of the traditional IS adoption research (for example, the unified theory of acceptance and use of technology model or the expectation confirmation model), such biases might occur and should be considered during real world implementations. Possible biases could also have arisen in the recruitment of participants in the context of higher education institutions; not all participating institutions are universities. At the same time, we have no information on the distribution of the individual universities.

Management implications

Our study also provides insights for managers. The high number of participants in the survey demonstrates that many researchers and students are using commercial cloud storage services for storing scientific and academic data. From the universities' perspective, this raises serious concerns because sensitive data is being stored with commercial service providers, thus giving host companies access to the stored data. In such a situation, it is crucial to benchmark the planned features of a UCCI against other solutions that the target groups already use. More generally, it is not sufficient for the universities to only offer comparable benefits, since users perceive they have to sacrifice a whole range of benefits by switching to the new solution. This problem can be solved by establishing a trustworthy infrastructure such as a UCCI. As our analysis shows, designing such an infrastructure is challenging because potential users need to be convinced, not only to adopt a new service but also to stop storing certain data in already established services. The results show that the key to success is that the universities must

capitalize on their unique selling proposition. A UCCI does not usually provide robust security standards or better encryption than commercial services. In fact, most universities often do not have the resources to invest large amounts of time and effort in data protection in the way that commercial cloud storage services like Google, Amazon, or Dropbox can. UCCIs are unique infrastructures that derive their reputation from the reputation and trust that researchers put in the research institutions. The reason that the results of this work show that users consider UCCIs to be more secure than commercial cloud storage services lies in the fact that users trust the university to ensure that their data is not read by the operators and that the university does not make any claims on the data. This trust is a valuable asset which universities can promote, but which must also be preserved. A loss of trust would lead to far-reaching consequences.

However, the focus on the unique selling proposition alone is not enough to overcome the strong competition from commercial cloud services. In order to make future UCCIs attractive in terms of their usefulness and pleasurable aspects, operators can learn from services such as Sciebo: UCCIs need to be created as open systems that can be used for various working tasks. Universities are expected to offer the same or even greater data storage volume than free services from commercial providers, different types of devices should be able to access the services, and these services should be easily integrated into a daily work routine.

The high levels of interest among researchers and students for a research infrastructure, which was evident in our study, shows that cloud computing is still lagging behind in the research environment, at least in Germany. This is an alarming state of affairs because the amount of collected and sensitive research data is also constantly increasing. Consequently, the demand on researchers and students to protect this newly collected data against access by third parties is increasing.

Conclusion

A number of important implications for IS research arise from our findings. First, our measures offer insight into user switching intention in higher education. As assumed by Ye and Potter (2011), we discovered that IT adoption cannot easily be used to explain IT migration. IT adoption does not presume the presence of an incumbent IT system, while IT migration describes the (potential) switch from an incumbent IT system (reference point) to a new solution. We provide insight into the relevance of important factors that

influence migration behavior in the context of cloud storage services. Our findings clearly contribute to the explanatory value of migration theory by testing factors that have not been considered before and by providing results based on such a large data sample.

Secondly, our results indicate that relative usefulness, as well as security concerns, are influential factors. Switching costs and satisfaction with current IT systems seem to be the greatest hindering factors when it comes to IT migration. These findings lead to our third conclusion because both hindering factors are related to what we call "value-based migration". Hindering effects, like the status quo bias in the context of prospect theory, have to be considered since they influence the actual migration process. Future research needs to take a closer look at the role of emotions in user decision processes.

This study makes significant contributions to IS research and sheds light on several research areas. We used the migration theory of Ye et al. (2013), which is one of the most recent IT migration theories and which has not yet been adequately evaluated. While Bhattacherjee et al. (2014) introduced their theory in the context of switching between collaboration and communication services, we applied the theory in the context of a cloud infrastructure for the first time. This study is based on a unique survey dataset using a sample of over 5,000 participants. Therefore, the results of our research are grounded in one of the biggest datasets so far used for migration theory. The findings are beneficial for researchers and managers who aim to establish a cloud service.

In further research, the insights provided into drivers of technology migration should be tested in other contexts (for example, the business environment) and in other countries. As we showed in our study, the concept of migration helps to provide a better understanding of why individuals use certain technologies. Following this approach, further research should not exclusively concentrate on technology adoption but should also consider the abandonment of systems that we see as an important aspect of technology adoption.

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Appendix A: Measurement Items

Table A. Questionnaire.

Construct	#	Mean	Standard	Measurement Items	Source
Switching cost	SC1	2.54	1.01	It will take a lot of time to set up my computer to use sciebo.	Jones et al. (2002)
	SC2	2.65	1.01	It will take a lot of effort to set up sciebo and reach a similar performance as on my current system.	
	SC3	2.93	1.12	I think switching from my current cloud system to sciebo costs me a lot of time and effort.	
	SC4	2.98	1.12	Switching my current cloud system requires a time-consuming setup process (e.g. by transferring data).	
Relative value of UCCI	RV1	3.11	0.83	Compared to sciebo I find my cloud system easier to use.	Adapted from Choudhury & Karahanna (2008) and Karahanna, Ahuja, Srite, & Galvin (2002).
	RV2	2.95	0.86	Compared to sciebo, my cloud system offers more useful features.	
	RV3	2.83	0.80	Compared to sciebo, my cloud system is more reliable.	
	RV4	3.03	0.90	Compared to sciebo, I think my cloud system is better overall.	
Perceived data security	DS1	3.20	1.01	I would feel secure sending sensitive information to sciebo.	Pavlou, Liang, & Xue (2007)
	DS2	3.52	1.19	The security of sensitive information is a major reason for me to use sciebo.	
	DS3	3.46	0.99	Overall, sciebo is a safe place where I can save my personal information.	
Relative usefulness	RU1	2.50	0.79	Using sciebo will help me accomplish my tasks more quickly than my current storage system.	Adapted from Hsieh et al. (2012)
	RU2	2.46	0.85	Using sciebo will improve my performance compared to my current storage system.	

	RU3	3.00	1.01	I will find sciebo to be more useful in my work than my current storage system.	
Dissatisfaction with current cloud solution	How do you evaluate your overall experience with your current storage system?				Bhattacherjee (2001)
	SA1	3.97	0.81	Extremely dissatisfactory ..Extremely satisfactory. (R)	
	SA2	3.84	0.83	Extremely unpleasant... Extremely pleasant (R)	
Intention to completely switch to UCCI	IM1	2.82	1.08	I intend to use sciebo in the future instead of my existing cloud system.	Adapted from Bhattacherjee & Park (2014)
	IM2	2.57	1.03	I intend to invest my time and effort in sciebo.	
	IM3	2.40	1.03	I intend to switch from my current storage system to sciebo permanently.	
Perceived enjoyment	PE1	3.04	0.98	Sciebo gives me a good feeling.	van der Heijden (2004)
	PE2	2.45	0.90	I would love to work with sciebo.	
	PE3	2.68	0.87	Using sciebo would be fun.	
Social influence	SI1	1.75	0.96	People who are important to me think that I should use sciebo.	Venkatesh et al. (2003)
	SI2	1.75	0.96	People who influence my behaviour think I should use sciebo.	
	SI3	2.27	1.20	I use sciebo because my colleagues use it.	
Perceived critical mass	CM1	2.48	0.84	The number of users of sciebo is large.	Lou et al. (2000)
	CM2	1.82	0.88	Many of my colleagues use sciebo.	

Appendix B: Estimates

Table B. Estimated Factors.

Construct	Items	Estimate	S.E	t-value	p-value
Switching cost	SC1	0.59	-	-	-

	SC2	0.70	0.04	40.02	0.000
	SC3	0.91	0.03	38.35	0.000
	SC4	0.70	0.03	50.45	0.000
Relative value of UCCI	RV1	0.70	-	-	-
	RV2	0.70	0.02	43.94	0.000
	RV3	0.69	0.02	43.07	0.000
	RV4	0.85	0.03	50.09	0.000
Perceived data security	DS1	0.81	-	-	-
	DS2	0.79	0.02	53.12	0.000
	DS3	0.77	0.02	52.08	0.000
Relative usefulness	RU1	0.83	-	-	-
	RU2	0.86	0.02	59.38	0.000
	RU3	0.63	0.02	44.78	0.000
Dissatisfaction with current cloud solution	SA1	0.87	-	-	-
	SA2	0.87	0.02	42.90	0.000
Intention to completely switch to UCCI	IM1	0.75	-	-	-
	IM2	0.80	0.02	68.30	0.000
	IM3	0.85	0.02	50.58	0.000
Perceived enjoyment	PE1	0.66	-	-	-
	PE2	0.85	0.03	47.36	0.000
	PE3	0.80	0.02	46.21	0.000
Social influence	SI1	0.93	-	-	-
	SI2	0.94	0.01	90.01	0.000
	SI3	0.49	0.02	36.94	0.000
Perceived critical mass	CM1	0.65	-	-	-
	CM2	0.77	0.04	30.25	0.000

A.d P4: Do researchers dream of research data management?

Fact Sheet of Publication P4

Title	Do researchers dream of research data management?
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Abstract

The ongoing digitalization of academic work processes has led to a shift in academic work culture where researchers are supposed to take on more responsibility in term of adequate data management. Third party funding institutions as well as high class journals are increasingly asking for standardized data management processes and started to set up policies which should guide researchers to manage their data properly. In this work, we deal with the highly IS relevant topic of research data management (RDM) and provide an overview of the different existing research data management guidelines of the eight biggest governmental funded institutions and the biggest politically-independent institution. All existing guidelines of those institutions were considered in a qualitative analysis, summarized and evaluated. It has been found that non-technical requirements evolve to non-technical barriers, which institutions need to address to a greater extent within their guidelines to promote scientific research. This work shows the shift in the understanding of RDM and provides the present perspective which help researchers to better understand the ongoing trend of RDM within science.

Introduction

Due to the rapid digitalization of academic work processes, researcher are forced to deal with a deluge of data among their fields [1], [2]. Research data emerge over the entire research lifecycle, including the collection, analysis and evaluation of data [3]. These data are of high value, since they help to discover new insights and innovations. Researchers, educational institutions, and by this also governments are highly interested in mining available research data, since it leads to a faster progress regarding research in different fields of study [4], [5]. In addition, research data lay the foundation for any research results and constitute the basic prerequisite to prove or reject scientific hypotheses or to replicate empirical statements [6]. Hence, the management of research data is increasingly important for the utilization and preservation of such data [3], [7]. Consequently, there is an increasing demand for consistent data management policies, which can guide researchers to annotate, store, or disclose their research data properly.

However, many researcher refuse to management their research data properly. Today, there are plenty of documented cases where researchers reject to make their data available via open access, despite the fact that different tools and platforms exist, which allow them to easily share and reach research data [8], [9]. Within the work of [10], requests to

authors of PLOS journals to ask for their research data are sent; but only 10% of all requests were answered. The reason to withhold research data differ: Researchers often fear security issues and a possible misappropriation of their data [6]. Additionally, ethical reasons hinder researchers to publish their data, mainly because the data was gained from human individuals, who would probably not agree with an openly publication of their personal data [11].

As a consequence, different institutions (majorly funded by governments) set up data policies and try to define norms which help researchers to conduct adequate RDM [2], [12]. Such guidelines include policies on e.g. the management of data via infrastructures, long-term storage, the disclosure of research data, preservation, ethical aspects, and communication between researchers as well as different fields of study [12], [13]. All those varying guidelines and requirements from different funding institutions made it difficult for researchers to practice proper RDM [12].

As latest studies indicate, researchers' understanding regarding RDM differs, and several researchers do not even know RDM or RDM guidelines in general. Moreover, it became difficult for research infrastructure developer to design suitable information systems to support researchers in this regard [9], [14]. The rapid changes in technology created a gap between researchers understanding of data management and the requirements of third-party organizations. Still, a common understanding regarding the conceptualization of RDM is missing, as well as there is a lack of scientific work to encourage researchers to discuss the shift in requirements. To support both researchers and IT developers concerning the compliance with different international RDM restrictions, this work focuses on current themes and resulting categories, such as technical and non-technical requirements. Due to that, the following research question was generated:

Which requirements are set up by (governmental) funded institutions in order to conduct research data management?

Concerning the research method, the guidelines of eight governmental funded institutions, as well as one politically independent institution are collected and compared with each other. Before, the guidelines are categorized by an inductive qualitative analysis based on the suggested process by [15]. The possible finding of new requirements are of high significance for future research, since they might be the main reason to prevent research data management on behalf of the researchers [6].

The structure of this work is presented as follows:

First, the paper provides a literature review with focus on the current status quo of RDM research. In the following, the qualitative content analysis will be explained, just as the eligibility of the eight examined institutions. Next, the determined categories, as the results, will be presented. Finally, our results will be discussed and research implications will be given.

Literature Review

Until today, there is no common definition of the term “research data management”, especially since researchers from different disciplines have varying opinions and perceptions towards RDM. Nevertheless, some definitions do exist: [3] for example define research data management as an “organization of data, from its entry to the research cycle through the dissemination and archiving of valuable results” [3](p. 1). It includes, for instance, the management of data via infrastructures, the long-term storage and security of data, and open access, but also communication between researchers and different fields of study [13]. Data constitute the basis of research, scientific progress and communication, and due to that its management is of huge importance towards the scientific community [6]. As implied by [16] and [17], data constitute the main source of knowledge, since they are hierarchically related to both information and knowledge. Overall, RDM is said to offer different positive aspects, which mostly occur due to the increased collaboration and data sharing among researcher. As stated by [18] authors who provide access to their research data are more likely to be cited by the scientific community. According to the long tail theory, shared research data have the potential to provide increased knowledge as the data are discovered and used by new audiences [19]. Hence RDM has the potential to overcome bottleneck effects which show up if research insights are only represented within a specific community or academic field [20]. Hence, RDM is said to offer an adjusted pressure by journals, perceived benefits regarding the own career, and altruism; while on the contrary, the factor perceived effort had a negative effect on research data management [21]. Although researchers often fear that giving access to their data might lead to negative criticism about their research, studies revealed that openly shared data in fact defend against accusations by the granting of insights [22]–[24].

Mental and physical barriers that inhibit efficient RDM “are deeply rooted in the practices and culture of the research process as well as the researchers themselves” [25](p. e21101). Those barriers could either be of technical and non-technical nature [12]. Data, which remains untraceable to researchers, so called “Dark Data”, might get lost over time and offers special technical and non-technical barriers regarding its management [26]. Even if technical and non-technical barriers by researchers regarding research data management are overcome, it is questionable that, for example, the supply of openly shared data due to research data management is used by other researchers [27].

Yet, it is questionable which data should be shared, since once they are loosened from the original context they might get misinterpreted or get misused due to missing standardized policies [2]. Anyhow, there are arguments for providing insights into own data and by this for using RDM stated by [2], namely the possible reproduction and verification of research, the availability of research which was funded by and its obligations towards the public, the generation of progress regarding the research with the help of other individuals, which might ask questions concerning the existing data, and finally the improvement of the current state of research in general. [28] suggested an accurate definition of sharable data “as the combined experimental data and descriptive metadata need[ed] to evaluate and/or extend the results of a study” [28] (p. 3). An analysis of researchers’ experiences about the usage of shared data collected by others reveals that standards alone do not lead to re-using data, but rather knowledge of the context, which is often left behind when it comes to research data management [29].

The importance and advantages of RDM are already widely known, and universities start building own checklists and platforms to provide among others data sharing, mainly to collect their data and to allocate todays’ data for their future researchers [13], [30], [31]. It happens that existing platforms do not offer the special needs of different research institutions and fields of study, just as sufficient storage and security safeguards [9], and due to that universities, for example, develop their own platforms with individual research data management guidelines [32]. The university of Rochester (New York), as an example, spent US$200,000 in designing and implementing a digital archive to manage the data of their researchers [24]. But such investments often do not work out as they were planned, since the digital archive of the University of Rochester remained empty [24]. Researchers reported that they could not find their data, nor could offer the time to work on the management of their data and additionally have certain concerns regarding the release of their research data, like misuse and misunderstanding [24]. Likewise, libraries

currently develop research data management guidelines, since they hold the view that the management of research data might become an important part in their future work [33]. Libraries' priorities make up the "provision of research data management advisory and training services" [33] (p.1). Besides, funds for open access researchers are taken into consideration by academic libraries to support data sharing, open access and researchers in general [34]. As institutional information experts, librarians should be part of data sharing efforts, since enormous administrative and operational capabilities are urgently needed [35].

Researchers often struggle with the quantity, diversity and complexity of the generated data, whether it is their own or produced one by colleagues, making future research data management inevitable [36]. [37] recommend an international framework to optimize research data management and to support the connection of the scientific community, due to an increasing amount of data in different research disciplines. It is recommended to cohere of all the professionals in research data management, such as researchers, libraries, publishers and research funders, to assure the preservation of research and data, and to secure the usability of platforms providing research data management [38]. While [39] found that most of the researchers avoid data archiving, [40] revealed that there is an increasing awareness in regards to data storage, since the majority of researchers nowadays store their own data. Yet, the guidelines regarding research data management by nonprofit institutions influence significantly the "how, when, and whether research data are shared" [2](p. 1).

Method

To answer the research question asking for the requirements which are set up by (governmental) funded foundations in order to conduct research data management, a qualitative research setting was conducted. The qualitative design was chosen to gain detailed unsupported insights about the different guidelines and the specific understanding of RDM.

For the discovery of already existing international standards towards research data management guidelines and to alert on possibly missing guidelines, the biggest and most influential institutions regarding research data management within the scientific community were selected. Thus, the existing guidelines of the eight largest and widest known governmental funded institutions were collected. Additionally, Wellcome Trust,

as a widely known, but politically independent institution, was consulted within the list as well. “Large” as a requirement connotes the number of the institutions’ salaried employees, as well as its international influence. The considered institutions are the following:

The Australian Research Council (ARC)[41], the Bundesministerium für Bildung und Forschung (BMBF) [42], the Deutsche Forschungsgemeinschaft (DFG) [43], the European Commission H2020 Program (Horizon 2020) [44], the National Institutes of Health (NIH) [45], the National Research Council Canada (NRC) [46], the National Science Foundation (NSF) [47], the Organisation for Economic Co-operation and Development (OECD) [48] and the Wellcome Trust [49] as the only politically and financially independent institution within this list is settled in London, United Kingdom (around 2000 employees).

This work undertakes an inductive category development as research method. At first, the research question was generated to determine the definite goal of the work, as suggested by [15]. Hereafter, definitions regarding the constructed categories, just as levels of category abstractions are given. Via a step-by-step process, inductive categories are formulated by use of the constructed categories and abstractions, leading to a synopsis of categories and the creation of new ones. Following this, all categories will be revised after up to 50% of the collected material to secure a formative check of reliability [15]. Again, all texts and guidelines are worked through, ensuring a summative check concerning the reliability [15]. The basis of the constructed categories constitutes the guidelines of the different institutions named before. Those guidelines were collected from the institutions’ websites at the end of February 2017. Possible main categories were accumulated and the applicableness regarding the institutions was examined. Subsequently, sub-categories, as suggested by [15], were generated, giving a more specific representation of the institutions’ concerns and guidelines regarding the management of research data.

Moreover, the established categories were divided in technical and non-technical requirements. Technical requirements involve topics like the allocation of RDM platforms, safety warranty, research data storage, memory size and suchlike. Whereas non-technical requirements represent context-oriented topics regarding the research data, such as ethical provisions, and its management. This leads to an overview of the heeded technical and non-technical requirements by the different institutions and their varieties,

with special regard to the non-technical ones, since they might influence current research data management significantly [11].

Results

By use of the inductive category development as suggested by [15], seven main categories and fourteen sub categories were evolved. Due to the used step-by- step process, the constructed categories and their abstractions lead to the summarization of already existing categories and the development of new ones. Through the consideration of different levels of abstraction and the repeated peruse of the text, the following categorized guidelines, as a result of the qualitative analysis by [15] were formulated.

Infrastructure. Belonging to the main category “Infrastructure”, the four sub categories “documentations and focus settings”, “infrastructure policies”, “Stabilization of RDM infrastructures”, and “Tools for RDM” were determined.

The sub category “documentations, and focus settings” includes the institutions’ guidelines which address the need and importance of data definitions and data documentations to simplify the reuse of data within data storage systems. As stated by the NIH: “Regardless of the mechanism used to share data, each dataset will require documentation. [..] Proper documentation is needed to ensure that others can use the dataset and to prevent misuse, misinterpretation, and confusion.” [45](p. 1).

Within the sub category “infrastructure policies”, all guidelines concerning the urgency of standardized policies within research data management, preferably on an international level, are collected. These standardized policies are needed to facilitate data sharing between researchers worldwide and to ease scientific communication. But solely the BMBF, NRC, and OECD provide those guidelines, while the left institutions do not mention the topic of coherent infrastructure policies.

“Stabilization of RDM infrastructures” involves guidelines that focus on research data management systems and infrastructures itself, especially on their consistency and availability. Solid infrastructures are needed to inhibit possible uncertainty of researchers and to ease the usage of RDM systems. The DFG already recognized the need for international standardized infrastructures: “[..] requirements must be defined through the cooperation of researchers and information specialists. Infrastructures are to be

developed according to these requirements and, if possible, interoperably integrated in international and interdisciplinary networks from the start.“ [43](p.1).

The last sub category, “Tools for RDM”, includes recommendations and examples of special tools for a sufficient RDM. The DFG, NIH, and Wellcome Trust offer those tools, trying to make research data management easier and more present to researchers. The Digital Curation Centre, as an example, offers different tools for research data management, such as DMPonline, which was developed by Wellcome Trust.

Security. “Security”, as a main category, includes solely the sub category “Data security”. Since the security of research data has been of great importance to researchers and institutions in the past, according to for example [31] and [50], and in addition is one of the mostly named advantages of research data management, it builds up its own category.

“Data security” involves guidelines that face up to safety concerns and problems. Behaviors for a responsible dealing with foreign data on behalf of the researchers and the platforms developer and staff, but also the advantages of research data management systems concerning the security of data are mediated. Except the NIH and NSF, all consulted institutions provide guidelines regarding the safety of data.

Sharing. The third main category composes “Sharing” with its two sub categories “Open access of data” and “Timeliness of data sharing”. Since both sub categories consider institutions requested data sharing behavior on behalf of researchers, they are collected within one main category.

“Open access of data” implies that research data is accessible for everyone, regardless if they are researchers or not. Since research is often funded by the public, it is postulated that every individual should get free access to research data [51]. Additionally, it is important for researchers to have easy access to the work and data of others, since due to that progresses in science could get achieved. All consulted institutions provide guidelines for an open access of research data, showing that standardized guidelines might already exist. The OECD states conditions which open access should fulfill: “Openness means access on equal terms for the international research community at the lowest

possible cost, preferably at no more than the marginal cost of dissemination. Open access to research data from public funding should be easy, timely, user-friendly and preferably Internet-based.“ [48](p. 15).

“Timeliness of data sharing” includes guidelines that recommend periods of time in which researchers should publish the data at the latest that relate to their already published studies. Based on the consulted institutions, two of them, namely the ARC and NIH present guidelines which suggest periods of time concerning the publishing and sharing of data. Since it is difficult to decide on a period of time to publish data because of the varying types of data, guidelines concerning the timeliness of data sharing are often unspecific, as shown as follows by the NIH: “In general, NIH considers the timely release and sharing of data to be no later than the acceptance for publication of the main findings from the final dataset. However, the actual time will be influenced by the nature of the data collected.” [45](p. 1).

Storage. The main category “Storage” includes “Long-term storage of research data”. Just as the security of research data, it is often named as one of the main advantages of research data management (see for example [50].

“Long-term storage of research data” means the deployment of long-term storage within research data management platforms. These long-term storage guidelines are important to legally ensure those platforms and to safely keep the data, inhibiting the loss of data. The last aspect is especially important to educational institutions, since they fear the loss of data which might be used by their future researchers according to [13]. All named institutions, except the NIH, offer guidelines for the long-term storage of research data. The OECD, as an example, does not name an exact period of time in which data should be stored. As opposed to this, the ARC names more specific time periods regarding the storage of research data from different scientific disciplines. The general recommended time period is five years from the date of publication. For clinical trials, “retaining research data for 15 years or more may be necessary” [41](p. 2.1). The DFG specifically states that primary research data should be available for at least ten years on suitable memories [52].

Ethics. “Ethics” involves institutions guidelines that state procedures in dealing with humans and animals within science and their gained data. Since the dealing with such data causes difficulties regarding research data management [6], especially when it comes to data sharing and open access, standardized guidelines would be of great importance for researchers, but also for human participants. Within the considered institutions, nearly all of them, released guidelines that handle the dealing with such ethical issues, like for example the sharing of patients’ data. By way of comparison, the statement concerning the handling of human data given by the OECD will be offered: “Privacy and confidentiality: data on human subjects and other personal data are subject to restricted access under national laws and policies to protect confidentiality and privacy. However, anonymization procedures that ensure a satisfactory level of confidentiality should be considered by custodians of such data to preserve as much data utility as possible for researchers.“ [48](p. 16).

Management. The category “Management” contains the two sub categories “Dealing with research misconducts” and “Education of research data management staff”. Both sub categories address the management of research data management systems and platforms, which is why they are assigned to the same category.

Within “Dealing with research misconducts”, guidelines concerning the dealing with misconducts made by researchers are summarized. Due to the fact that the possible finding of research misconducts inhibits the data sharing of researchers [6], it is important to counteract this problem. Solely the ARC and Wellcome Trust address this problem by offering guidelines to managers of research data management platforms.

Likewise, “Education of research data management staff” is much needed and of great importance concerning research data management. A well-educated staff is needed to foster and improve research data management systems and platforms, but also to support and help researchers who make use of research data management. Five out of nine examined institutions offer guidelines concerning this topic. The ARC, BMBF, DFG, OECD, and Wellcome Trust published guidelines concerning the education of research data management staff.

Researchers. The last main category “Researchers” consists of the three sub categories “Identification of ownership”, “Inducements of recognition regarding RDM usage”, and lastly “Protection of intellectual property”. All these sub categories address researchers directly, which is why they were collected within one category.

“Identification of ownership” means a continuous recognition of the works’ author and the data constitutor. Offered guidelines concerning that topic handle the guarantee of a stable author identification. Since researchers often fear that their work and data might get misused and that they might lose credits for their work, they will not share their data [2], institutions need to address this problem and provide assurances to enable successful research data management.

As studies already revealed, “Inducements of recognition regarding RDM usage” have a significantly positive influence on researchers’ attitude towards research data management, especially on the sharing of data [53]. By means of that background knowledge, inducements of recognition because of an openly sharing of data for scientific progress must be provided within research data management. Without offering incentives to researchers for sharing their data and managing their research data, progress of research data management might be unlikely.

The last sub category “Protection of intellectual property”, includes guidelines that are aimed at researchers who work for private institutions and who are, due to organizations’ policies, inhibited to publish their data and research. The ARC, DFG, NRC, NSF, OECD and Wellcome Trust provide guidelines and promise support for researchers who are legally not allowed to publish and share their research data. The OECD undertakes distinctions whether the intellectual property belongs to researchers within educational institutions or companies, albeit the OECD says that a “private sector involvement in the data collection should not, in itself, be used as a reason to restrict access to the data” [48](p. 17). The OECD reveals by this implicitly, that they do not support every researcher in protecting their intellectual property.

Figure 1 presents and overview including the different main and sub-categories concerning the guidelines and whether they are offered or not by the different institutions.

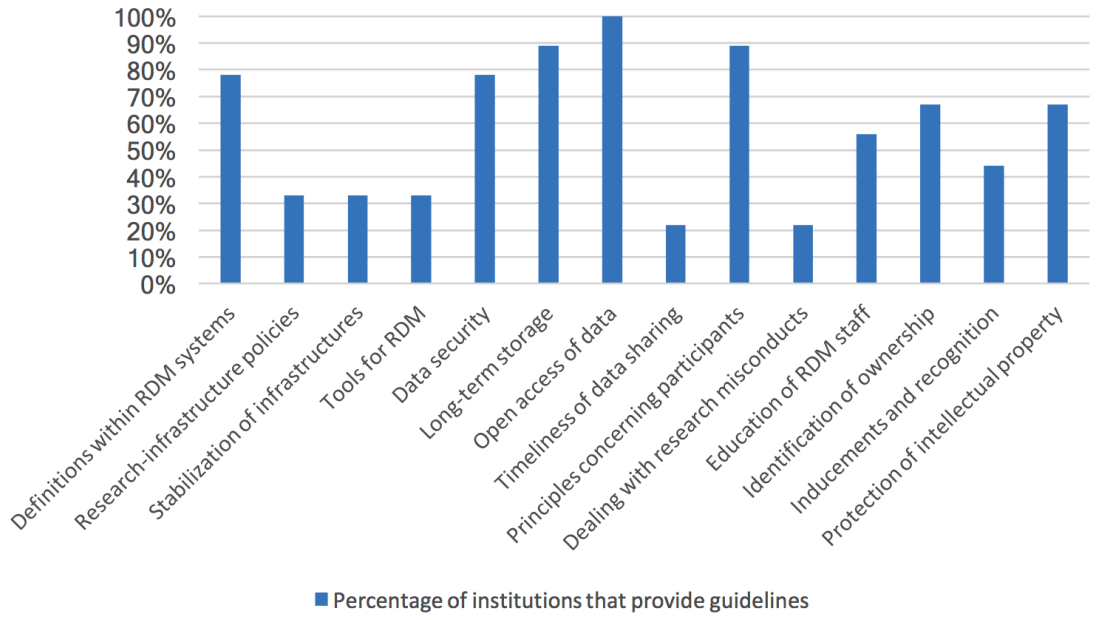

Figure 1. *Percentage of institutions that provide the categorized guidelines.*

Definitions, documentations and focus settings within research data management guidelines are provided by altogether 78% of the examined institutions. Guidelines concerning international research-infrastructure policies are provided by 33% of the institutions, while another 33% offer guidelines regarding the stabilization of infrastructures and tools for research data management. With 78%, guidelines relating to data security are released by institutions and further 89% address the long-term storage of data. Additionally, 100% of institutions provide guidelines towards an open access of research data. 22% of the institutions own guidelines for the timeliness of data sharing and another 22% own policies in regard to the dealing with research misconducts. 56% offer guidelines for education of research data management staff. 89% of the nine institutions present guidelines concerning principles towards the handling with human participants, animals, and their data. Altogether 67% address the identification of ownership as well as protection of intellectual property. Further 44% out of nine institutions offer guidelines that address inducements and recognition for researchers regarding the usage of research data management.

Based on the developed main and sub-categories, a differentiation of technical and non-technical requirements regarding the management of research data was made. The derivation of those segregated requirements is of importance, since institutions often

solely address the technical requirements as well as their barriers, while various studies revealed that non-technical requirements include barriers that are equally important, since they might constitute the main reasons for researchers to not manage their research data, especially when it comes to data sharing [6], [54], [55]. Since both, technical and non-technical requirements can inhibit research data management, they are henceforth exclusively termed as technical and non-technical barriers.

The following table provides an overview of the differentiation of the main categories regarding their sub categories named before in technical and non-technical barriers:

Technical barriers	**Non-technical barriers**
Infrastructure	Ethics
Security	Management
Sharing	Researchers
Storage	

Table 1. *Differentiation of technical and non-technical barriers.*

Discussion and Conclusion

On closer consideration, it occurs that open access of data, and thus data sharing, was apprehended by all nine institutions within their guidelines, but most solely on a technical perspective, since the possibilities of data sharing for future research and the dealing with research data management infrastructures and tools are rather approached than researchers point of view and their existing fears.

Instead of giving opportunities for action regarding a secure dealing with data sharing and the removal of possible abuses, solely the importance of data sharing for a scientific progress is thematized, without any regard on researchers' perspective. This has been the case with all nine examined institutions, independently if they were funded by governments or a non-governmental institution. As already referred to in the current state of research within this work, researchers want to keep their own opportunity of sharing their data instead of giving it to research data management institutions [56].

The institutions guidelines indeed address researchers' fear of security risks on RDM platforms, but confine themselves upon technical requirements, and ignore researchers' security risks regarding the loss or possible misuse of their data. Still, it should be

mentioned that respectively six institutions offer guidelines which address data security and its secure long-term storage. As a further reason why researchers avoid data sharing, a lack of career rewards was mentioned [6]. Within this work, it turned out that solely three out of nine examined institutions provide guidelines concerning the recognition and rewards to researchers for using research data management. This aspect, as a non-technical barrier, attaches no value in most of the institutions guidelines, leading to inhibition and indifference by researchers towards research data management. [54] already indicated researchers' fears concerning data sharing as non-technical barriers. Those non-technical barriers should be negotiated in the future, since they have the same importance as the provision of technical solutions. Nevertheless, six out of nine institutions approach researchers by providing guidelines in regard to the importance of ownership and the protection of intellectual property, which has main importance to researchers [6]. However, as seen by the example of the OECD, not every researcher will be supported to protect their intellectual property. It rather depends on the type of organization they work for. But overall, those institutions miss their aim that all data will be reached via open access in the future to advance scientific progress due to the fact that they do not react to researchers' inhibitions.

In addition, by consideration of the results it gets obvious that the provision of consistent infrastructures and guidelines regarding research data management on an international level is barely detectable. Admittedly, all institutions speak out in favor of open access of research data, yet only three institutions provide guidelines and emphasize international research data management policies within infrastructures. Another three institutions argue in support of the need for RDM infrastructures stabilization within their guidelines. Those international guidelines and policies, but also stable RDM infrastructures are necessary to ease the sharing of data and its preparation on behalf of researchers. Inasmuch as institutions want to expedite science by research data management they should agree upon international RDM guidelines. It shall be said that all of the governmental funded institutions named in this work should possess consistent guidelines, since all those countries are member of the OECD, which created guidelines regarding the dealing with research data. Yet, as shown by the table within the results, the institutions seem to be discordant concerning those guidelines. For instance, some institutions dismiss guidelines, although these are provided within the OECD's principles and guidelines. The ARC, as an example, plead the OECD guidelines, while simultaneously offering own policies regarding research data management. While the OECD speaks out by way of

example regarding the long-term storage of data in a very general way, and without naming specific periods of times, the ARC specializes the long-term storage of data within their own guidelines by providing principles towards periods of time for different kinds of data. Such variations mostly cease within specifications inside institutions own guidelines, but might extent sooner or later to extreme divergences. To facilitate research data management, educated staff for research data management infrastructures are particularly needed, for example to recognize and handle research misconducts. Thereby, the quality of shared data and scientific work in general would be improved. Nevertheless, only four institutions realize the importance of educated staff for research data management. Still, more than the half of the examined institutions within this work realized the importance of data definitions, documentations and focus settings within RDM infrastructures to simplify data sharing for researchers and to increase data quality just as scientific progress.

A huge topic for researchers, as already mentioned before, are ethical concerns, for example the dealing with data which was collected from human individuals, but also the dealing with animals as participants [11]. Since ethical principles inhibit researchers to openly share their data, and since it might lead to a possible decrease of human participants in the future [57], [58], specific guidelines should be provided by institutions to decrease researchers' fears. Solely six institutions address this topic, rather generalized than providing helpful guidelines which support researchers with their dealing regarding ethical principles and possible solutions. Wellcome Trust, for example, states that "the Trust believes that the basic DNA sequence of humans and other organisms should be placed in the public domain as soon as is practical, without any fees, patents, licenses or limitations on use, [...]" [49] (p.1), but does not give attention to researchers' main ethical concerns like legitimacy. A further problem constitutes the different types of data. Medical and health related data are sorer than those gained via surveys or social media. Differences concerning the dealing with different kinds of data are solely found when it comes to data storage. The ARC specifies different periods of time for different types of data. Nevertheless, guidelines regarding the ethical aspects towards different types of data, such as the dealing with human DNA, are urgent needed and still missing. Altogether, all founded guidelines concerning non-technical barriers deal with those aspects named within the literature, but solely at a low and insufficient level.

An additional problem constitutes the general provision of research data management guidelines. Several institutions refer to a number of different institutions websites that

provide research data management policies. The ARC additionally refers to the OECD, and the NRC refers in addition to the Research Data Canada institution. Instead of providing a clear depiction of research data management guidelines, as seen by the OECD, researchers must search numerous links and websites to gain guidelines of different sub topics of RDM. Most institutions are solely eager to openly share research data without answering researchers' interests, and thereby forget that the future of research data management lies within researchers' hands.

Relating to the research question, it can be said that technical requirements concerning the definition, documentation, and focus setting of data within research data management infrastructures, international research policies, stabilization of infrastructures, provision of RDM tools, open access of data and security, timeliness of sharing, and long-term storage of data are set up. The non-technical requirements constitute principles regarding the handling of human participants, animals, and their data (in this work named "Ethics"), the dealing with research misconducts and the education of research data management staff, but also the protection of intellectual property, the identification of ownership, and recognition and inducements for researchers for using research data management.

Those technical and non-technical requirements turned out to rather be barriers, since the consulted literature suggested that the as technical and non-technical discussed generalized guidelines include inhibitions and difficulties for researchers regarding research data management. Furthermore, it transpired that institutions guidelines mostly answer those difficulties rather general, without any regard to researchers concerns and opinions. Admittedly, the examined institutions argue that research data management is inalienable and much needed for scientific progress, yet themselves inhibit the usage of research data management by researchers due to a lack of support and comprehension. More specific guidelines are needed to still researchers' fears and to give them an understanding of the advantages of research data management. In terms of technical requirements, we recommend future IS investigations to focus on motivational IS designs (e.g. [59], [60]) to increase researchers' acceptance towards RDM.

It should be mentioned that the examination within this work had limitations. The biggest governmental funded institutions and the biggest independent institution concerning the dealing with research data management were consulted indeed, yet those are overall solely nine out of thousands existing. Beyond, some worked through guidelines included overlaps, since institutions referred to guidelines from other institutions (for example the

ARC invokes on the OECD), but simultaneously offer own guidelines which dissent from those invoked ones. It is necessary to consider that the classification and collection of guidelines could be more specific or more general, depending on the used process of qualitative analyses.

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A.e P5: Open Data in Higher Education – What Prevents Researchers from Sharing Research Data?

Fact Sheet of Publication P5

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Abstract

Open data – a concept, where researchers not only publish their findings in form of research publications but share the corresponding (raw) data sets – has gained increasing attention within the past years. One reason for the increasing popularity is the emergence of new e-science technologies in higher education (HE) making the exchange of data more available. However, the adoption rate of open data technologies remains low compared to the topics' significance in research. While Information Systems (IS) research has majorly focused on the technical perspective of e-science technologies, this work tries to emphasize non-technical factors which impact researchers' acceptance towards the concept of open data. Grounded on the value-based theory, this research-in-progress proclaims that most potential users in academia conduct open data if the personal advantages outweigh the disadvantages. Simultaneously, uncertainty factors impact the decision-making process. This research-in-progress work presents the primarily results of an ongoing quantitative analysis including n=280 researchers from two large universities in Germany. The results indicate that new technologies diminish the perceived effort occurring during the data preparation process, as well as researchers perceived personal benefit regarding data exchange. Implications of these findings and future enhancements are discussed.

Keywords: *Sharing Research Data, Research Data Management, Data Management*

Introduction

Along with the proliferation of data-intensive research processes (e.g. online experiments), researchers and funding agencies started to call on data extensive research disciplines to provide open data exchange (Link et al. 2017). Open data constitutes a concept where researchers not only publish their findings in form of research publications, but share the corresponding (raw) data sets. Consequently, various universities and third-party online platforms started to develop diverse e-science technologies (e.g. data repositories and digital research environments) to allow researchers to share their resources and raw data sets without restrictions (Kim and Zhang 2015). Although several studies promoted the benefits of open data, latest research demonstrates a low willingness to share data across those platforms (Amorim et al. 2017; Perrier et al. 2017). As a

consequence, scientifically based strategies on how newly developed information systems can be efficiently used to promote open data are needed (Ribes and Polk 2014).

Although there exists a lot of IS research dealing with the implementation and adoption of open data environments, research primarily examined researchers' technical requirements and expectations towards technology (e.g. Amorim et al. 2017). While technical barriers represent one of the two pillars of open data acceptance, non-technical barriers were neglected so far (Wilms et al. 2018). Non-technical barriers occur due to ethical or legal restrictions, as well as individual factors prohibiting the researcher from sharing the data (Wilms et al. 2018). Individual factors are represented by positive and negative drivers that directly influence individuals' evaluation process towards open data (Kim and Zhang 2015). Besides positive and negative determinants, uncertainty factors appear to be drivers directly influencing researchers intention to share research data (Bauer et al. 2015; Kim and Stanton 2012).

There solely exists a rudimentary knowledge of scientifically proven individual uncertainty factors. A multilevel research model based on inference statistical research was proclaimed to examine the impact of individual factors on researchers data sharing behavior and the cross-level interplay of uncertainty factors (Bauer et al. 2015; Kim and Stanton 2012; Wilms et al. 2018). Therefore, this research-in-progress work introduces a novel research model based on the two concepts of value-based theory (Kim et al. 2007), and prospect theory (Kahneman and Tversky 1979) to examine researchers individual factors and uncertainty factors. While the value-based theory assumes that an individual decides against a new alternative and remains in old habits as far as the alternatives' disadvantages outweigh the perceived advantages, the prospect theory (Kahneman and Tversky 1979) assumes that individual uncertainties influence an individuals' decision-making. In view of the current discussion on open data it is essential to examine whether the refusal of researchers is caused by uncertainties or by a perceived low value concerning open data. Thus, the following research question is examined: *How do uncertainty factors and perceived value impact researchers' intention to practice open data?*

The aim of this research-in-progress work is to enrich the current research debate on e-science technology implementation. The knowledge on how specific drivers influence researchers decision-making process is of great significance for the development of internal implementation strategies (Link et al. 2017; Lyytinen 2009). Therefore, this

works' research contributes to a better recognition and addressing on behalf of universities and research facilities concerning researchers' difficulties during the implementation phase of open data concepts. Future results and insights of this research-in-progress paper will be highly relevant for IS research, since open access and data reusability in science constitute a relevant ongoing topic (Link et al. 2017; Ribes and Polk 2014; Wilms et al. 2018).

This work is structured as follows: a short definition of open data will be presented. Next, both theories mentioned above will be explained within the context of open data. Afterwards, the presumed impact of individual factors, including uncertainty factors, will be explained and presented in form of hypotheses. Hence, a novel research model, as well as the preliminary results of the largest open data survey in Germany to date will be presented. Finally, research implications will be discussed, and the further research process will be presented.

Model Development

Background on Open Data, Value-Based Theory and Prospect Theory

Open data, as a component of research data management (RDM), got increased priority especially since several international research funding institutions, such as the National Science Foundation (NSF), the Australian Research Council (ARC), or the German Research Foundation (Deutsche Forschungsgemeinschaft 2013) set research data accessibility on their primary agenda (Wilms et al. 2016). The NSF defined open data as "publicly available data structured in a way to be fully accessible and usable" (National Science Foundation 2016). Open data covers "original scientific research results, raw data and metadata, source materials, digital representations of pictorial and graphical materials and scholarly multimedia material" (Berlin Declaration, 2003, p. 1).

While the call for open data practices in academia is not novel, recent studies indicate that the concept of open data has been declined among diverse research communities so far (Bauer et al. 2015; Kim and Zhang 2015). Instead, cases are documented where research data were withheld or got lost without the possibility of replication or re-usage (Savage and Vickers 2009). To protect public funded research from any allegation of misconduct (Joshi and Krag 2010), and to guarantee open access of data for the public, governments and funding agencies started to call on research disciplines to embrace open data concepts (Ahmadi et al. 2016; Link et al. 2017; Perrier et al. 2017). Until today, diverse

international research funding institutions set up different open data policies, where compliance constitutes a prerequisite for funding (Wilms et al. 2018). Still, there exists a huge mistrust across several academic fields when it comes to recording, preserving, and sharing research data (Perrier et al. 2017; Piwowar and Vision 2013). One reason for this rejecting behavior constitutes the presence of non-technical barriers outweighing the advantages of open data (Kim and Stanton 2012; Wilms et al. 2018). Non-technical barriers directly determining individuals' value processing constitute a significant aspect of the value-based theory (Kim et al. 2007).

The value-based theory is grounded on the general assumption that an individual's decision-making process is based on a cost-benefit principle: an individual (homo economicus) constantly tries to maximize its own profit. Hence, within a rational decision-making process, an individual considers from its current reference point whether the advantages of an alternative outweigh the disadvantages. The trade-off between perceived advantages and disadvantages are exemplified in the concept of value (Dodds et al. 1991): Value represents an overall estimation of an alternative on which the individual chooses its future behavior. In contrast to value, attitude (a basic component of TPB) represents a "psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Kim et al. 2007). Attitude was shown to lead to a weak mediation of beliefs on adoption intention with several studies discussing their relationship (Kim et al. 2007). As indicated by Kim et al. (2007), the concept of value-based theory can be successfully adopted to the research field of user-acceptance and service adoption.

While the valuing process is described as a rational process, the existence of uncertainty factors is not considered. Therefore, the prospect theory by Kahneman and Tversky (1979) is used within this work to explain the effect of expected uncertainty factors during an evaluation process. The prospect theory considers cognitive distortions as significant factor within decision-making processes: Individuals tend to act risk-averse whenever a possible change to a new alternative is associated with perceived uncertainty (Kahneman and Tversky 1979), for example a change of the current behavior and a switch to a new alternative behavior cause uncertainties. It is expected that an individual is anxious about the possible unknown outcome. Based on prospect theory, individuals tend to prefer an option with a certain, but lower benefit (Kahneman and Tversky 1979).

Hypotheses

Drawing on the value-based theory (Kim et al. 2007) coupled with the prospect theory by Kahneman and Tversky (1979), this section describes the development of a structural equation model to measure the impact of value and uncertainty factors on researchers' compliance intention. The model is shown in Figure 1.

Perceived Advantages (Hypotheses 1a-b): Perceived advantages affect an individual's perceived utility of switching to a new alternative, and thus are seen as major reason for changing attitudes (Kim and Kankanhalli 2009). In the context of open data, performance advantages refer to perceived advantages researchers enjoy by practicing open data: Conducting open data results in advantages in form of performance enhancement and quality enhancement (Kim and Stanton 2012). Besides performance incensements, open data offers diverse personal advantages, for example increased citation rates, recognition, and reputation (Kim and Stanton 2012; Piwowar and Vision 2013). Those aspects not only affect researchers' impact factor (Tsolakidis et al. 2017), but the relevance of their own publications leading to increased peer recognition (Hsu et al. 2007), new collaboration possibilities (Feijen 2011), and overall career benefits (Kim and Zhang 2015). Thus, it is hypothesized that:

H1a: Perceived performance advantages have a positive effect on the perceived value of open data.

H1b: Perceived career advantages have a positive effect on the perceived value of open data.

Perceived Disadvantages (Hypotheses 2a-b): The impact of disadvantageous factors on value evaluation has already been examined in various IS research investigations (Kim and Kankanhalli 2009; Ranganathan et al. 2006). As literature shows, non-monetary costs occurring by a change usually include time costs, effort costs, and psychological costs, for example frustration or discomfort (Bender 1964; Zeithaml 1988). As equivalent to performance advantages, performance disadvantages are defined as a measurement for additional work and expense associated with open data. Individuals rather justify remaining in their current IT environment instead of making an effort to learn a new one (Lending and Straub 1997). As against career advantages, career disadvantages are defined as "a researcher's belief about the possibility of receiving an undesirable consequence on their careers from data sharing" (Kim and Zhang 2015), initiated by, for example a loss of publication opportunities (Savage and Vickers 2009). As indicated by

Kim and Zhang (2015), career risks influence researchers data sharing behavior to a great extent. Thus, it is hypothesized that:

H2a: Perceived performance disadvantages have a negative effect on the perceived value of open data.

H2b: Perceived career disadvantages have a negative effect on the perceived value of open data.

Perceived Value (Hypotheses 3): Value is defined as a trans-situational goal varying in importance and serving as a guiding principle in an individual's life (Schwartz 1994). Therefore, value is defined over perceived gains and losses relative to a natural reference point (Kahneman and Tversky 1979), and directly influences individuals behavior and decision-making (Gutman 1997). Every time an individual evaluates the perceived value of a change as low, it develops a greater resistance towards a possible change (Kim and Kankanhalli 2009). In case of high value evaluation, individuals are less likely to resist the changes (Sirdeshmukh et al. 2002). The positive and significant influence of perceived value on the adoption decision was already demonstrated in several studies (Chiu et al., 2014; Kim et al., 2007). Thus, it is hypothesized that:

H3: Perceived value has a positive effect on the intention to conduct open data.

Uncertainty Factors (Hypotheses 4a-c): Anxiety and fear are provoked by the perception of uncertain situations (Featherman 2001). Uncertainty factors are defined as emotional psychological determinants, "that compromise worries regarding a potential threat as yet unidentified or unrealized accompanied by a similar—but attenuated—version of the physiological reaction to fear" (Carleton et al. 2007, p.1). In contrast to perceived advantages and disadvantages, uncertainty factors represent emotionally based concerns about future injustice, and do not influence an actions' value (Lagrange et al. 1992; Rountree and Land 1996). The difference between the advantage, disadvantages, and uncertainty factors is illustrated by an example from air traffic: Albeit passengers are aware that flying is time-cost efficient while the risk of an accident remains low compared to other options, they might be frightened of flying, and refuse to fly at all. This fear does not constitute a disadvantage of air traffic, but an individual fear deeply rooted in the personality.

The same phenomenon applies to the concept of open data: open data can be evaluated as valuable, since the advantages outweigh the disadvantages. Nevertheless, the uncertainty prevents researchers from practicing open data. Therefore, uncertainty negatively influences usage behavior (Featherman and Pavlou 2003), leading to individuals tending to stay in their status quo (Ortoleva 2010). From researchers' perspective, uncertainty factors occur in different stages of open data: researchers fear that data sharing results in increased competition (Wallis et al. 2013). In addition to an increased publication pressure, researchers express their concerns regarding not being the first to publish their own data if it was openly available (Lynch 2008), resulting in a fear of being replaced by others having access to the exclusive knowledge of one's research data (Renzl 2008), which is based on the psychological phenomenon of "fear of missing out" (Przybylski et al. 2013). Simultaneously, an individuals' fear of possible data misuse plays a significant role: Researchers stated that unawareness about the further use of their data, as well as a lack of control over the whereabouts prevent them from sharing (Fecher et al. 2015). An interview study by Enke et al. (2012) indicated that fear of loss of control is the most relevant factor to decline open data. It is therefore hypothesized that:

H4a: Fear of competition has a negative effect on the intention to conduct open data.

H4b: Fear of losing one's unique value has a negative effect on the intention to conduct open data.

H4c: Fear of data misuse has a negative effect on the intention to conduct open data.

Research Design and Results

To validate the research model and to determine the hindering and supporting factors of practicing open data in higher education, a large-scale study using an online questionnaire was designed and conducted. The aim of the quantitative method was to collect descriptive knowledge about researchers' status quo on research data management practices and requirements, and to test and validate the presented research model. The study focuses on university members from Germany. Currently, 9 large-sized universities (above 20.000 members), and two medium-sized universities (above 10.000 members) agreed to run the survey among their staff members. The survey did not start at the same time at all partaking universities due to internal specifications, thus the runtime of the survey proceeds between March 2018 and October 2018. This research-in-progress work presents the preliminary results of the first two investigations at two large universities

running since March 2018. The preliminary results help to draw and interpret initial conclusions.

Overall, data of 280 researchers were analyzed and presented in this research-in-progress work. The sample included data of 66 (23.6%) professors, 57 (20.3%) post-docs, and 157 (56.1%) PhD students and full members. 9 (3,2). The distribution of academic fields was as follows: 114 (40.9%) social sciences, 76 (27.2%) engineering, 34 (12.2%) life sciences, and 55 (19.7%) nature sciences. Only one participant could not answer the question regarding his affiliation. To maintain participants' anonymity, the study did not collect data on age and gender. The participation was voluntary. The survey was split into two parts: A descriptive part asked user-specific questions to get an overview of the status quo of current research data management. The second part used item instruments adopted or modified from previously validated instruments to ensure adequate measurements. Two used constructs, namely fear of competition and fear of misuse, were newly developed. The questionnaire was in English to avoid translation biases. All items were measured on a 5-point Likert scale ("Strongly Agree" – "Strongly Disagree"). Table 1 offers an overview of all self-developed and adapted constructs.

Item Development

Most of the used constructs were adapted/borrowed from existing scales (see table 1). Since no adequate instruments for the uncertainty factors "fear of competition" and "fear of misuse" were identified, new scales were developed and refined. In a first step, the new construct items were designed within a group process including six researchers from different scientific areas (IS, physics, mathematics, computer science, psychology, and economics). In a second step, an open sorting process was conducted (Moore and Benbasat 1991) to assure items' validity. The process was conducted with 70 researchers working at universities. The 70 participants were from different scientific areas (30% social sciences, 35% engineering, 7% life sciences, and 28% nature sciences) and were briefed about the context of research data management and open data in a workshop. Later, all items assigned by less than 61% of the participants were rejected (Nahm et al. 2002). Table 1 shows the reliability of the constructs used in this survey. Reliability was assessed since the composite reliability (CR) of all constructs was above the threshold of .70 (Fornell and Larcker 1981). All constructs reached a Cronbach's Alpha (CA) above the recommended threshold of .70 (Nunnally and Bernstein 1994). Convergent validity was assumed since the average variance extracted (AVE) for each construct exceeded the

threshold of 0.50 (Fornell and Larcker 1981). All items were checked for discriminant validity, leading to the exclusion of those with high cross loadings.

Construct	CA	AVE	CR	Mean	SD	Source
Intention to Share Research Data	.84	.75	.90	3.31	0.93	(Bhattacherjee and Park 2014)
Perceived Value	.89	.82	.93	3.06	1.01	(Kim and Kankanhalli 2009)
Performance Advantages	.91	.79	.94	2.33	0.95	(Kim and Kankanhalli 2009)
Career Advantages	.93	.83	.95	2.84	1.04	(Kim and Zhang 2015)
Performance Disadvantages	.82	.59	.80	3.22	1.01	(Kim and Kankanhalli 2009)
Career Disadvantages	.87	.72	.91	3.06	1.08	(Kim and Zhang 2015)
Fear of Competition	.91	.79	.94	2.61	1.05	(self developed)
Fear of Losing One's Unique Value	.78	.62	.83	2.59	1.02	(Renzl 2008)
Fear of Data Misuse	.95	.81	.94	3.03	1.17	(self developed)

Table 1. Construct Measurement and Results

Both, performance and career advantages, are distinguished from perceived disadvantages as being an individual belief for which there does no corresponding negatively antipole exists. A researcher who does not agree with the sentence that open data provides career advantages does not automatically assume that it offers disadvantages. Therefore, career disadvantages are measured on a different scale. This distinction was made by Cenfetelli (2004) and Cenfetelli and Schwarz (2011), who described the differentiation of enablers and inhibitors on divergent scales. Additionally, this view is based on frameworks from earlier studies of which the constructs were adapted. The questionnaire as well as the presented survey data are freely available for re-usage.

Measures

The aim of this preliminary data evaluation was to identity key constructs that influence the intention to share research data, rather than to carry out theory testing, theory confirmation, or the comparison of alternative theories. Due to the small sample size (less than 500) and since the sample does not fully follow a multivariate normal distribution, which is required by covariance-based SEM (CBSEM) methods, PLS software with bootstrapping technique was used in this research-in-progress work (see. Hair, Hult, Ringle, & Sarstedt, 2014).

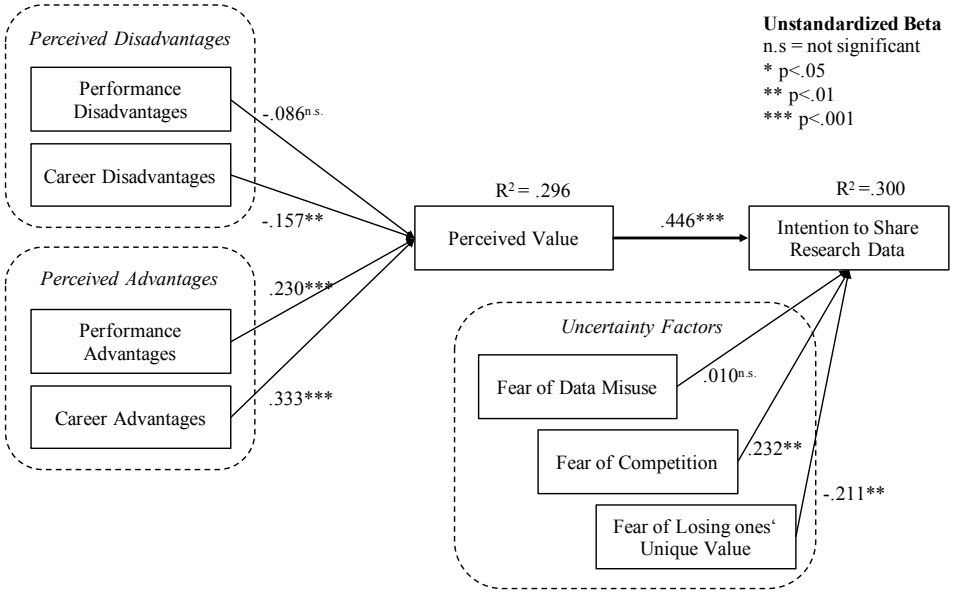

Figure 1. Research Model

Discussion and Conclusion

Implications

The intention to share research data is a basic prerequisite for the acceptance of e-science technologies, allowing researchers to conduct open data. However, previous strategies to make these technologies more attractive primarily focused on the improvement of technical features and characteristics. While this practice-oriented approach is initially comprehensible, the background of researchers' acceptance towards technologies cannot be solely gained through technical features and improvements. In this regard, this work focuses on the non-technical perspective of open data acceptance, and further demonstrated the impact of psychological motivators and barriers.

This research concerning the non-technical aspects of open data acceptance includes several practical implications for universities, IT executives in HE, and academic libraries that provide data services for researchers. Grounded on the value-based theory, this work investigated the relevance of the concept of value processing in the context of open data acceptance. Hence, it was examined that value constitutes a significant mediator within the relationship between individuals' evaluation and their intention to share research data. The preliminary results of this study confirm the presumption as per researchers decision-making process concerning the conduction of open data depends on their former evaluation process, weighing out costs and benefits against one another. This process is significantly determined by beneficial factors, such as performance advantages and career

advantages, as well as hindering factors, such as career disadvantages. Albeit previous research assumed that researchers expect a benefit for the community rather than personal benefits in data exchange (e.g. Piwowar et al. 2007), this works' results indicate that researchers are indeed aware of personal benefits, including career advantages as well as performance advantages. Furthermore, the results indicate that individual disadvantages do not outweigh the individual advantages, constituting an interesting finding in the discussion of open data. The degree to which personal benefits and benefit for the community arise, may vary between the specific scientific disciplines and between the hierarchy levels (e.g. professor, PhD. student). Moreover, researchers are not negatively affected by the additional effort of data preparation and release, which is an unexpected result, since they are in contrast to former research investigations where efforts involved in the data sharing process were claimed as a reason hindering researchers to share their data (Campbell et al. 2002; Foster and Gibbons 2005).

Yet, the presumed presence of uncertainty factors seems to have a lasting influence on individuals' acceptance towards open data exchange. As the results show, there exist several uncertainty factors influencing researchers' decision-making process towards open data to a different extend. While fear of misuse had no significant impact on researchers' intention to conduct open data, the positive impact of fear of competition is of high interest with regard to prior research, where the factor was represented as negative impact factor (Bauer et al. 2015; Feijen 2011). An explanation of the non-significant impact of fear of misuse could be that accessible research data has already been worked with and published: Therefore, a possible misuse of such data by third parties (i.e. other researchers) could lead to serious consequences. Simultaneously, the visibility and accessibility of data in a suitable repository can serve to anticipate publications and disclose results before being subjected to long-term review processes. In this case, the publication of data records can lead to competitive advantages. While the positive influence of fear of competition seem conflicting at first, it is explained by the observations of Piwowar and Vision (2013), who stated that RDM and open data increase the visibility and reputation of researchers in the community. This might lead to a competitive advantage from researchers' perspective.

Limitations & Outlook

The presented preliminary findings include diverse limitations which should be addressed in future research. The survey focusses on the general intention to share research data, yet

ignores domain-specific regulations or policies: researchers may be prevented from sharing research data due to ethical or legal aspects. To control such domain-specific peculiarities, descriptive data need to be taken into consideration. While previous studies on descriptive open data acceptance examinations focused on researchers in different countries (e.g. Netherlands, Austria, US academics), the participants of this preliminary study belong to two German universities which already started first initiatives to educate their researchers regarding open data practices. It can be assumed that the participants already gained initial experience with open data and therefore were informed about the rights and possibilities of data exchange. This might explain why the value of open data is more likely to be uncovered by positive determinants, and why uncertainty factors solely partly indicate unexpected effects. Thus, it is planned to extend the data sample by participants of universities whose researchers were yet not able to take advantage of further training courses. A second aim for future investigations is to examine a possible moderation of different research disciplines regarding uncertainty factors' impact. Bauer et al. (2015) stated that the fear of competition was majorly indicated by researchers from the field of biology, while other disciplines were not affected that high. This argumentation is supported by Wilms et al. (2018) who stated that disciplinary differences indeed exist. Although these findings help to understand the impact of fear of competition, there does not exist an explanation why it constitutes a driver instead of a hindering factor. Additionally, further research should examine the hierarchical levels: differences between the professorship level and the academic mid-level (i.e. academic members and PhD students) can indicate whether future implementation strategies should be directed from top to bottom or introduced by the next generation of academics.

Overall, this work constitutes a basis concerning interesting avenues for future research. The authors hope that this work motivates scholars to carry on interesting research in the field of open data.

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A.f P6: A Value-Based Perspective on Supporting and Hindering Factors for Research Data Management

Fact Sheet of Publication P6

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Abstract

Research data management (RDM) in academia is an important prerequisite for a substantial and sustainable contribution to knowledge. There is a pressing need to examine why researchers hesitate to store, annotate, share and manage their research data. To model underlying psychological factors influencing researchers' refusal to conduct RDM, the social exchange theory is extended with the economic principle of prospect theory. Thus, it allows psychological insights into researchers' decision-making, and displays the role of cost and benefit evaluations under uncertainties. Data management policies of a major funding agency were presented to a homogeneous group of researchers from the information systems community in Germany. The findings show that a large number of researchers see a high value in RDM but are still held back by risk factors. While benefits seem to outweigh costs, we ascertain the risk factors which hinder researchers' intention to conduct RDM in the future. Thus, perceived fear of data misuse is identified to be a major hindering factor, while the fear of losing their unique value did not prevail. The study provides novel insights for executives, administrators, and developers of higher education institutions, which are especially important for further RDM implementation strategies, as well as system development.

Keywords: *Knowledge Management, Data Sharing, Knowledge Sharing, Higher Education, Research Management*

Introduction

Along with the proliferation of data-intensive research processes, for example via online experiments, survey data as well as simulations and sensor measurements, enormous amounts of varied research data are generated and collected continuously (Chalmers, 1978; van der Aalst, Bichler, & Heinzl, 2017). Researchers and institutions of higher education (HE) repeatedly reach their limits when managing and storing research data, a circumstance that has already led to huge data losses or to the inability to provide annotated research data for reuse (e.g. Savage and Vickers 2009; Vines et al. 2014; Blumenthal 2017). In order to cope with the growing flood of digital data, governments and funding agencies have started to call on research disciplines to embrace adequate research data management (RDM) (Ahmadi, Jano, & Khamis, 2016; Link et al., 2017; Perrier et al., 2017). RDM can be described as a form or prerequisite of knowledge

management, which consists of the initiatives, processes, strategies and systems that support and improve the storage, evaluation, sharing and refinement of data to create knowledge (Makani 2015).

In this regard, several international research funding institutions, such as the National Science Foundation (NSF) or the Deutsche Forschungsgemeinschaft (DFG; German Research Foundation) have set up mandatory RDM policies, compliance with which is a basic prerequisite for future funding (Wilms, Stieglitz, Buchholz, Vogl, & Rudolph, 2018). Comprehensive RDM encompasses, for example, the long-term storage and annotation of research data, but also the concept of open data that can be accessed and used by anyone (Link et al., 2017; Wilms et al., 2018). While there is an increasing pressure on higher education institutions to promote RDM, there still exists a huge mistrust across several academic fields when it comes to recording, preserving, and sharing research data (Borgman, 2012; Perrier et al., 2017; Piwowar, 2011; Sayogo & Pardo, 2013).

Since recent publications only point out minor attention towards RDM by scholars (Sayogo and Pardo 2013; Rudolph et al. 2015; Wilms et al. 2018), a gap can be identified between the responsibility of universities to prioritize the topic and researchers' actual data management. Consequently, there seems to be a pressing need for research to analyse what factors influence researchers' decision to conduct RDM. According to the Social Exchange Theory (Homans, 1958), which has successfully been applied in the context of knowledge exchange (e.g. Liang et al. 2008), individuals comply with knowledge management strategies by weighing up the advantages and disadvantages. The individual will immediately consider the loss involved in changing their current behaviour and decide against the new strategy (i.e. following new RDM guidelines) if the disadvantages outweigh the advantages. In addition, the prospect theory by Kahneman and Tversky (1979) assumes the presence of risk factors, which appear and influence an individual's decision under uncertainties. In this work it is argued that risk factors are not the same as perceived disadvantages, but could increase the likelihood of rejection, since individuals generally act risk-averse (Kahneman & Tversky, 1979). An individual will therefore often prefer the less risky opportunity, even if the advantages of the alternative prevail (Yang, Liu, Li, & Yu, 2015).

In view of the current discussion on RDM in higher education (HE), it is essential to examine whether the refusal of the researchers is caused by risk factors or by a generally

low perceived value of RDM. To get to the bottom of the problem, the concept of social exchange theory and the idea of prospect theory were adopted, leading to the following research question: *How do risk determinants and perceived value influence (IS) researchers' decision to comply with new guidelines on RDM?*

Future results and insights of this research will be highly relevant for data and knowledge management executives in HE and librarians, since RDM and data reusability in science constitute an important present topic (Link et al., 2017; Ribes & Polk, 2014; Wilms et al., 2018). Executives, administrators, and developers of HE institutions gain new insights in researchers' behaviour, which is especially important for further implantation strategies, as well as system development.

The remainder of the paper is structured as follows. We first provide the theoretical foundation and derive our research model, including corresponding hypotheses. We then present the research design, followed by the results, discussion and conclusion.

Theoretical Background

Research Data Management

RDM is defined as the active and ongoing management of data "from its entry to the research cycle through the dissemination and archiving of valuable results" (Whyte & Tedds, 2011) (p. 1). This includes, for instance, long-term storage and accessibility of research data over time (Shreeves & Cragin, 2008), protection of data (Schopfel et al., 2014), the creation of institutional data repositories (Monastersky, 2013), and the exchange of data (Devarakonda, Palanisamy, Green, & Wilson, 2011; Higman & Pinfield, 2015). The DFG for instance, the major research funding institution in Germany, states that 1) primary research data should be stored for at least ten years on suitable memories, 2) data should be described by metadata, and 3) each scientist or academic makes his or her primary research data freely available (if possible) (Deutsche Forschungsgemeinschaft, 2017). In this regard, RDM does affect "any research materials resulting from primary data collection or generation, qualitative or quantitative, or derived from existing sources intended to be analysed in the course of a research project" (Corti et al. 2014 p.viii). Besides raw data, RDM covers any informational data that has been given meaning by way of relational connection, as well as research publications which can be described as a type of stored knowledge (Kuula, Borg, & 2008, 2008).

Social Exchange Theory

Social exchange theory is a socio-psychological approach which defines interpersonal interaction as a process where participants and their partners engage in activities and exchange valuable resources (Homans, 1958; X. Wang, 2013). One of the key assumptions of the social exchange theory is that individuals use different forms of social interaction which are built upon reciprocal exchanges and which are based on a self-interested evaluation of costs and benefits (Colquitt et al., 2013). Based on an evaluation in which costs and benefits are weighed against each other, the individual will make a decision as to whether or not an interaction takes place (see. Fig. 1). Thus, people will not tend to interact with each other unless they find that the exchange is beneficial for them. Costs, for example, are represented by the time and effort the individual has to invest in the interaction. Benefits, on the other side, are represented e.g. by the economic and social rewards the individual expects to gain from the interaction (Wasko & Faraj, 2005).

The social exchange theory has been applied to several contexts related to knowledge management and knowledge sharing (Liang et al., 2008). According to Rode (2016), people are more willing to manage and share their knowledge when costs are low and benefits are high. While this concept alludes to the economic principle of value maximization, there are significant differences: In contrast to economic exchange theory, where the other side of the exchange is the entire market, the exchange in social exchange theory is between human actors (X. Wang, 2013). The distinction is important, since social exchange mechanisms use social capital as an opportunity to compensate the cost incurred e.g. by possible knowledge senders. The concept of social capital is used to explain knowledge exchange behaviour, and refers to the collective abilities that arise from social networks (Bourdieu, 1977). According to Wang (2013), a social exchange based on social capital can be illustrated, for example, by a situation where an individual A passes his/her experience on to individual B for free in order to gain prestige and reputation.

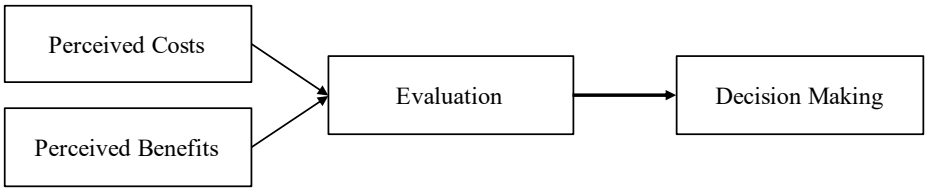

Figure 1. Social exchange theory by Homans (1958).

2.3 Prospect Theory

The prospect theory seeks to explain and predict individuals' behaviour, e.g. in a situation where the individual has to decide whether an alternative behaviour is chosen over the current behaviour (status quo). **According to the prospect theory,** individuals tend to use mental reference points to code the outcome of an action as a gain or loss. For each decision, the individual sets a new mental reference point, which could be described as a mental representation of the status quo. The outcome of this decision is based on the comparison of the reference point and the new alternative (e.g. current behaviour as reference point vs. new behaviour as new alternative).

During the evaluation process, individuals are more sensitive to losses than gains (H.-W. Kim, Chan, & Gupta, 2007). If the individual should decide whether to leave the reference point or to change to a new alternative, the losses of the current status quo quickly come to mind. Individuals tend to value losses higher than benefits, leading to the prospect that the sacrifices occurring on a switch from the reference point will hurt more than the expected pleasure (Kahneman and Tversky 1979). This effect is caused by risk aversion which comes up every time that individuals start to evaluate possible risks associated with the new alternative. A change from the current behaviour to a new one causes uncertainties since the individual may be anxious about the possible unknown outcome. According to prospect theory, individuals tend to prefer a certain option even if the evaluation of the alternative is higher (Kahneman and Tversky 1979). Prospect Theory has been conceptualized before in the contexts of IS adoption (Constantiou, 2009; Feng & Yan Tam, 2013; H.-W. Kim et al., 2007), behavioural actions in online environments (Chiu, Wang, Fang, & Huang, 2014; H.-W. Kim & Kankanhalli, 2009; Yang et al., 2015), and rational decision making (Afflerbach, 2015; Park & Sung, 2013).

3 Research Model Development

Drawing on Kahneman and Tversky's (1979) original prospect theory and Homans's (1958) social exchange theory, this section describes the development of the value-based

framework. It includes a small number of factors that account for most of the variance in the intention to comply with research data management guidelines. The model is shown in Figure 2. All constructs used in this model and cross-loadings are presented in the Appendix.

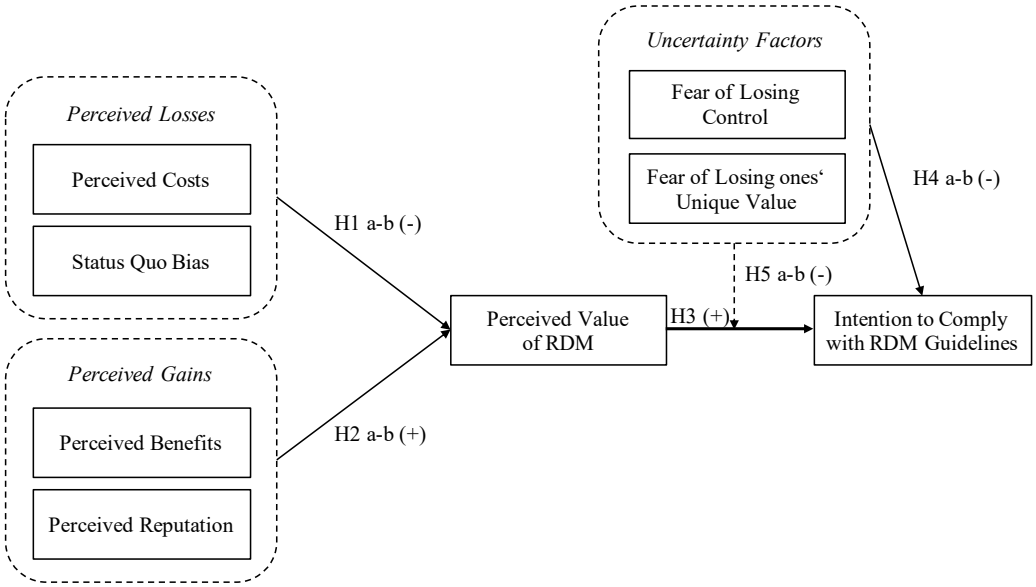

Figure 2: Hypotheses on the value-based model.

3.1 Perceived Losses

According to social exchange theory, an evaluation takes place after the benefits and costs of an action have been weighed against each other. Previous literature has evaluated such costs which might occur on a behavioural change and which need to be overcome in order to change the reference point (H.-W. Kim & Kankanhalli, 2009; Ranganathan, Seo, & Babad, 2006). Non-monetary costs occurring on a change usually include time, effort, and psychological cost, like frustration (Bender, 1964; Zeithaml, 1988). As prior research has shown, individuals will justify remaining in their current behaviour instead of making the effort it takes to learn a new one (Lending & Straub, 1997). According to rational decision-making principles, costs that appear on a behavioural change decrease the perceived value of the change to individuals. Therefore, it is expected that perceived costs will decrease the perceived value of RDM. Hence, it can be hypothesized:

H1-a: *Perceived Costs have a negative effect on the Perceived Value of RDM.*

In line with the prospect theory, the status quo bias (SQB) describes a mental state where a person is strongly bound to his or her usual behaviour, and resists any changes. A person affected by this bias will be more likely to resist any behavioural changes, since dealing with a new situation would affect the status quo (Samuelson & Zeckhauser, 1988). SQB has been identified in different studies in which users had to change their former behaviour (H.-W. Kim & Kankanhalli, 2009; Polites & Karahanna, 2012). This bias often occurs when users have to evaluate costs, due to the fact that changing the current behaviour means leaving the current reference point and therefore giving up on the status quo. Thus, it is expected that SQB has a strong impact on the relationship between the perceived costs and the perceived value. It is therefore hypothesized:

H1-b: *Status Quo Bias has a negative effect on the Perceived Value of RDM.*

3.2 Perceived Gains

Benefits refer to the perceived utility that an individual gains in changing from the status quo to a new behaviour (H.-W. Kim & Kankanhalli, 2009). Within this study, benefits refer to the perceived utility researchers would enjoy due to switching from their current way of managing research data to a new alternative, which fits common norms of adequate RDM. The switch (or change in behaviour) to a new method of data management could result in benefits in the form of performance enhancements, quality enhancements and higher expected effectiveness. We expect that higher switching benefits will increase the perceived value of RDM. We thus present the following hypothesis:

H2-a: *Perceived Benefits has a positive effect on Perceived Value of RDM.*

To encourage an active knowledge management without giving any rewards is hard to achieve. Knowledge is a laboriously collected repertory of information that no one is willing to offer without any motivation. However, sharing and managing knowledge can have a rewarding structure by showing others the obtained expertise and in doing so, enhancing one's self-confidence (Ba, Stallaert, & Whinston, 2001). There are several studies suggesting that participants offer knowledge to earn peer recognition (Hsu et al. 2007) and to improve their status in the community (Marett & Joshi, 2009). This implies that if people notice that knowledge management might affect their reputation in a

positive way, they are more inclined to share information (Wasko & Faraj, 2005). Furthermore, a study by Piwowar et al. (2007) shows that researchers can expect a higher citation rate, going in line with an increased reputation. Therefore, reputation can be seen as an essential motivational factor for knowledge management (Kankanhalli, Tan, & Wei, 2005). Since (research) data management is strongly related to knowledge management, the following hypothesis is suggested:

H2-b: *Reputation has a positive effect on the Perceived Value of RDM.*

3.3 Perceived Value of RDM

Value is defined as a trans-situational goal, which varies in importance and serves as a guiding principle in the life of a person (Schwartz, 1994). According to Gutman (1997), values constitute motivational constructs that directly influence people's behaviour and decision making. According to the value function, based on the prospect theory, perceived value can be defined over perceived gains and losses relative to some natural reference point (Kahneman & Tversky, 1979). Similar to this, the theory of social exchange suggests that the perceived value of an action is calculated by weighing costs and benefits, which are psychological equivalents to losses and gains (Homans, 1958). If the individual evaluates the perceived value of an action as low, the individual develops a greater resistance to change (H.-W. Kim & Kankanhalli, 2009; Samuelson & Zeckhauser, 1988). On the other side, if the value evaluation of an action is high, individuals are less likely to resist the changes (Sirdeshmukh et al., 2002). While the relationship between perceived value and intention to comply with RDM guidelines has never been evaluated before, there are various studies which indicate that perceived value has an influence on individuals' intention to change the current behaviour, e.g. in cases of IT adoption (Kim et al. 2007), or consumer decision making (Sweeney et al. 1997). Therefore, perceived value is defined as an indicator which regulates users' behavioural intentions to practise RDM. Thus, it is hypothesized:

H3: *Perceived Value has a positive effect on the Intention to Comply with RDM Guidelines.*

3.4 Uncertainty Factors

Uncertainty factors are defined as emotion-based psychological determinants, "comprising worries regarding a potential threat as yet unidentified or unrealized

accompanied by a similar – but attenuated – version of the physiological reaction to fear" (Carleton et al. 2007, p.1). In contrast to advantages and disadvantages, uncertainty factors represent emotionally based concerns about future injustice and do not directly influence the value of an action directly (Lagrange, Ferraro, & Supancic, 1992; Rountree & Land, 1996). The difference between uncertainty factors and perceived pain and gain factors can be illustrated by an example from air traffic: Although passengers are aware that flying is time-cost efficient and the risk of falling is low, they may have fear of entering a plane, which ultimately prevents them from flying. This fear is not a disadvantage of air traffic, but a personal fear deeply rooted in the personality of the passenger.

The same phenomenon also applies to the concept of RDM: While the general concept can be evaluated as valuable (if the gains outweigh the pains), uncertainty factors might prevent the researcher from practicing RDM. Uncertainty can be provoked through the perception of risky situations or actions (M. Featherman, 2001) and is negatively associated to usage behaviour (M. S. Featherman & Pavlou, 2003; Jarvenpaa & Staples, 2000). Therefore, uncertainty during decision making could lead insecure persons to stay in their status quo (Ortoleva, 2010). Since control over sensitive data or information security is a major concern of individuals, it deters them from uploading their data to an online repository (Horvath & Rajeev, 2015; Shaikh & Sasikumar, 2012). Based on the findings of Feijen (2013), researchers think that they have more control if they tend to manage their research data locally. Hence, it is hypothesized that there is a direct relationship between perceived risk of losing control and the actual intention to conduct RDM. Thus, it is hypothesized that:

H4-a: *Fear of Losing Control has a negative effect on the Intention to Comply with RDM Guidelines.*

As studies have shown, another barrier to knowledge management is a potential loss of knowledge power (Huang, Davison, & Davison, 2008). When losing power, individuals may lose their value by giving up their uniqueness (Gray, 2001). Offering knowledge or data to others might cause the source to lose its unique value relative to what others know (Renzl 2008), especially when others benefit from the results (Wasko & Faraj, 2005). If individuals fear losing in a cooperative relationship based on open access, they reject the whole concept. The fear of losing one's unique value serves as a determining factor in the

decision process, since it reflects uncertainties that researchers fear by switching from the status quo. Thus, it is hypothesized:

H4-b: *Fear of Losing One's Unique Value has a negative effect on the Intention to Comply with RDM Guidelines*

As a basic principle of prospect theory, it is expected that losses loom larger than gains, which is caused by the presence of uncertainties. Due to this effect it is possible that individuals choose the alternative which is less beneficial, because the level of uncertainty is lower. In context of the research model, one would expect that a high level of uncertainties compensates the effect of high value on intention to conduct RDM. This results in a lower intention to conduct RDM, while amplifying the effect of low costs on migration intention. This expectation leads to the hypothesis:

H5-a: *Fear of Losing Control negatively moderates the effect of Perceived Value of RDM on the Intention to Comply with RDM Guidelines*

H5-b: *Fear of Losing One's Unique Value negatively moderates the effect of Perceived Value of RDM on the Intention to Comply with RDM Guidelines*

4 Research Design

This work aimed to evaluate how the intention to comply with research data management regulations (RDM guidelines) is influenced. Before measuring researchers' intentions, it was ensured that all of the participants had a common understanding of RDM guidelines. Since data may be managed differently in certain academic areas or institutions due to varying regulations, legal restrictions, or data management "culture", a few requirements for the experimental approach were set up:

First, researchers of a specific scientific discipline were recruited. The Information Systems (IS) discipline is known as a "data poor field" with inadequate data preservation and reuse practices, and with relatively little advanced data instrumentation (Lyytinen, 2009). Furthermore, previous IS literature has continuously called for adequate data management policies in this field (Avital et al., 2007; Link et al., 2017; Lyytinen, 2009; Wilms et al., 2018). Since IS is known as an IT-related discipline in which RDM has become an important issue during the last decade (Link et al., 2017), researchers from this field of research were selected for the study. Second, since IS researchers can be distinguished by their geographic locale (Avgerou, Siemer, & Bjørn-Andersen, 1999), the

questionnaire aimed to capture only data from IS academics in Germany. The Deutsche Forschungsgemeinschaft (DFG) constitutes one of the primary research funding institutions for IS research in Germany, and offers representative guidelines on RDM (Wilms, Meske, Stieglitz, Rudolph, & Vogl, 2016) (see Appendix B). Third, in order to ensure that all of the participants were aware not only of the DFG as a third-party funding institution, but also of its guidelines on RDM, the survey started by 1) asking the participants if they knew about DFG, and 2) briefing the participants about the guidelines in detail.

To assess model constructs, a quantitative online questionnaire was developed and pretested. All item instruments within this study were adopted or modified from previously validated instruments in order to ensure adequate measurements. All of the borrowed measurements were originally published in the English language. To avoid translation biases, the questionnaire was kept in English as well. All items were measured on a 5-point Likert scale ("Strongly Agree" – "Strongly Disagree"). To test the hypotheses, the following constructs were used: To measure *perceived value*, we modified the 3-item scale from Kim & Kankanhalli (2009). *Perceived Benefits* and *Perceived Costs* were also adopted from Kim and Kankanhalli (2009). *Intention to Comply with RDM Guidelines* was measured by using the modified 3-item scale of switching intention by Bhattacherjee and Park (2014). *Status Quo Bias* was measured using original scales from Polites and Karahanna (2012). *Reputation* was measured by using the modified scale of Chang and Chuang (2011). *Fear of losing one's unique value* was conceptualized by using the scale of Wang and Chan (2011). Furthermore we measured the construct of fear of losing *one's unique value* by the modified scale of Renzl (2008) and the construct *fear of losing control* by the modified scale from Ernst (2014).

First, the adopted and modified instruments were reviewed and discussed by six reviewers, resulting in minor changes of wording. Second, construct validity and comprehensibility were assured using five raters and an open sorting procedure (Moore & Benbasat, 1991). Third, a pilot study with 20 participants was set up to receive feedback on item composition, wording and length. The participants were asked to give feedback on the instructions, survey length and other issues they experienced. Afterwards, the instruments were shortened and refined. The final constructs and items are shown in Appendix A. The survey was conducted online between March and June 2017. To reach a greater number of participants, a survey link was spread among a mailing list for the German community of Information Systems academics (at that time we reached 1124

people). In a second round, 301 IS researchers from Germany were contacted directly via email and asked to participate.

5 Results

The research model was transferred into a structural equation model (SEM) for validation (Chin, 1998). Due to the sample size (less than 500) and since the sample does not fully follow a multivariate normal distribution, which is required by covariance-based SEM (CB SEM) methods, the partial least squares offers a suitable alternative for SEM showing a greater robustness (Ringle, Wende, & Becker, 2014). PLS is a composite-based approach to SEM, which aims at maximizing the explained variance of dependent constructs in the path model (e.g. Hair, Hult, Ringle, & Sarstedt, 2014). All the hypothesized constructs were modelled as reflective measures of their respective indicators.

5.1 Descriptive Data

Overall, 111 completed responses were collected (response rate: 7.8%). Out of all the collected datasets, 11 participants were excluded since they indicated 1) that they were not responsible for managing their own research data or 2) that they already followed strict data management guidelines. Furthermore, we excluded those participants with suspicious completion times (less than 5 minutes), which left us with a total of 96 adequate data points. The size of the dataset is suitable for the PLS-based approach since it is higher than the minimum recommended by Hair et al. (2014), which is calculated as the number of indicators multiplied by ten. In terms of gender distribution, there was a majority of male participants, since only 33 of the participants were female (34%). The average age was 37. Thirty-two of the participants stated to be employed as university professors (33%), whereas 26 were working as post-docs, assistant professors or senior lecturers (27.1%). Thirty-seven of the participants stated that they worked as doctoral candidates (38.5%). All of the participants indicated that they had full authority over their research data. 81.3% of the researchers indicated that more than three-quarters (>75%) of their research data are generated in digital formats, while 31.3% said that they had already experienced data loss.

According to our findings, only 10.4% of the participants stated that they are aware of data management standards like institutional guidelines (e.g. documentation standards). The majority of researchers, namely 53.1%, use self-developed procedures for

documentation. Furthermore, more than one quarter of the university employees (27.1%) do not use data management standards at all. 9.4% of the participants indicated that they do not know about data management standards.

5.2 Measurement model

The reflective measurement model was assessed by estimating reliability, as well as convergent and discriminant validity (see Table 1). Reliability was assessed since the composite reliability (CR) of all constructs was above the threshold of 0.70 (Fornell & Larcker, 1981). Convergent validity was assumed, since the average variance extracted (AVE) for each construct exceeds the threshold of 0.50 (Fornell & Larcker, 1981). Discriminant validity is tested by comparing the square root of AVE for each construct with the bivariate correlations of each measured construct (Fornell & Larcker, 1981). Discriminant validity can be assumed when the square root of AVE is greater than any inter-factor correlation. The scores are summarized in Table 2. Before the testing of the hypotheses, it was ensured that the measurement was not affected by the common method bias (CMB). To alleviate concerns about CMB, Harman's one-factor test was conducted to identify common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The single factors calculated accounted for 31.04% of the variance in the model. Additionally, the factors did not account for most of the covariance. In addition to Harman' one-factor test, multicollinearity was tested using the inner variance inflations (VIF), resulting in values between 1.00 and 3.00, which is lower than the suggested maximum values of 3.30 (Kock, 2015). Therefore, the data set was not affected by the CMB.

Table 1: Reliability and Validity Measurements. CR = composite reliability, AVE = average variance extracted. Bold numbers on the diagonal are the square root of the AVE.

Variables	CR	AVE	1	2	3	4	5	6	7	8
(1) Fear of losing control	.91	.77	**.88**							
(2) Intention to comply	.96	.89	-.32	**.94**						

(3) Reputation	.95	.82	-.16	.39	**.91**					
(4) Switching benefit	.94	.83	-.09	.39	.33	**.91**				
(5) Switching cost	.80	.57	.49	-.33	-.33	-.13	**.75**			
(6) Unique value	.89	.73	.61	-.19	-.18	-.15	.49	**.85**		
(7) Value of RDM	.93	.81	-.33	.66	.48	.64	-.40	-.30	**.90**	
(8) Status quo	.87	.69	.01	-.06	.16	.17	.06	.07	.08	**.83**

5.3 Structural model

Figure 4 shows the results of the structural path analysis. All of the paths related to prospect theory were significant, with a p value less than 0.05. The significance of all of the paths was assessed by 500 bootstrap runs. All of the correlations are listed in Appendix A.

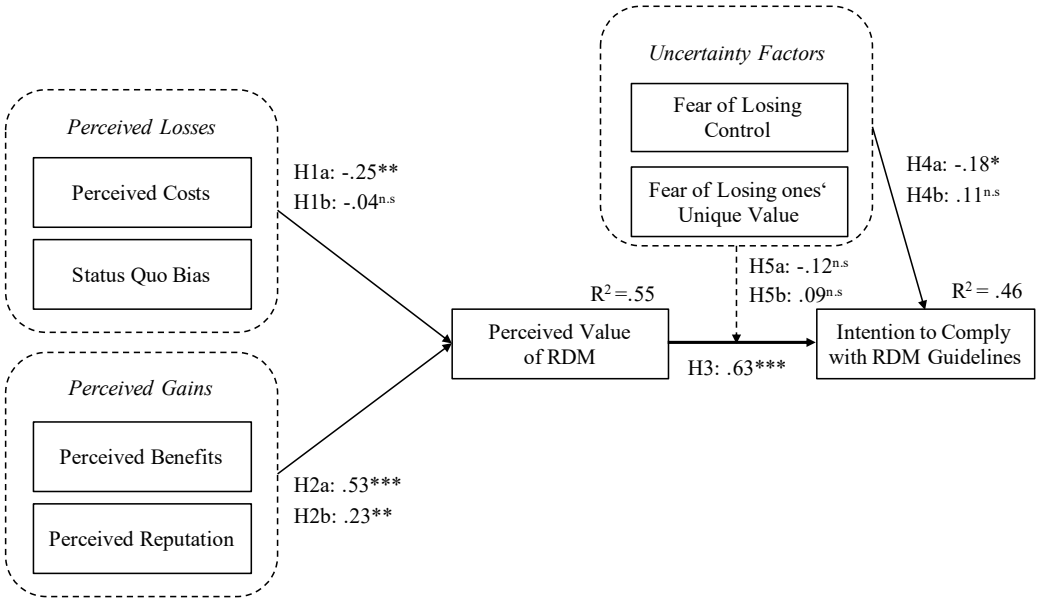

Figure 3: Research model (n=96). *p ≤ 0.05; **p≤ 0.01; ***p ≤ 0.001; ns = not significant.

Overall, the developed main model could explain nearly 46% ($R^2 = 0.455$, adjusted $R^2 = 0.437$) of the variance of the intention to comply with RDM guidelines. Additionally, 55% ($R^2 = 0.546$, adjusted $R^2 = 0.526$) of the variance of the perceived value could be explained by our model (see Figure 3). Table 2 summarises the results of our survey. Overall, five out of seven hypotheses were confirmed.

Table 2: Main effects model

Predictor	**Standardized Beta**	**S.E.**	**t-value**	**p-value**
Fear of losing control	-.18	.10	1.80	.037
Reputation	.23	.09	2.65	.004
Switching benefit	.53	.06	8.43	.000
Switching cost	-.25	.09	2.86	.002
Unique value	.11	.10	1.03	.152
Value of RDM	.63	.07	8.61	.000
Status quo bias	-.04	.07	.47	.319

Table 3: Moderating effects model

Predictor	**Standardized Beta**	**S.E.**	**t-value**	**p-value**
Fear of losing control	-.22	.11	2.05	.021
Reputation	.23	.09	2.54	.006
Switching benefit	.53	.07	8.06	.000

Switching cost	-.25	.08	3.06	.001
Unique value	.12	.11	1.08	.140
Value of RDM	.61	.08	7.74	.000
Status quo bias	-.04	.07	.47	.319
Fear of losing Control* Value of RDM	-.12	.08	1.55	.061
Unique Value* Value of RDM	.09	.07	1.24	.107

To assess the statistical power of our data, we analysed the effect size by calculating Cohen's f^2. Cohen (1988) suggested the following criteria for interpreting effect size: (1) for small effect size, $.02 < f^2 \leq .15$; (2) for medium effect size, $.15 < f^2 \leq .35$; and (3) for large effect size, $f^2 > .35$. The effect size of Perceived Value ($f^2 = .64$) was large and contributed significantly to the R2 of further Intention. The effect size of Switching Benefits was large ($f^2 = .55$), while the effect size of Switching Cost was small ($f^2 = .12$). Reputation showed a small effect size ($f^2 = .09$), while Status Quo Bias had no significant impact on Perceived Value ($f^2 = .003$). The risk factors Fear of losing Control ($f^2 = .04$) and Fear of losing one's unique value ($f^2 = .013$) also showed small effects sizes. In addition, the predictive relevance was analysed by application of the Stone-Geisser test (Q^2), which indicates how well the data can be reproduced by the PLS model. The Q^2 values for perceived value ($Q^2 = .41$) and Intention to conduct RDM is ($Q^2 = .37$) is positive, indicating a high level of predictive relevance.

Our moderating effects model increased the variance explained (R^2) in Intention to conduct RDM from 46% in the main effects model to 47% in the moderating effects model (see Table 3). Cohen's f^2 value was $f^2 = 0.02$ for Fear of losing control, and $f^2 = 0.012$ for Unique value, suggesting that the moderating effects in our study had only a slight effect.

6 Discussion

6.1 General Discussion

The framework in this study was built on social exchange theory (Homans, 1958) and prospect theory (Kahneman & Tversky, 1979). Based on social exchange theory, value was defined as the combination of various costs and benefits perceived by the researchers if they were asked to practise common standards of RDM. This principle was adopted from other research on knowledge management, where the intention of managing knowledge was related to individuals' evaluation of the action.

As the results indicate, the perceived value of RDM is not only influenced by negative elements such as perceived costs, but also by positive, non-monetary aspects like reputation and perceived benefits (e.g. task performance, work efficiency). We could show that the perceived benefits have a strong effect on the perceived value of RDM, while the perceived costs only had a small effect. Other beneficial motivators like increased reputation were also only shown to have a slight effect on the evaluation of RDM. The status quo bias on the other hand did not seem to have any effect. In summary, these results show that during the evaluation process of the RDM guidelines, the advantages of structured data management clearly outweigh the disadvantages. Hence, the results indicate that researchers see a high benefit in the *preservation and disclosure of research results*. Isolated form other effects such as the presence of risk factors, these findings are quite important, since other descriptive research assumed that disadvantages such as increased time and effort outweighed advantages (e.g. Feijen 2011; Borgman 2012). A possible explanation discussed below is the understanding of research data as a symbolic capital. Research data are often regarded as a researcher's most important resource, which can be used to gain reputation and recognition (Borgman, 2012; Piwowar et al., 2007). According to the definition of Bourdieu, symbolic capital refers to the opportunities that lead to gaining and maintaining social recognition and prestige (Bourdieu, 2015). As a sign of social recognition and power, symbolic capital bestows prestige, reputation, and positions. From this point of view, the presence and the visibility of high-quality research data can be used to successfully increase an individual's status among the research community. Thus, researchers who collected good and valuable research data and are willing to share these data command a high symbolic capital and therefore increase their unique value among the community. Another possible explanation might be that other research investigations focused on multiple research

areas, including e.g. natural sciences (e.g. biology), engineering sciences or medicine. As indicated by Bauer et al. (2015), those research areas are characterized by strong competitive pressure. Adverse factors like the fear of losing one's unique value might be more relevant in these specific research areas than in IS. Although previous research assumed that researchers expect a benefit for the community rather than personal benefits from managing and offering research data (e.g. Piwowar et al. 2007), this works' results indicate that researchers are indeed aware of personal benefits.

But why is the acceptance of RDM still so low among scientific communities? Why did nearly 90% of the participants indicate that they do not use institutional or national standards? To answer that question, we need to take a deeper look at the results and focus on the presence of risk factors. Based on prospect theory it is expected that the presence of uncertainty factors impacts the intention to conduct RDM directly and through the moderation of perceived value on the intention. In this regard, it was expected that even if the benefits outweigh the cost and the evaluation is high, risk factors could impact the final decision-making and causes the individual to pick the less beneficial alternative. While loss of control really seems to be a hindering factor for researchers to follow RDM guidelines, the fear of losing one's unique value turned out to have no significant impact on the final decision making. Since this study focusses on the RDM guidelines in general, including all recommendations such as preservation and disclosure of research results, we can only assume that the fear of losing control refers to the recommendation to give other interested parties access to the research data. This is also supported by the results from previous studies, where researchers indicated that they could develop negative feelings when disclosing their research data (Fecher, Friesike, & Hebing, 2015; Feijen, 2011; Y. Kim & Zhang, 2015; Piwowar, 2011). The unwillingness to share resources in parallel work situations is deeply rooted in the human mindset (Hamann, Warneken, Greenberg, & Tomasello, 2011). From the psychological findings of Hamann et al. (2012), it can be expected that this reluctance will diminish if researchers increasingly work together towards a joint goal. A look at other research disciplines shows that such joint goals could be manifested, for example, through the establishment of knowledge and data repositories (e.g. Arend et al., 2014; Príncipe et al., 2014).

6.2 Limitations

As a consequence of the specific data sample used for the research method, this work is limited since the participants were only related to the field of IS researchers in Germany

and only represent a small group within the IS discipline. While it could be argued that studies using small sample sizes are not meant to quantify general performance within a population, the data are representative to document the existence of an effect. Nevertheless, to validate the findings in this work, future research is needed to investigate a broader range of samples. Future investigations need to research requirements for technical solutions on an international level. Especially requirements like open access might be different in countries which are more collectivistic, and countries where data protection laws are not as strict as in Germany might have a different understanding of data protection and security. Specific German legal frameworks that may differ from those in other countries, as well as the organizational culture at German universities, may influence the generalizability of the results. Individual differences and national cultures might affect how RDM unfolds under differences along this dimension. The questionnaire focused on participants who had a common knowledge of RDM and of guidelines related to the DFG. These guidelines are related to the German research community but do not completely fit the guidelines of other international funding institutions. Even today, there is no common definition or standard for how research data should be managed equally.

7 Contribution and Implications

One of the main theoretical contributions of this research is the development of our value-based framework. The framework offers a new perspective. The whole RDM integration process is viewed in the context of social exchanges. This work's value-based perspective helps to understand the pains and gains researchers are receiving when they have to decide whether to perform RDM or not. While previous research on RDM integration was not able to determine the relevance of individual promoting and hindering factors to RDM integration, this work offers a novel model, which can be used to identify the importance of several determinants within this process. While the model in this work only includes a small number of factors that account for most of the variance in the intention to comply with research data management guidelines, the value-based model offers a theory-based framework for further investigations in the context of (research) data and knowledge management. By introducing the prospect theory as a novel explanation component for the negative outcome of decision-making processes, future research in the field can benefit as much as ongoing research in the field of RDM integration.

As practical implications resulting from the findings in this work, research institutions have new grounds to build novel RDM implementation strategies. For future strategies,

it is not enough to put effort into creating an impression of low cost and high benefits. While increased quality as well as increased reputation are already seen as attractive benefits of RDM, the level of uncertainty needs to be drastically minimized. In the course of our findings, we therefore have a few recommendations for action on how institutions of HE can increase the acceptance of RDM in the future.

The fear of losing control arises when researchers think that they are "forced" to share their data without knowing who will use the data and how. Thus, the level of uncertainty must be reduced by giving researchers back the perceived control over their research data. Research infrastructures need to interlink submissions, reveal joint goals between researchers and focus on concepts of group-building processes (e.g. Pries-Heje and Pries-Heje 2011), to raise the acceptance of data sharing. Researchers must have the opportunity to inform themselves about their rights in case of data abuse. Uncertainties are not only caused by strict data sharing policies – they occur due to uncertainties in regard to ethical restrictions and national data protection laws (Verbaan & Cox, 2014). Since universities generally do not have the capacity to evaluate research projects in detail and provide feedback, strategies must be developed to inform researchers efficiently and without much effort about their basic rights.

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Appendix A

Table A

#	Measurement Items	Source
FEAR OF LOSING ONE'S UNIQUE VALUE (Mean: 2.58; SD: 1.04)		
UV1	I don't gain anything if I share my research data.	Modified from (Renzl, 2008)
UV2	If I share my research data I will lose my knowledge advantage.	
UV3	Sharing research data means losing power.	
FEAR OF LOSING CONTROL (Mean: 2.88; SD: 1.02)		
LC1	The new way of managing research data leads to a loss of control over my work.	Modified from (Ernst, 2015)
LC2	The new way of managing research data allows others to misuse my research data.	
LC3	Overall, I see a threat to my work if I have to conduct the new way of managing research data.	
REPUTATION (Mean: 2.65; SD: 0.95)		
RP1	I earn respect from others by conducting the new way of managing research data in the scientific community.	Modified from (Chang & Chuang, 2011)
RP2	I feel that conducting the new way of managing research data improves my status in the scientific community.	
RP3	Conducting the new way of managing research data in the scientific community can enhance my reputation in my professional field.	
RP4	I can earn some feedback or rewards through conducting the new way of managing research data that represents my reputation and status in the scientific community.	
PERCEIVED VALUE OF RDM (Mean: 2.66; SD: 0.82)		
VA1	Considering the time and effort that I have to spend, the change to the new way of managing research data is worthwhile.	Modified from (H.-W. Kim & Kankanhalli, 2009)
VA2	Considering the loss that I incur, the change to the new way of managing research data is of good value.	
VA3	Considering the hassle that I have to experience, the change to the new way of managing research data is beneficial to me.	
INTENTION TO COMPLY WITH RDM GUIDELINES (Mean: 2.84; SD: 1.03)		
IC1	I intend to increase the new way of managing research data in the foreseeable future.	Modified from (Bhattacherjee & Park, 2014)
IC2	I intend to invest my time and effort in the new way of managing research data.	
IC3	I intend to switch from my current way of managing research data to the new way of managing research data.	
SWITCHING COST (Mean: 3.10; SD: 0.82)		
SC1	It would take a lot of time and effort to switch to the new way of managing research data.	Adopted from (H.-W. Kim & Kankanhalli, 2009)
SC2	Switching to the new way of managing research data could result in unexpected hassle.	
SC3	I would lose a lot in my work if I were to switch to the new way of managing research data.	
SWITCHING BENEFITS (Mean: 2.34; SD: 0.95)		
SB1	Changing to the new way of managing research data would enhance my effectiveness on the job more than working in the current way.	Adopted from (H.-W.

SB2	Changing to the new way of managing research data would enable me to accomplish relevant tasks more quickly than working in the current way.	Kim & Kankanhalli, 2009)
SB3	Changing to the new way of managing research data would increase my productivity more than working in the current way.	
STATUS QUO BIAS (Mean: 2.73; SD: 0.93)		
I will continue using my current method for managing research data...		
SQ1	...even though I know it is not the best way of doing things.	Adopted from (Polites & Karahanna, 2012)
SQ2	...even though I know it is not the most efficient way of doing things.	
SQ3	...even though I know it is not the most effective way to do things.	

Table B

	LC	IC	RP	SB	SC	UV	VA	SQ
LC1	**0.905**	-0.322	-0.157	-0.045	0.431	0.548	-0.285	-0.011
LC2	**0.865**	-0.263	-0.053	-0.068	0.402	0.524	-0.236	-0.007
LC3	**0.853**	-0.234	-0.210	-0.128	0.472	0.522	-0.340	0.053
IC	-0.303	**0.936**	0.339	0.327	-0.279	-0.160	0.583	-0.066
IC	-0.289	**0.968**	0.381	0.365	-0.289	-0.191	0.622	-0.032
IC	-0.305	**0.925**	0.375	0.399	-0.351	-0.184	0.659	-0.057
RP1	-0.159	0.407	**0.910**	0.351	-0.214	-0.171	0.468	0.180
RP2	-0.116	0.316	**0.936**	0.283	-0.366	-0.160	0.446	0.122
RP3	-0.164	0.273	**0.892**	0.198	-0.375	-0.125	0.358	0.136
RP4	-0.137	0.391	**0.886**	0.334	-0.255	-0.176	0.459	0.122
SB1	-0.066	0.332	0.289	**0.900**	-0.163	-0.162	0.604	0.151
SB2	-0.114	0.364	0.326	**0.895**	-0.100	-0.102	0.558	0.209
SB3	-0.059	0.363	0.285	**0.944**	-0.099	-0.140	0.576	0.107
SC1	0.241	-0.199	-0.278	-0.197	**0.782**	0.424	-0.336	-0.070
SC2	0.470	-0.296	-0.308	-0.156	**0.838**	0.342	-0.346	0.153
SC3	0.472	-0.263	-0.100	0.173	**0.626**	0.377	-0.182	0.045
UV1	0.449	-0.196	-0.246	-0.268	0.462	**0.841**	-0.329	0.016
UV2	0.529	-0.126	-0.089	-0.035	0.426	**0.888**	-0.177	0.071
UV3	0.596	-0.145	-0.073	-0.014	0.359	**0.832**	-0.218	0.111
VA1	-0.304	0.540	0.432	0.582	-0.322	-0.263	**0.919**	0.126
VA2	-0.346	0.584	0.433	0.548	-0.403	-0.316	**0.870**	0.059
VA3	-0.234	0.654	0.439	0.588	-0.352	-0.228	**0.916**	0.028
SQ1	0.120	-0.105	0.063	0.016	0.136	0.091	-0.020	**0.690**
SQ2	0.041	-0.063	0.153	0.142	0.085	0.076	0.058	**0.979**
SQ3	0.050	-0.137	0.015	0.068	0.065	0.107	0.008	**0.791**

Appendix B

Short version of the data management policies of the DFG. Full text can be accessed here: http://www.dfg.de/download/pdf/foerderung/antragstellung/forschungsdaten/guidelines_research_data.pdf (last access 06/20/2018)

- A discipline-specific organisational concept that regulates effective and sustainable storage of the data is to be defined.
- The data are described by metadata.
- If possible, each scientist or academic makes his or her primary research data freely available on a transregional level.
- The data are quality-controlled.
- The data are personally labelled and are stored under the name of the researcher.
- The research data are stored within the framework of defined standards.

A.g P7: Understanding the Utilitarian Value of Enterprise Social Networks and its Role for Use Continuance – A Digital Infrastructure Perspective

Fact Sheet of Publication P7

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Abstract

In this study, we first show that while both the perceived usefulness and perceived enjoyment of enterprise social networks impact employees' intentions for continuous participation, the utilitarian value significantly outpaces its hedonic value. Second, we prove that the network's utilitarian value is constituted by its digital infrastructure characteristics: versatility, adaptability, interconnectedness and invisibility-in-use. The study is set within a software engineering company and bases on quantitative survey research, applying partial least squares structural equation modeling.

Keywords: Enterprise social networks, digital infrastructure, usefulness, enjoyment, adoption, use continuance, small- and medium-sized enterprise (SME), PLS-SEM

Introduction

In conjunction with the popularity of public social media like Facebook (Larosiliere, Meske, & Carter, 2015), the implementation of social media within organizational contexts has significantly increased over the last years and became an important focus of the information systems research community (Engler & Alpar, 2017; Soto-Acosta, Cegarra-Navarro, & Garcia-Perez, 2017). Enterprise social networks (ESNs) such as Confluence, IBM Connections, Jive, Slack, Sharepoint or Yammer have hence started to play an increasingly influential role at organizational workspaces. However, since participating in the provided ESN is usually not mandated, organizations often face the challenge of voluntary ESN adoption and continued use (Choudrie & Zamani, 2016; Engler & Alpar, 2017), why there is a high risk that ESN projects fail and lead to significant sunk costs. From literature on public social media we know, that hedonic motivations like enjoyment are recurrently mentioned as important factors for users to adopt or continually use social networks (e.g. Hu, Poston, & Kettinger, 2011; Chen & Sharma, 2013; Song, Wang, Zhang, & Qiao, 2017). At the same time, literature on information systems at the work place has shown, that usefulness is one of the most important predictors for use behavior (e.g. Davis, Bagozzi, & Warshaw, 1989; Venkatesh & Davis, 2000; Lu, Yao, & Yu, 2005; Venkatesh, Thong, & Xu, 2016). This relationship has also been proven in the context of ESN (e.g. Engler & Alpar, 2017). However, to the best of our knowledge, no comparison has yet been made between the role of utilitarian and hedonic motivations to use an ESN, which can be used for work purposes but also

imports basic principles from public social media and therefore may be seen as a mean to socialize and increase enjoyment. Our first goal is to close this research gap by comparing the impact of perceived usefulness and perceived enjoyment on employees' ESN use continuance intentions.

Our second goal is to identify factors, that influence the employees' perception of the ESN's usefulness, as this aspect has two major implications for information systems managers. If they do not know why the ESN is useful, it is difficult to justify a corresponding project to the top management (Wehner, Ritter, & Leist, 2017; Pérez-González, Trigueros-Preciado, & Popa, 2017), what may impede introducing the ESN in the first place. In addition, managers face the challenge to communicate the work-related added value of the ESN to the potential participants. Shortcomings may lead to impeded ESN integration, or limited acceptance and usage (Iglesias-Pradas, Hernandez-Garcia, & Fernandez-Cardador, 2017; Meske & Stieglitz, 2015). While ESNs have often been described as communication or collaboration infrastructures in work contexts (Kwahk & Park, 2016), an empirical investigation of infrastructure characteristics as antecedents of their usefulness is still missing. To fill this gap, we conceptualize ESNs as digital infrastructures and argue that certain infrastructure characteristics, which can also be found for physical infrastructures such as railways or roads, make ESNs useful for participants. This perspective helps in understanding that ESNs can be perceived as useful by employees, even though they are not designed to directly support certain business processes or specific tasks. In the current information systems literature, the term 'infrastructure' has been used to describe a multitude or diversity of hardware devices, software applications, or all-embracing application layers (Pipek & Wulf, 2009). According to Pipek and Wulf (2009) and based on the work of Star and Bowker (2002), information systems can be reconceptualized as digital work infrastructures, and can be described by certain key characteristics: interconnectedness, adaptability, reflexivity, versatility and invisibility-in-use. In this study, we examine how the perception of these infrastructure characteristics influences employees' perceived usefulness as an antecedent of ESN use continuance. Understanding the nature of ESNs is crucial, since they influence performance, particularly of knowledge-centric organizations (Cleveland & Ellis, 2014; Fischbach, Gloor, & Schoder, 2009; Leon, Rodríguez-Rodríguez, Gómez-Gasquet, & Mula, 2017; Wu & Chang, 2013).

In sum, we therefore pursue to answer the following two research questions:

1) *To which extent do both factors, usefulness and enjoyment, influence the use continuance of enterprise social networks in organizations?*

2) *How do the infrastructure characteristics of enterprise social networks influence the employees' perception of their usefulness and hence utilitarian value?*

To answer these two questions, in our study, we conduct a quantitative survey in an international, medium-sized company that offers software engineering and cloud services, and which is one of the leading companies in enterprise content management systems in Germany. In 2013, Confluence (developed by Atlassian) was introduced and promoted as a tool to support day-to-day work routines.

The contributions of this study are threefold. *First*, to the best of our knowledge, no study has directly compared the influence of perceived usefulness and enjoyment on ESN adoption or post-adoption behavior within an organization, even though both can play a significant role. In this regard, we fill a research gap regarding the phase of post-adoption, which has also important implications for practice. As we will show, a single-sided-analysis, e.g. utilitarian motivations only, would not take into account, that employees could also be motivated by hedonic aspects of ESN use at the same time, and vice versa, which eventually influences ESN implementation processes. *Second*, we adopt an infrastructure perspective on ESN that has often been discussed on a theoretical level but has not been tested empirically until now. Besides adding first empirical work in this context, our shift in perspective also impacts our general understanding of communication and collaboration technologies, such as ESNs, as rather being open work-infrastructures than task-oriented artefacts. This in turn influences research on the design, adoption and management of corresponding infrastructures, for which we however need a proper understanding of their core characteristics. This has also significant impacts on practitioners, since the shift of perspective on ESNs as digital infrastructures and better understanding of their perception by employees may influence corresponding investment, selection, management and evaluation processes within organizations. *Third*, we introduce new constructs to capture infrastructure characteristics, which can also be applied for adoption and post-adoption studies of other information systems, inside and outside of organizations.

The remainder of the paper is structured as follows: in the next section, we provide an overview of related work on ESNs in organizations, and describe both the utilitarian and hedonic aspects of ESN usage. We also introduce the perspective of ESNs as digital infrastructures. In the following section, the overall research model and hypotheses are developed. Afterwards, the research design is described in detail, including context information and measurement instruments. Then, we describe the results, including the descriptive statistics, measurement analysis and hypotheses testing. Subsequently, the findings are discussed and implications for research and practice are derived. This paper ends with a conclusion and outlook in terms of further research.

Literature review

In this section, we discuss the role of ESNs in organizations. We also show the relevance of both the utilitarian and hedonic motivations for ESN use continuance. We then review the literature supporting the conceptualization of ESNs as digital infrastructures and how the infrastructural characteristics may influence the perceived usefulness of ESNs.

Enterprise social networks in organizations

ESNs are defined as "platform[s] for tight integration of multiple types of Web 2.0 tools into a single private/semi-private network for businesses and organizations" (Scott, Sorokti, & Merrell, 2016, p. 2), and describe the phenomenon of social networking in an enterprise context via social media platforms. Typical examples that have been researched in context of information systems research, are for instance collaborative platforms such as Yammer, Jive, or Sharepoint (Choudrie & Zamani, 2016; Pawlowski et al., 2014; Riemer, Stieglitz, & Meske, 2015). ESNs can functionally be compared to social network sites (SNS) (e.g. Facebook, Twitter, LinkedIn) but differ in terms of accessibility, since these platforms can only be reached through the intranet of the enterprise (Richter, Riemer, & vom Brocke, 2011). Thus, the majority of ESNs are only accessible exclusively by the employees of the respective organization (Richter et al., 2011). These organizational information systems are often implemented as stand-alone platforms or as tools which enhance organizational work processes through social network specific functionalities such as blogs, wikis and discussion forums (Turban et al., 2011). Similarly to ordinary social network sites, ESNs commonly offer a core set of features which allow their users to e.g. create customized online profiles (Dugan et al., 2008); connect with other coworkers and track their activities (Wu, DiMicco, & Millen, 2010); share content

and experiences by exchanging short messages with coworkers via direct messages or blogs (Richter et al., 2011; Riemer et al., 2015; Sarrel, 2010) or posting, commenting, editing and linking files with themselves or others (Leonardi, 2011). Additionally, these platforms offer enterprise specific collaboration capabilities (e.g. integration of existing communication tools, storage of documents or knowledge searches) which are not provided by common SNSs by default (Avanade, 2013). In the literature, ESNs are also referred to as enterprise social media (Beck, Pahlke, & Seebach, 2014), enterprise social networking systems (Fulk & Yuan, 2013), enterprise social software (Le-Nguyen, Guo, & Qiong, 2017), or organizational social web sites (Raeth, Kügler, & Smolnik, 2011).

ESNs are primarily used for internal communication purposes and to increase social interaction within the enterprise (Choudrie & Zamani, 2016). They are not typically linked to business processes or designed as purpose-driven artefacts such as ERP systems. Hence, there is an ongoing discussion on the utilitarian usefulness of ESNs. While current research in the field of information systems has already started to investigate the associated potential of ESNs in context of workspaces (Dimicco et al., 2008; Kwai Fun IP & Wagner, 2008; Leftheriotis & Giannakos, 2014; Moqbel & Aftab, 2015), the latest literature implies that an ESN's usefulness is influenced in a more indirect way, for example: i) quicker access to information and knowledge (Alpar, Engler, & Schulz, 2015; Engler, 2014); ii) increased group performance (Kügler et al., 2015b; Wehner, Falk, & Leist, 2017); and iii) the establishment of intangible social capital (Riemer, Finke, & Hovorka, 2015; Cummings & Dennis, 2016). Particularly in terms of information sharing and knowledge transfer, organizational social media platforms have been identified as useful artefacts (Alsayadi & Algarni, 2017; Meske, Wilms, Brockmann, & Stieglitz, 2016; von Krogh, 2012). According to previous research investigations, the implementation of ESN technologies "can increase the accuracy of people's meta-knowledge (knowledge of 'who knows what' and 'who knows whom') at work" (Leonardi, 2015). As stated by Leon et al. (2017), the use of an internal social network tends to evaluate the knowledge flow within organizations and to determine which users act as knowledge diffusers by sharing what they know with others.

Beyond such knowledge-based investigations, ESNs seem to positively influence users' communication and group work (Raeth et al., 2011). Related work by Kwahk and Park (2016) demonstrates, for example, that ESNs can help to increase users' communication and collaboration. Users who are physically separated or do not share the same cultural profile can be connected via an ESN (Shirky, 2008). Besides these physical and cultural

barriers, ESNs also have the potential to reduce hierarchical barriers within enterprises. For instance, communication clusters, in which users only communicate with other users of equal position within the enterprise hierarchy, seem to dissolve over time (Riemer et al., 2015). According to Beck et al. (2014) ESNs can be regarded as sociotechnical systems which provide a better sense of the social identity of others and increase the interaction transparence of users. Moreover, ESNs can potentially strengthen the relationships among users and enterprises (Fulk & Yuan, 2013).

In addition to enhanced group work experiences, social networking among employees supports creativity within groups, which may lead to competitive advantages (Yuhashi & Iijima, 2010). These findings are in line with recent investigations by Kügler et al. (2015b), who show that both the innovation and performance of employees are influenced by the way ESNs are used in practice. Hence, ESNs that are used for team building have a stronger effect on the task performance of employees. ESNs that are increasingly used for connecting teams have a stronger effect on employees' innovation. In line with these findings, research shows (Moqbel, Nevo, & Kock, 2013; Moqbel et al., 2015) that the use of an employee social networking site leads to higher organizational commitment and job satisfaction. The authors also demonstrate the effect of ESN use on job performance through the mediation of job satisfaction (Moqbel et al., 2013).

Enterprise social networks for utilitarian and hedonic purposes

Even though previous studies confirm the effect between the use of ESNs by employees and work performance (Kügler et al., 2015b; Leftheriotis & Giannakos, 2014; Moqbel et al., 2013), many companies are still facing issues such as limited employee usage. Although there has been research in the field of ESN acceptance in an organizational context, there are still unanswered questions concerning how to achieve sustainable employee participation (Engler & Alpar, 2017).

In traditional information systems adoption literature and the context of work performance, the measurement of perceived usefulness (Davis, 1989) or performance expectancy (Venkatesh, Morris, Davis, & Davis, 2003) has become a major determinant of adoption and post-adoption use continuance. Perceived usefulness is defined by Davis (1989, p. 320) as "the degree to which a person believes that using a particular system would enhance his or her job performance". According to prior literature, such utilitarian value is one of the strongest determinants of user acceptance in system-use environments (Venkatesh & Davis, 2000; Lu et al., 2005; Venkatesh, Thong, & Xu, 2016). This seems

also to apply to ESNs, as previous studies identified perceived usefulness or performance expectancy as significantly influencing the adoption of ESNs by employees (e.g. Antonius, Xu, & Gao, 2015; Engler & Alpar, 2017).

However, while highlighting the important accomplishments of these investigations, studies have also criticized an incomplete understanding of system-use behavior (e.g. Benbasat & Barki, 2007; Wu & Lu, 2013). One critical aspect of models and studies that focus on usefulness is that they may miss an important aspect in the context of systems that could also be used for hedonic purposes (Lin & Bhattacherjee, 2010; Wu & Lu, 2013). While perceived usefulness was shown to measure utilitarian value, it "may not be the sole prominent determinants for using hedonic systems" (Wu & Lu, 2013, p. 1). Utilitarian systems are designed to provide instrumental value, such as increasing the task performance or productivity of users. As defined by Sun and Zhang (2006) a system can be categorized as utilitarian when "it is aimed mainly at outcome-oriented tasks, in other words, when its users are mainly driven by an external locus of causality" (p. 622). In contrast, hedonic systems provide self-fulfilling value to the users (e.g. users experience enjoyment when using the system) (van der Heijden, 2004). If a system is categorized as hedonic, it "supports tasks focusing mainly on the process, and users have an internal locus of causality" (Sun & Zhang, 2006, p. 622). Despite their different natures, utilitarian and hedonic systems do not necessarily conflict with each other, and may be used for both productivity and pleasure (Chesney, 2006; Sun & Zhang, 2006; Wu & Lu, 2013).

From internet research on public social media we learn that social network use and continuous participation is strongly influenced by hedonic motivations (e.g. Hu et al., 2011; Chen & Sharma, 2013; Song et al., 2017). Transferring this finding to the workplace context within a company, recent qualitative investigations imply that the use of an ESN by employees may also be affected by hedonic motivations, not just by utilitarian values (e.g. Chin, Evans, & Choo, 2015). In addition, Kügler & Smolnik (2014) also showed that besides consumptive and contributive use, ESN may also be leveraged for hedonic and social use in the post adoption phase. Yet the impact (and comparison) of according motivations on future usage intentions has not been investigated. Further confirmation based on quantitative studies in the workplace context is still missing. Since individuals may use them either for utilitarian or hedonic purposes, ESNs could hence be categorized as dual-purpose systems as defined by Wu & Lu (2013). In our quantitative study, we therefore investigate at first to which extent usefulness as well as hedonic motivations influence ESN use behavior and compare the roles of both latent variables.

In addition, while reasons for ESNs to satisfy hedonic needs (e.g. socializing) seem to be intuitive, there is still an ongoing discussion regarding the reasons for ESNs to be useful in the employees' day-to-day work routines. To shed light on the latter question, in the next part of this work, we conceptualize ESNs as digital infrastructures and argue that their infrastructure characteristics are the reason why users perceive ESNs as useful, even though they are not conventional, task-oriented information systems artefacts.

Enterprise social networks as digital infrastructures

Recent investigations have demonstrated that besides the organizational, social and individual factors, technological factors also seem to have a strong impact on the utilitarian use of ESNs (Chin et al., 2015). These technological factors are "related to ESN platform characteristics" (Chin et al., 2015, p. 5) and to IT infrastructure, which is one of the key concerns in technology-related system contexts. IT infrastructure can serve as a strong driver, and can serve as an enabling or hindering factor in obtaining organizational competitive performance (Broadbent, Weill, Brien, & Neo, 1996). Weill and Vitale (2002) define IT infrastructure as "a set of services that users can understand, draw upon, and share, to conduct their business" (p. 19). As defined by Hwang, Yeh, Chen, Jiang and Klein (2002), IT infrastructure is "the base foundation for building business applications, which is shared throughout the firm as reliable services" (p. 56). While both definitions focus on a service perspective, this can be understood in the context of an ESN as a (new) work-oriented infrastructure for employees. According to the definition of Hanseth and Lundberg (2001), "work-oriented infrastructures are shared resources for a community; the different components of an infrastructure are integrated through standardized interfaces; they are open in the sense that there is no strict limit between what is included in the infrastructure and what is not, and who can use it and for which purpose or function; and they are heterogeneous, consisting of different kinds of components—human as well as technological." This technical perspective shows that infrastructures are not equal to standardized task-orientated artefacts. To properly design and manage the adoption process of a new work-orientated infrastructure, its basic characteristics need to be analyzed. According to Pipek and Wulf (2009), and similarly to Star and Bowker (2002), the following exemplary key characteristics need to be considered:

- *Versatility:* Infrastructures such as ESN can be used for many purposes. They are open systems that allow users to decide individually on utilitarian and hedonic usage scenarios that are unforeseen by management and even by the users themselves.

- *Invisibility-in-use:* When using an infrastructure, it remains "invisible" to the uers as long as everything works properly (front-end easy to use, back-end without disruptions); only if the infrastructure fails it becomes "visible", being cognitively present to the user.

- *Adaptability:* ESNs are based on a variety of different technology layers (e.g. organizational intranet, local area networks, the internet). The ability of the ESN to adapt to the IT environment is crucial to making the infrastructure work.

- *Reflexivity:* ESNs as digital infrastructures are often re-designed and modified on the basis of usage experiences. In this sense, the user becomes an essential part of the infrastructure design, thus ending the strict separation between users and designers. Furthermore, users can "modify and appropriate different parts of the [technology] in ways unforeseen by the technology designers" (Pipek & Wulf, 2009, p. 6).

- *Interconnectedness:* Like other types of infrastructure, an ESN is interconnected, for instance when looking at the hardware (e.g. storage, processors and servers) or software (e.g. applications and databases). At the same time, the ESN is not only interconnected itself, but its usage also helps people in the organization to interconnect. We hence see interconnectedness not exclusively from a technical perspective.

These key characteristics allow the quality of a work-oriented, digital infrastructure to be described, and have already been used in different contexts such as crisis management infrastructures (White, Plotnick, Kushma, Hiltz, & Turoff, 2009) or cloud computing infrastructures (Stieglitz, Meske, Vogl, & Rudolph, 2014) to measure and improve the impact of technology. For a better understanding of the following infrastructure-related hypotheses, we want to point out, that we understand an ESN as a digital infrastructure for its own, which however can be interconnected with other systems and hence be integrated in an overriding infrastructure. Using an analogy from the offline-world, the ESN could be compared to a city with its own infrastructure, which is interconnected via

highways with the infrastructure of other cities nearby. The user can hence perceive the ESN as a digital (sub-)infrastructure but also evaluate its interconnectedness with other systems.

Hypotheses development

This section presents the development of our research model. We first describe how both the perceived usefulness and perceived enjoyment influence an individual's ESN usage intention (Section 3.1). We then explain how infrastructure characteristics can influence the perceived usefulness of the ESN (Section 3.2). The research model is summarized in Figure 1.

Utilitarian and hedonic motivation for using ESNs

An employee's decision to use ESN "is associated with the perception of ESN in enabling them to achieve a certain goal and fulfil their needs" (Chin et al., 2015, p. 5). As 'dual-purpose systems' (Wu et al., 2013), ESNs serve both utilitarian and hedonic goals. The usage of a utilitarian system primarily involves the motivation to improve job performance or increase the efficiency of work-related tasks (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017; Davis, 1989). As a vast body of literature did demonstrate, perceived usefulness is strongly connected to the intention to continuously use an information system (Davis, Bagozzi, & Warshaw, 1992; Venkatesh et al., 2012). Hence, we theorize that utilitarian system usage will also be positively correlated with an individual's intention to continuously use an ESN. Thus, we state:

H1: Perceived usefulness is positively correlated with ESN use continuance

ESNs are said to be affected by both hedonic and utilitarian values (Chin et al., 2015; Leftheriotis & Giannakos, 2014). Contrary to utilitarian systems, in hedonic systems the achievement of external goals is subordinated to the use of the system itself (van der Heijden, 2004). Perceived enjoyment is defined as the extent to which the activity of using computers is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Alsabawy, Cater-Steel, & Soar 2016; Davis et al., 1992; Moghavvemi, Sharabati, Paramanathan, & Rahin, 2017; Venkatesh & Davis, 2000). Hedonic motivations can be important both for the initial adoption of technology (Salehan, Kim, & Kim, 2017) and for intentions regarding continued use in post adoption

models (Lowry, Gaskin, & Moody, 2015; Schwarz & Schwarz, 2014), as shown in the contexts of online shopping (Stafford & Stafford, 2001), streaming music (Chu & Lu, 2007) or videos (Kim, Na, & Ryu, 2007), experiencing virtual worlds (Wu, Li, & Rao, 2008), participating in public social networking or social blogging (Tscherning & Mathiassen, 2010). Thus, we theorize:

H2: Perceived enjoyment is positively correlated with ESN use continuance

The influence of infrastructure characteristics on perceived usefulness

According to the layer approach and standardization (Pipek & Wulf, 2009), digital infrastructures are based on a variety of different protocols and can adapt to environments. These service layers are crucial to leveraging the IT infrastructure and ensuring it is adaptable to the existing environment. As demonstrated by Alsabawy et al. (2016), such infrastructure services are positively related to users' perceived usefulness. Hence, the perception of their adaptability may also influence the users' perceived usefulness of ESNs. We therefore hypothesize:

H3: Perceived adaptability is positively correlated with the perceived usefulness of the ESN

Another key characteristic of infrastructures is their invisibility-in-use. According to Star and Bowker (2002), infrastructures are invisible but become visible upon breakdown. This aspect can be explained with the example of roads or railways, which can be seen but are not 'consciously present' and hence 'visible' to the everyday work-traveler, until these infrastructures break down (he/she does not think about the roads/railways when commuting, the infrastructure is just 'there' in the background). Transferred to the information systems context, Pipek & Wulf (2009) argue that such invisibility-in-use also applies to information systems as infrastructures. We therefore adapt that understanding and assume, that using the ESN in e.g. daily communication-routines leads to the effect, that the visible artefact ESN becomes an 'invisible' but constantly available infrastructure, if it does not require high cognitive efforts to use it in daily work routines (front-end, interface) and if it runs smoothly without interruptions (back-end, server). Walker and Hong (2017) demonstrated that the presence of workplace infrastructure is related to users' perceived usefulness. Similar effects have already been shown in the context of e-learning technology, in which Wedel and Rothlauf (2014) demonstrated the mediated influence of infrastructure availability on perceived usefulness. As stated by

Sun, Tsai, Finger, Chen and Yeh (2008), "little operational reliability and long transmission times lead to learner frustrations and, hence, to negative emotions." Based on these findings, it is assumed that the perceived invisibility-in-use of an ESN is positively associated with users' perceived usefulness of the ESN.

H4: Perceived invisibility-in-use is positively correlated with the perceived usefulness of the ESN

The fifths hypothesis involves the interconnectedness of an infrastructure. Perceived interconnectedness describes the extent to which hardware and software layers are connected to other services to support an efficient work environment. One example that combines multiple infrastructures is grid computing; this leads to a reduction of administration effort since users no longer need to manage multiple standalone systems (Buyya & Sulistio, 2008; Strong, 2005). The interconnectedness of systems can also lead to a higher probability of IT adoption. ESNs are not only interconnected from a technical perspective but also allow users to interconnect with others, which can again increase their usefulness (Kügler et al., 2015a). The perceived interconnectedness, both technical and social, can play an important role in the users' perception of an ESN's usefulness. We hence hypothesize:

H5: Perceived interconnectedness is positively correlated with the perceived usefulness of the ESN

Another important criterion of infrastructure is versatility. According to Pipek and Wulf (2009), infrastructures can be used for various purposes in different work environments and areas, and can therefore be flexibly adapted to the respective business processes. The success of the infrastructure is measurable by its ability to combine several purposes in an instrument or technology (Morledge & Owen, 1997). The versatility of an infrastructure can hence have a positive influence on its usefulness. The literature has shown that ESNs can be used for many different purposes, such as to establish and access information repositories (Leon et al., 2017), contact experts (Han, Sörås, & Schjodt-Osmo, 2015) establish social capital (Beck et al., 2014), coordinate projects (Suh & Bock, 2015), socialize (Fulk & Yuan, 2013) and others. Hence, we assume that the perceived versatility of an ESN has a positive influence on its perceived usefulness.

H6: Perceived versatility is positively correlated with the perceived usefulness of the ESN

Infrastructures not only allow the user to store data (including data related to the infrastructure itself) and to identify applications, but are also subject to constant change, and are further developed and shaped on the basis of user experiences. The integration of end users' perceptions of the system development process therefore increases the perceived usefulness of a system (Foster & Franz, 1999). In this sense, the user becomes an essential part of the infrastructure design, and thus eliminates the strict separation between users and designers, resulting in the reflexivity of infrastructures. Information systems as reflexive infrastructures are part of the same global infrastructure as those of users and "all improvements to the global infrastructure are developed within that infrastructure" (Pipek & Wulf, 2009, p. 449). ESNs also undergo a reflexive development process through which the design and features are continuously enhanced (Wehner et al., 2017). We suggest that the perceived reflexivity of an ESN has a positive influence on the perceived usefulness of this work infrastructure. Hence, we hypothesize:

H7: Perceived reflexivity is positively correlated with the perceived usefulness of the ESN

In the following figure, we summarize our research model.

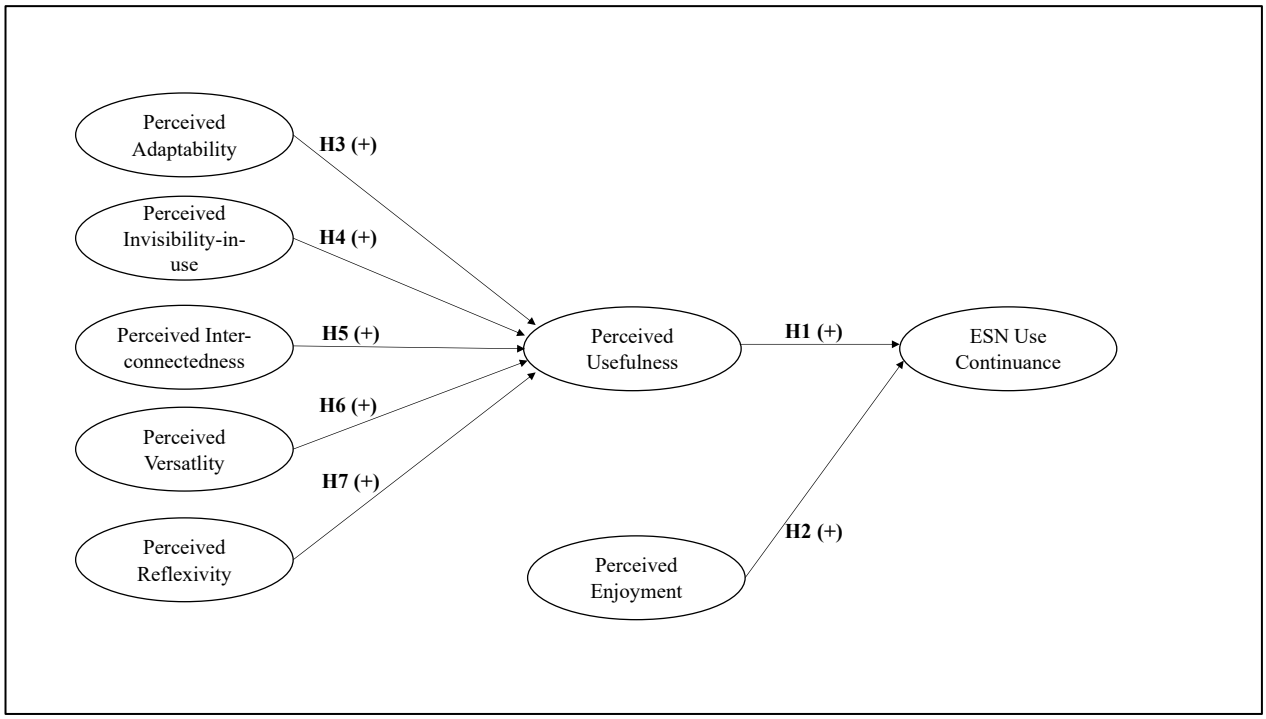

Figure 1. Research model

Research design

Context information

The company of this study is a medium-sized organization with 260 employees. It was established in 1990, has its headquarter in Germany and operates internationally with branches in Austria, Great Britain, Turkey, the United States of America and Singapore. It is one of the leading companies in enterprise content management in Germany, and also offers software engineering and cloud services.

This company introduced Confluence (developed by Atlassian) as an ESN in 2013. Each employee has an account with a personal profile on the network. Whole departments are also represented on the network, e.g. finance and control, marketing and sales. The system offers classical ESN functionalities such as private messages, microblogs and wikis. Confluence was established in 2004 in Australia; it is one of the most popular social network solutions for small and medium-sized enterprises, and is available in 11 different languages. Since the management had a more conservative perspective and wanted to avoid, that the ESN is perceived as a duplicate of social media to only socialize and chit-chat, Confluence was introduced and promoted from the beginning as a tool to only support the employees' work tasks. Comparisons with public social media also obstructed the ESN investment decisions for some time because of the problem to calculate a return on investment for a tool, that somehow seems to support work-related tasks but is not designed as a task-driven artefact. In the following it is described, which measurement instruments were applied to investigate, if there is also a hedonic perspective besides the promoted utilitarian one that influences use continuance, and if an infrastructure perspective on ESN can help to increase the understanding of its perceived usefulness.

Measurement instrument

In line with traditional information systems adoption methodology (Venkatesh et al., 2003; Venkatesh et al., 2016), for our explanative approach we chose to conduct quantitative survey research within the boundaries of an organization and to apply structural equation modeling. The quantitative survey took place between October 4th and October 15th, 2016. It was advertised via e-mail to all employees, and participation in the study was optional. We adapted validated scales for use continuance from Agarwal & Karahanna (2000), which was used in many intra-organizational information systems contexts (e.g. Chandra, Srivastava, & Then, 2012; Huang, Wu, & Chou, 2015) but also in the context of public social networks (e.g. Bataineh, Al-Abdallah, & Alkharabsheh, 2015). For perceived usefulness we adapted items from Davis et al. (1989), which is

similar to the construct of performance expectancy (Venkatesh et al., 2003) and has also been applied in organizational ESN contexts (e.g. Engler & Alpar, 2017). For perceived enjoyment we adapted existing items from Davis et al. (1992), which has been applied in many studies ever since, also in the context of public social network adoption (e.g. Lin et al. 2010). New (reflective) constructs were developed for the infrastructure characteristics of perceived versatility, adaptability, invisibility-in-use, interconnectedness and reflexivity. For this purpose, we followed the guidelines of Straub (1989). First, we derived initial item pools for each of the constructs and reduced the number of items successively by conducting multiple workshops (Cronbach, 1971) with up to four researchers. During these workshops, the participants were asked to evaluate the fit of the item for the target construct. We then conducted a quantitative pre-test with several Confluence users in the company, followed by qualitative interviews involving the individuals' understanding of the given items and constructs. Based on this feedback, the list of items was finalized. For each construct, a seven-point Likert scale was used, ranging from "strongly disagree" (1) to "strongly agree" (7). All measurement items are displayed in Table 1.

Table 1. Definitions and measurement items

Perceived Versatility (VER): The degree to which the user perceives the ESN as being useful for different purposes. (self-developed)	
VER1	<The ESN> can be used for specific subtasks as well as superordinate tasks.
VER2	<The ESN> can be used for many different work-related purposes.
VER3	Different tasks can be performed in <the ESN>.
Perceived Adaptability (ADA): The degree to which the user perceives the ESN as being adaptable to the given environment of the company. (self-developed)	
ADA1	The structures in <the ESN> are constantly evolving.
ADA2	<The ESN> structures are constantly adapting to the environment of the organization.
ADA3	<The ESN> has become adapted to my organization's structures.
Perceived Invisibility-in-use (INV): The degree to which the user perceives the ESN to be operating in the background without consciously noticing it. (self-developed)	
VIS1	I often use <the ESN> unconsciously, as it has become an integral part of my working infrastructure.
VIS2	I unconsciously use <the ESN> for many of my tasks.
VIS3	<The ESN> is always available in the background during working hours.

Perceived Interconnectedness (INT): The degree to which the ESN is interconnected with the existing processual, technological and social infrastructures. (self-developed)	
INT1	In my organization, <the ESN> supports <1) only a few ... 7) most> of the existing processes.
INT2	In my organization, <the ESN> is an <1) important ... 7) unimportant> component of the existing infrastructure.
INT3	Through <the ESN>, I am connected with my colleagues.
Perceived Reflexivity (REF): The degree to which the user perceives his/her activities as having an influence on the ESN's development over time. (self-developed)	
REF1	<The ESN> allows me to influence its future development.
REF2	I can participate in designing <the ESN>.
REF3	My activities in <the ESN> have an influence on its evolving structures.
Perceived Usefulness (PEU): The degree to which the individual evaluates the ESN as useful. (adapted from Davis, 1989)	
PEU1	Using <the ESN> has been beneficial to me.
PEU2	Compared to other resources, it is easier to access information through <the ESN>.
PEU3	Using <the ESN> supports me in accomplishing tasks more quickly.
Perceived Enjoyment (ENJ): The degree to which the user perceives the usage of the ESN as enjoyable. (adapted from Davis et al., 1992)	
ENJ1	I find using <the ESN> to be enjoyable.
ENJ2	The process of using <the ESN> is pleasant.
ENJ3	I have fun using <the ESN>.
ENJ4	Using <the ESN> gives me a good feeling.
ESN Use Continuance (EUC): The intention of the user to continuously use the ESN. (adapted from Agarwal & Karahanna, 2000)	
EUC1	I intend to continue actively using <the ESN> rather than discontinue its use.
EUC2	My intentions are to continue using <the ESN> rather than to use any alternative means.
EUC3	If I could, I would like to discontinue my use of <the ESN> (reverse coded).

Data analysis and results

Descriptive statistics

In total, 121 of the 260 employees participated in the survey (response rate: 47%). Providing demographic data was optional. Of these, 102 of the participants were male

(84%), 19 were female (16%). In terms of age, 37% (n=45) were aged 40 or below, 31% (38) were between 41 and 50 years old, while 29% were between 51 to 60 years. One person was older than 60. A total of 88 people (73%) had been using the system for more than 12 months. A detailed overview of descriptive statistics is displayed in Table 2.

Table 2. Descriptive Data

Gender	N	%
Male	102	84.3
Female	19	15.7
Age		
<30	16	13.2
31–40	29	24.0
41–49	38	31.4
51–60	35	28.9
>60	1	.80
No response	2	.70
ESN Usage Experience (months)		
0–12	17	14.0
13–18	26	21.5
19–24	17	14.0
>24	45	37.2
No response	16	13.2

In line with information systems adoption theories (Davis et al., 1989; Bhattacherjee, 2001; Venkatesh et al., 2003; Venkatesh et al., 2016), we assume that the experience with a system is a prerequisite for individual perceptions, e.g. regarding the system's usefulness, which are the cause for usage intentions and eventual post-adoption behavior. We tested, if experience moderates the correlation of perceptions of e.g. the ESNs usefulness with intention to use, but the results showed no significant moderating effect.

In the following Table 3, we provide an overview of the mean, min, max and standard deviation for all items of all constructs.

Table 3. Descriptive Statistics of Item Values

	Mean	Min	Max	Std. Dev.			Mean	Min	Max	Std. Dev.
Perceived Versatility (VER)						**Perceived Reflexivity (REF)**				
VER1	4.91	2	7	1.34		REF1	3.06	1	7	1.43
VER2	5.30	1	7	1.29		REF2	2.63	1	7	1.40
VER3	4.93	1	7	1.49		REF3	2.95	1	7	1.49
Perceived Adaptability (ADA)						**Perceived Usefulness (PEU)**				
ADA1	5.06	2	7	1.29		PEU1	3.93	1	7	1.70
ADA2	4.86	2	7	1.40		PEU2	4.96	1	7	1.55
ADA3	4.15	1	7	1.51		PEU3	4.06	1	7	1.74
Perceived Invisibility-in-use (INV)						**Perceived Enjoyment (ENJ)**				
VIS1	3.97	1	7	1.93		ENJ1	3.88	1	7	1.65
VIS2	3.63	1	7	1.70		ENJ2	4.06	1	7	1.54
VIS3	4.92	1	7	1.79		ENJ3	3.75	1	7	1.64
						ENJ4	3.04	1	7	1.50
Perceived Interconnectedness (INT)						**ESN Use Continuance (EUC)**				
INT1	4.30	1	7	1.41		EUC1	5.27	1	7	1.52
INT2	4.98	1	7	1.19		EUC2	4.83	1	7	1.78
INT3	5.65	1	7	1.34		EUC3	5.09	1	7	1.95

Measurement model analysis

We applied partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.0. The constructs are reflective measures of their indicators. To assess convergent validity, we applied the following three criteria (Fornell & Larcker, 1981): the average variance extracted (AVE) for each construct should exceed .50 (see Table 4); the composite reliability (CR) of constructs should exceed .70 to assure construct reliability; and scale items should have loadings exceeding .70 on their respective scales. Our data met all criteria for convergent validity (see Table 4). Regarding internal consistency, all items factor loadings exceeded .70 (Bearden, Netemeyer & Mobley, 1993) (see Table 4).

Regarding CR, all construct values exceeded .70 (see Table 4), and internal consistency can therefore be assumed (Bearden et al., 1993). In terms of discriminant validity, we compared the square root of the AVE of each construct, which was greater than any

correlation in that construct's row or column, as recommended by (Fornell & Larcker, 1981) (see Table 4). In addition, the respective loadings were all lower than the cross-loadings (Gefen & Straub, 2005). Multicollinearity was tested using the variance inflations (VIF), resulting in values between 1.18 and 2.58, which are lower than the suggested maximum values of 5.00 (Menard, 1995).

Table 4: Measurement model analysis and inter-construct correlations

	CR	AVE	ADA	VER	INV	REF	INT	PEU	ENJ	EUC
ADA	.88	.70	.84							
VER	.92	.79	.62	.89						
INV	.88	.70	.53	.55	.84					
REF	.87	.69	.39	.32	.36	.83				
INT	.82	.69	.37	.28	.29	.18	.83			
PEU	.93	.81	.62	.58	.67	.42	.45	.90		
ENJ	.96	.85	.60	.78	.62	.47	.35	.78	.92	
EUC	.89	.73	.55	.56	.62	.35	.34	.78	.73	.86

CR = composite reliability; AVE = average variance extracted; ADA = adaptability; VER = versatility; INV = invisibility-in-use; REF = reflexivity; INT = interconnectedness; PEU = perceived usefulness; ENJ = perceived enjoyment; EUC = ESN use continuance

Hypotheses testing

We estimated the structural model using PLS (Ringle, Wendel, & Becker, 2015). R2 for ESN use continuance is 65%, suggesting substantive data variation that is explained by the independent variables of perceived usefulness and perceived enjoyment. Perceived usefulness has a positive and significant effect (β=.54; $p<.001$) on ESN use continuance, which means that Hypothesis 1 is supported. Perceived enjoyment also has a significant and positive effect (β=.31; $p<.01$) on ESN use continuance, supporting Hypothesis 2.

The R2 of perceived usefulness is 61%, suggesting high data variation that is explained by the independent constructs of infrastructure characteristics. Perceived adaptability has a significant and positive effect (β=.21; $p<.01$) on perceived usefulness, supporting Hypothesis 3. Perceived invisibility-in-use (β=.39; $p<.001$) also shows a highly significant and positive path to perceived usefulness, supporting Hypothesis 4. Perceived interconnectedness (β=.20; $p<.05$) has a significant and positive effect on perceived usefulness, as does versatility (β=.14; $p<.05$), supporting Hypothesis 5 and 6. Perceived reflexivity has a positive but insignificant correlation (β=.11; $p>.05$) with perceived

usefulness, and hence Hypothesis 7 was not supported. All direct effects are stronger than the indirect effects (see Table 5).

Table 5: Direct and indirect effects

Predictor	Outcome	Standardized β	Standard Error	t-value	p-value
Direct effects					
ADA	PEU	0.21	0.08	2.68	0.004
VER	PEU	0.14	0.07	2.06	0.020
INV	PEU	0.39	0.07	5.70	0.000
REF	PEU	0.11	0.08	1.39	0.082
INT	PEU	0.20	0.12	1.68	0.047
PEU	EUC	0.54	0.09	6.19	0.000
ENJ	EUC	0.31	0.10	3.21	0.001
Indirect effects					
ADA	EUC	0.12	0.04	2.69	0.004
VER	EUC	0.08	0.04	1.89	0.029
INV	EUC	0.21	0.05	4.02	0.000
REF	EUC	0.06	0.04	1.40	0.080
INT	EUC	0.11	0.07	1.50	0.067

CR = composite reliability; AVE = average variance extracted; ADA = adaptability; VER = versatility; INV = invisibility-in-use; REF = reflexivity; INT = interconnectedness; PEU = perceived usefulness; ENJ = perceived enjoyment; EUC = ESN use continuance

A summary of our estimated final model is illustrated in Figure 2, the results regarding the support of the hypotheses are summarized in Table 6.

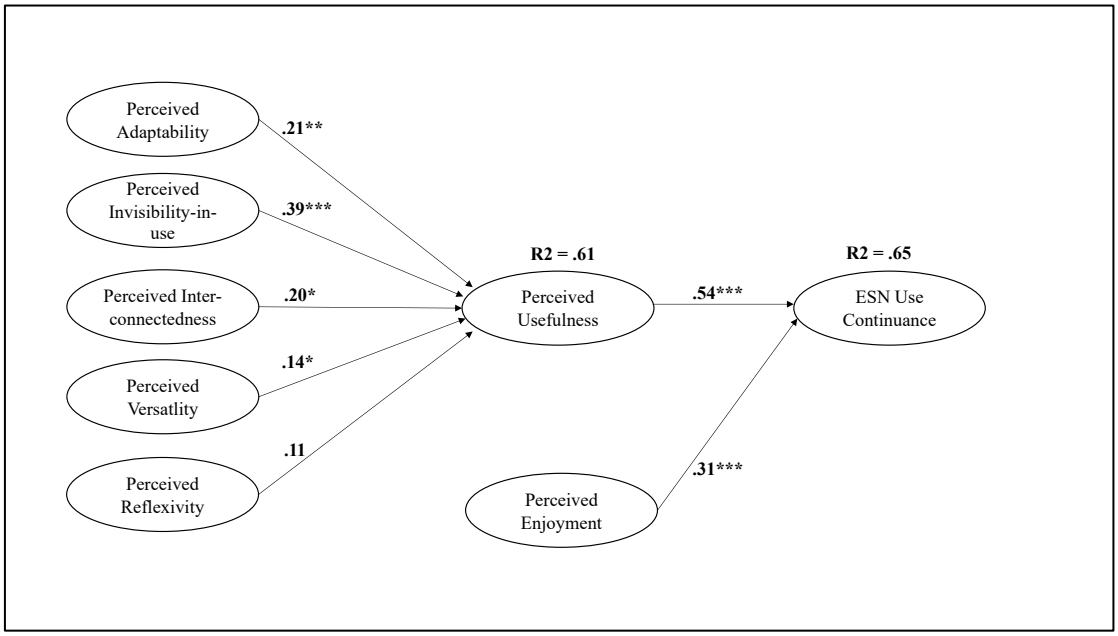

Figure 2. Model results

To assess the statistical power of our data, we analyzed the effect size by calculating Cohen's *f*2. Cohen (1988) suggested the following criteria for interpreting effect size: (i) for a small effect, $.02 < f2 \leq .15$; (ii) for a medium effect, $.15 < f2 \leq .35$; and (iii) for a large effect, $f2 > .35$. The size of the effect of perceived usefulness was large ($f2 = .33$) and contributed significantly to the R2 of use continuance. The effect size for perceived enjoyment is .10 and hence small. Regarding the contribution to R2 of perceived usefulness, the effect size of perceived invisibility-in-use is large ($f2 = .23$). Regarding the contribution to the R2 of perceived usefulness, low effect sizes were found for perceived adaptability ($f2 = .06$), perceived versatility ($f2 = .03$), perceived reflexivity ($f2 = .03$) and perceived interconnectedness ($f2 = .08$). In addition, we analyzed the predictive relevance of our model by application of the Stone-Geisser test (Q2), which indicates how well the data can be reproduced by the PLS model. The Q2 values for individual performance impact (Q2 = .45) and ESN use continuance (Q2 = .44) are positive, indicating a high level of predictive relevance.

Table 6: Hypotheses Results	
Hypotheses	**Result**
H1: Perceived usefulness is positively correlated with ESN use continuance	Supported
H2: Perceived enjoyment is positively correlated with ESN use continuance	Supported

H3: Perceived adaptability is positively correlated with the perceived usefulness of the ESN	Supported
H4: Perceived invisibility-in-use is positively correlated with the perceived usefulness of the ESN	Supported
H5: Perceived interconnectedness is positively correlated with the perceived usefulness of the ESN	Supported
H6: Perceived versatility is positively correlated with the perceived usefulness of the ESN	Supported
H7: Perceived reflexivity is positively correlated with the perceived usefulness of the ESN	Not Supported

Discussion and implications

Our analysis of ESNs as digital infrastructures yielded several results. In the following, we will discuss the results and thereby answer the two research questions, which were stated in the introduction.

Utilitarian value outpaces hedonic motivations for ESN use continuance

The results show, that in the investigated company, both, usefulness as well as enjoyment have an important influence on the employees' intention to continue using the ESN, answering the first research question. First, the finding is in line with recent quantitative studies, which found that the utilitarian value is important for ESN adoption and use behavior, as shown by e.g. Engler & Alpar (2017). It is also in line with Kügler & Smolnik (2014) who showed in a survey-based study on ESN post-adoption behavior that the means for e.g. work-related contributive usage were higher than those for hedonic usage. Yet, our findings also indicate, that social networks, even if introduced by the management for utilitarian purposes only, seem to have an inherent hedonic aspect, which needs to be taken into account when implementing and managing the ESN. On a quantitative basis, we therefore prove the assumptions of the qualitative study by Chin et al. (2015) who theorized, that it is not only the utilitarian but also hedonic motivation, that influences ESN use continuance intentions. This is also in accordance with recent discussions on technology affordances, which state that information systems and hence ESN use may vary based on individual perception as well as contextual needs (Leidner, Gonzales, & Koch 2018; Leonardi & Vaast, 2017). According to Affordance Theory, affordances are possibilities for action, which emerge as individuals interact with technologies (Hutchby, 2001; Stoffregen, 2003). These possibilities, may they be related to utilitarian or hedonic aspects, can differ within collective groups of individuals using the same communication and collaboration technologies, for instance within organizations. Depending on the particular workplace context in which workers have to communicate or exchange information with others, they may follow also hedonic motivations in utilizing ESN rather than act only to utilitarian goals of the management. Our results therefore demonstrate that with the introduction of ESNs, basic principles of public social media, which according to literature are mainly used for hedonic purposes (e.g. Hu et al., 2011; Chen & Sharma, 2013; Song et al., 2017), were also imported to the workplace area. It is hence necessary to acknowledge, that ESNs remain "social

technologies" to a certain extent, even if specifically introduced and promoted to increase work-related access to information and knowledge only.

However, the results also show, that utilitarian motivations take on the majority of explanatory power for sustainable engagement in ESN. When we compare the standardized β, the path coefficient between perceived usefulness and use continuance is almost twice as high as the one of perceived enjoyment and use continuance. In addition, when comparing Cohen's *f*2 between perceived enjoyment and perceived usefulness, the statistical power of the latter is over three times as strong. First, these findings are in line with general information systems adoption literature, in which the utilitarian value of information systems is postulated to be the most important predictor for behavioral intentions and eventual use behavior (e.g. Davis, 1989; Bhattacherjee, 2001; Venkatesh et al., 2003; Venkatesh et al., 2016). Second, if additionally taking the comparably high means of corresponding usefulness-items into account, it shows that such social technologies can be perceived as having an important utilitarian value for the employees' in day-to-day work routines. While these findings provide further indications that help to answer the often-discussed question *if* ESNs are useful, it yet does not provide information, *wh*y they are useful. In the next section, we therefore discuss the role of infrastructure characteristics for the perceived utilitarian value of ESNs in organizations.

Enterprise social networks can be understood as digital infrastructures

Our analysis supports the assumption that infrastructural determinants influence the perceived usefulness of an ESN. Based on the integrated perspective theory on design and use of IT by Pipek and Wulf (2009), we can show that in our study, four infrastructural characteristics significantly influenced the employees' perception of the ESN's utilitarian value.

The results show that **perceived invisibility-in-use** has the strongest effect of all infrastructural criterions on perceived usefulness in terms of both, the path coefficient as well as statistical power. As an adequate digital infrastructure, the system needs to work fluently without interruptions, and, as a consequence, recedes into the background (Star & Ruhleder, 1996). As soon as errors occur, and the employees are no longer able to carry out their work properly, the ESN as an infrastructure becomes visible. It is difficult for designers to conceptualize and to customize the ESN infrastructure to increase the effect

of invisibility-in-use. Bug fixes and improving design adjustments play an important role in the ongoing design process (Pipek & Wulf, 2009). Invisibility-in-use could also be compared to the concept of "immersion", in which cognitive absorption leads to users "diving into" the virtual collaboration environment (Agarwal & Karahanna, 2000; Vishal, 2016). It is therefore necessary, to increase immersive aspects of ESN use through its design and trouble-free operation.

Perceived adaptability is found to be another infrastructural criterion with a significant influence on perceived usefulness. This factor characterizes an infrastructure in terms of the degree to which the user perceives the system as being adaptable to the given environment of the company. In general, many different aspects in the organizational and technical environment constantly change in enterprises over time. If an ESN is perceived as being adaptable to according modifications, it helps to keep or even increase its usefulness. This development encompasses both technical and social elements, which are defined by Henfridsson and Bygstad (2013) as adaptation, innovation and scaling. In this context, adaptation means that the utilitarian value of the ESN as an infrastructure increases if e.g. the number of users increases, who can be incorporated by it. Innovation is defined as a self-reinforcing process through which new products and services extend the infrastructure, which in the case of an ESN would refer to its features and interfaces. Finally, the range of scaling increases due to the possibility of better collaboration via the system (Henfridsson & Bygstad, 2013)

Perceived interconnectedness is the third determinant that is found to significantly influence the perceived usefulness of the ESN. From a technical perspective, it is important that the users perceive the ESN as being interwoven with other necessary systems at work. This aspect can relate to interconnectedness in terms of both hardware and software in the organization. At the same time, from a social perspective, the ESN helps the users to be interconnected with their colleagues. A network can be established that can help to disseminate and access information and expertise quickly, without the barriers of departmental structures or hierarchies (Riemer et al., 2015). Interconnectedness is hence an important characteristic that impacts ESN use through increased perceived usefulness. In consequence, information systems managers need to consider possibilities to integrate the ESN into the existing infrastructural environment, linking it to other information systems. In addition, it is important to increase the perception of interconnectedness between the users, which has been proven to positively influence their individual work performance (Kügler et al., 2015a)

In terms of **perceived versatility,** our work shows a significant positive correlation with the perceived usefulness of the ESN. Pipek and Wulf (2009) state in their work that infrastructures can be used for different purposes. ESNs can also be applied in different work scenarios, with or without colleagues being involved, and can help to support tasks that were unforeseen by the ESN designers. To profit from this inherent versatility, employees need to be able to use the ESN in a self-determined and self-organized way, according to their own needs, responsibilities and work experiences. Only then can the ESN become versatile 'equipment' (Riemer & Johnston, 2017) that increases work efficiency and effectiveness, and hence positively influences its usage.

Perceived reflexivity is not found to have a significant impact on the utilitarian value of the ESN for the user. We were hence not able to prove that a user who believes that their activities in the ESN have an impact on the system's design and functionality perceives a higher utilitarian value for the infrastructure. The results are difficult to interpret, since there is yet no related work in this field. The current literature focuses mainly on the interaction between technology designers and users, and shows how the relationship between these actors can influence the design or the acceptance and use of technologies (Harris & Weistroffer, 2009; Park & Park, 2014).

In sum, *ESNs can be understood as digital infrastructures* that help employees to carry out their work more efficiently and effectively. This in turn affects the question of a potential return on investment. Due to its versatility, unforeseeable usage by employees and the fact that the ESN is usually not directly linked to business processes, it remains difficult to calculate a monetary added value for the ESN. However, the question of a return may not be a useful one; for example, one would not attempt to estimate the added value of a communication infrastructure such as a telephone system. Managers may have to relinquish the idea that ESN projects are comparable to conventional IT projects, in which the system usage can be controlled and a return can be quantified or even monetized. At the same time, work in knowledge-centric organizations has become more autonomous and anonymous, and in these environments ESNs have become crucial for self-organized workers to create and access informational paths that are unforeseeable by the managers. In addition, they help to keep employees in touch and increase the potential effects of serendipity. Management should therefore not promote an ESN as a specific tool for very specific tasks, but could provide exemplary ESN use cases and leave room for the employees to build their own usage scenarios and networks.

Limitations

As in every research study, this work involves limitations due to its design choices and the nature of the dataset. We derive our findings from a single company, impacting the study's generalizability. Yet, the software engineering company can be seen as representing a knowledge-centric service industry that significantly relies on employee contributions. Moreover, the construct of interconnectedness reflects aspects that are not solely related to technical aspects, since it also captures the interconnectedness of employees. Even though this approach is based on multiple workshops to establish the construct, one may argue that zooming in on the technical aspects of interconnectedness could be more conclusive. We would hence advice to adjust and test the corresponding construct items. In addition, we focused on antecedents of perceived usefulness, not of perceived enjoyment. As a consequence of this study design, we did not test, if single items such as INT3 also correlate with perceived enjoyment. Also, the investigation was conducted in Germany, and the findings may not be directly transferable to cultures of other countries in non-Western areas. In addition, behavioral intention does not necessarily lead to actual usage. Unfortunately, we were not able to analyze if the individual's behavioral intention of continued use did lead to actual use behavior, because of impeding data privacy policies.

Conclusion

In this work, we found that both, the utilitarian value as well as hedonic motivations influence ESN use continuance in organizations. We furthermore showed, that ESNs can be understood as digital infrastructures and that especially the attributes of adaptability, invisibility-in-use, interconnectedness and versatility of the ESN have a significant positive influence on its perceived usefulness. The results offer a new perspective on organizational technology, which can help to explain the gap between the perception of an ESN as being useful and the concurrent problem of measuring its added value. ESNs as digital infrastructures are flexible, constantly evolving enablers for multiple purposes, which cannot be defined beforehand. An added value for the individual and the company is an option rather than a promise.

With this study, we hence significantly increase the still limited understanding of the ESNs' "essence" by reconceptualizing them as digital infrastructures. This allows us to address questions that have been unanswered before, having a substantial impact on current and future ESN research as well as ESN management. Furthermore, we established and introduced a new instrument to analyze the perception of digital infrastructure characteristics, which did not exist before and may support future studies in any field of infrastructure research. In addition, we are also the first to directly compare the importance of usefulness and enjoyment of social technologies at the workplace for use continuance. Therefore, this study contributes to the information systems research and adjacent fields in general, but it also covers specific topics of the ESN community.

Future studies could benefit from a longitudinal approach that compares the behavioral intention with the actual, continuous engagement in the ESN. Also, future research should investigate the perception of ESNs as infrastructures in different companies of the same industry, between different industries as well as between different cultural settings. Also, the perceived infrastructure characteristics of different ESNs such as Confluence, IBM Connections, Jive, Slack, Sharepoint, Yammer or others could be analyzed. In addition to our quantitative investigation, future studies might add content analysis or qualitative interviews with both users and managers to learn more about the consequences that an infrastructure perspective on ESNs creates. In addition, a new approach on how to measure the value or return on investment of digital infrastructures would be of interest to researchers and practitioners.

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A.h P8: Digital Transformation in Higher Education – New Cohorts, New Requirements?

Fact Sheet of Publication P8

Title	Digital Transformation in Higher Education – New Cohorts, New Requirements?
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Abstract

Digital transformation refers to changes that digital technologies cause and that influence various aspects of human life. Previous researchers mainly focused on the impact of the digital transformation in the context of commercial organisations and business processes. In this study, we aim to examine how digital transformation affects universities and students. We examine differences and changes in the usage of collaboration and communication platforms between different groups of members at the university and within the university lifecycle. To gain new insights, a qualitative case study with semi-structured interviews was conducted. One of the main results shows that Bachelor and Master students prefer the usage of social network sites for collaboration and communication while Ph.D. students and employees do not. Even though an increasing number of modern platforms for direct communication is offered, the results show that the communication between the groups of students and employees still takes place via email.

Keywords: *Digital Transformation, Higher Education, Collaboration, Technology Adoption*

Introduction

Technology has become a fundamental part of our daily life. Today, IT artifacts can be discovered at home, work, education, transport, or leisure. Due to the drastically shift of technology, the whole society is changing in the way it communicates and collaborates. Prior research has started to focus on this phenomenon which is widely known as digital transformation (Henriette, Feki and Boughzala, 2015). Digital transformation does not only refer to a shift of technology. According to Stolterman and Fors (2004) digital transformation can be understood as the "changes that the digital technology causes or influences in all aspects of human life" (p. 689). Hence, the authors claim the prevalent "one-dimensional" understanding of information technology in Information Systems (IS). Digital transformation leads to an increasingly interconnected reality. In enterprise contexts, digital transformation encourages an organizational shift, where big data, analytics, cloud computing, mobile applications and even social media platforms have become omnipresent (Nwankpa and Roumani, 2016).

Previous research mainly focused on digital transformation in the context of commercial organizations and business processes, but there still exists a lack of research that determines the impact of digital transformation in the context of collaboration and communication at universities. As shown in prior research, social media technologies are currently affecting the way students communicate and collaborate at universities (Tess, 2013). Nevertheless, it is important to emphasize that technology is continuously and rapidly evolving. Even people from the same generation grew up with different types of technology (Akçayır, Dündar and Akçayır, 2016). Moreover, in case of universities, people with different demographical and educational backgrounds are forced to cooperate, collaborate and communicate together for a common goal. Thus, there might be significant differences in the usage habits depending on their technology affinity, which can in turn determine the success of the collaboration process. As this research area is yet an unexplored field we raise the following research question:

How does the usage of digital platforms differ between different groups of university members?

We also want to uncover collaboration and communication problems at the universities and to derive corresponding implications for the design and functionality of these platforms. To fill this research gap, a qualitative case study with semi-structured interviews was conducted to gain first insights in this research area. Through these insights it was possible to emphasize the relevance of digital transformation in the context of university and to provide a foundation for further research.

The next section provides a literature review on adoption and usage of technology in higher education, followed by the theoretical background of our study: the Collaboration Virtualization Theory. We will then describe our research design and subsequently show the empirical results. Research method and results will be presented and critically reflected in the discussion section. This paper ends with a conclusion and outlook to further research.

Adoption and Usage of Technology in Higher Education

Communication and collaboration systems are described as computer-based systems which support groups of people in common tasks or goals and which provide an interface to a shared environment (Borghoff and Schlichter, 2000). Alnuaimi, Robert and Maruping (2010) state that there exists a growing trend of using collaboration technologies to

support teamwork. A possible explanation for this trend may be that technology is a significant factor in facilitating the success of virtual teams (Majchrzak, Malhotra, Stamps and Lipnack, 2004). Communication and Collaboration Technology also provides numerous advantages for higher education. It allows to establish tools for sharing and communication between the various stakeholders involved in scientific research at universities (Elhissi and Haqiq, 2016). Furthermore, Information and Communication Technology (ICT) is important for education and it supports effective access to information and services (Incheon Declaration, 2015; Qingdao Declaration, 2015). A study by Li, Zheng, Shen and Guo (2015) demonstrates that students appreciate collaboration technology within group projects. Functionalities like content sharing, features for mobile support and interaction with social network sites (SNS) were valued as important features regarding collaboration technology (Li, Zheng, Shen and Guo, 2015).

Research shows that there exists an emerging trend of adopting different technologies in higher education besides conventional communication and collaboration systems. According to Kam and Katerattanakul (2010), Web 2.0 collaboration tools could be useful to support collaborative learning in a team-based environment as well as knowledge dissemination (Rollett, Lux, Strohmaier, Dosinger and Tochtermann, 2007). Especially, document management and the flexible usage regardless of time and user's location are beneficial functions (Kam and Katerattanakul, 2010). Furthermore, social media is considered as a communication and collaboration tool in higher education. According to Martin, Diaz, Sancristobal, Gil, Castro and Peire (2011) communication and collaboration are enhanced via the usage of SNS for educational purposes. Tess (2013) describes social media as omnipresent "at the university where technology [transforms] the ways students communicate, collaborate and learn" (p. A60). A study by King, Greidanus, Carbonaro, Drummond and Patterson (2009) demonstrates that the adoption of an educationally structured social networking environment supports effective communication. Additionally, research shows that social media use can facilitate students' collaborative activities (Zhang, Chen, Sun and Wang, 2016) and improve students' collaborative learning abilities and performance (Al-rahmi and Othman, 2013). Furthermore, Truong and Dustdar (2011) state that collaboration between various researchers and scientific groups could be improved by cloud computing. Literature also showed that the integration of collaboration features in a University Cloud Computing Service is highly requested (Meske, Stieglitz, Vogl, Rudolph and Öksüz, 2014; Stieglitz, Meske, Vogl and Rudolph,

2014). They also uncover a demand for features like sharing documents with other persons, real-time collaboration, version management of documents and commenting others‘ documents. The survey’s results additionally prove that the requirement for collaboration features differs between students and employees.

Regarding the different members of a university lifecycle, namely Bachelor students, Master students, Ph.D. students and employees, it could be supposed that they differ in their digital affinity and in their usage of ICT since they grew up with different kinds of technology. When talking about differences in the usage of technology, there are often two groups of people named: “Digital Natives” and “Digital Immigrants”. The terms Digital Natives and Digital Immigrants describe the difference between individuals that grew up using “new” technology their whole live and individuals that adopted the “new” technology at a later point in their life (Prensky, 2000). Originally, Digital Natives are defined as individuals born after 1980 with different technological skills as possessed by the members of the prior generation (Prensky, 2000). However, earlier studies found that it is too easy to just reduce Digital Nativeness to age, since there also exist important psychological, organizational and social factors (Wang, Myers and Sundaram, 2013). Earlier research found that even individuals within each respective age band differ among each other relating to their Digital Nativeness (Akçayır et al., 2016). One finding of the research conducted by Akçayır et al. (2016) demonstrated that there exist significant differences between the academic year and the Digital Nativeness. This finding suggests that a higher state in a university lifecycle makes an individual more likely to be a Digital Native. It seems to be conceivable that the different members of a university lifecycle also differ in their usage of ICT. But rather than just detect how people use media, it is much more revealing to understand the motives behind the usage of media. Studies focusing on the usage of technology by students found that they may differ in their motivations for using technology (Parker and Plank, 2000). Recently, there has been some research on students’ motives for using a certain type of technology. Guo and Tan (2007) examined university students’ motives for using computer mediated communication tools. They found the most important motives to be interpersonal/social utility, convenience and information seeking. Stevens, Guo and Li (2014) further investigated the motives for using technology mediated learning platforms in higher education and found accessibility, information seeking, interaction and the managing of content to be essential for the usage of those platforms. But still, there is a lack of research concerning

the usage and adoption of communicative and collaborative tools in an academic context, especially concerning differences between the different states in the university lifecycle.

Theoretical Background: A Collaboration Virtualization Theory

Through the rise of technology, most collaboration processes are virtual to a certain degree (Griffith, Sawyer and Neale, 2003). Hence, the overall collaboration process is rather a conjunction of physical and virtual activities than purely one of the two extremes. Also, the communication and collaboration process between the members of universities may contain both physical and virtual activities. To understand how the usage of communication and collaboration technology differs between the different states in the university lifecycle, it is also important to consider the factors, which may influence the motives and the usage of a certain communication and collaboration system.

Fan et al. (2012) developed the Collaboration Virtualization Theory, which provides an overview of factors that have already been proven to be significant for virtual collaboration. Fan et al. (2012) aim to collect factors of collaboration which influence the suitability of virtualization and to examine how those factors impact the design of effective collaboration systems. The authors identified three different main categories of characteristics which are determining the suitability of collaboration virtualization: the team, the task and technology characteristics. Besides the technology, researchers have also shown that the team itself affects the collaboration process. Moreover, the authors derive two team characteristics as predictors of collaboration virtualizability: the team relationship and the team experience. Thus, the experience and the familiarity of the team with task will reduce uncertainty and further lead to an improved collaboration process (Littlepage, Robinson and Reddington, 1997). Further, Aubert and Kelsey (2003) pointed out that a lack of relationship and trust between the team members reduces the virtualizability of collaboration. The second category, the task characteristics, involves three important indicators of the nature of collaboration tasks: the task urgency, complexity and sensitivity. For example, researchers have found that a team is more likely to use synchronous communication media, if the team performs more complex tasks (Bell and Kozlowski, 2002). Similarly, people are more likely to use real-time and synchronous communication media, like face-to-face meetings or telephone, if the task is perceived as urgent (Straub and Karahanna, 1998). Not only the complexity of the task, but also the data security is an important challenge to handle, especially in the case of broader teams (Smith and McKeen, 2011). As already mentioned above, the literature has shown that

technology is a significant factor in facilitating the success of collaboration (Majchrzak et al., 2000). Thus, the third category describes the technology characteristics and is divided in two different factors: the technology accessibility and the capacity. For example, researchers have already shown that a high accessibility of a collaboration technology increases the usage of an IT-System in virtual teams (Park, Roman, Lee and Chung, 2009). Also high technology functionality and information richness, in terms of capacity increase the usage of an IT-System in virtual teams (Smith and McKeen, 2011). In addition, the authors assume that the multi-task degree might have a moderating effect on the virtualizability of collaboration technology. The multi-task degree is defined as the number of tasks the team members have to participate at the same time. Fan et al. (2012) postulate that a high degree of multi-tasking could have negative consequences on the success of the collaboration tasks and they further assume that it might moderate the relationship between the team, the task, the technology and the collaboration virtualization. Thus, the authors highlight that collaboration technologies should provide additional functionalities for the management of different tasks.

The Collaboration Virtualization Theory (Fan et al., 2012) displays just a limited overview of all factors, which influence the effectiveness of a collaboration technology. Nevertheless, it provides an insight in the potential factors, which might affect the usage of collaboration technology in the context of the university. Furthermore, these factors could provide possible reasons why the usage differs between the mentioned groups of university members in case of the presented study. The following section presents the research and analysis method.

Research and Analysis Method

To answer the research question how the usage of digital platforms differs between different groups of university members, semi-structured interviews were conducted. A qualitative design was chosen to gain detailed unsupported insights about the different groups and their usage of digital platforms. To define the structure of the interviews an interview guideline was developed based on the Collaboration Virtualization Theory. The theory defines three main factors that influence the success of team work: the team, the task and technology characteristics (Fan et al. 2012). Those factors are depicted in the interview guideline regarding to experience, type and frequency of group tasks and usage of features. The semi-structured interview allows a change of order and additional questions if it seems necessary (Kuckartz et al., 2008). The guideline includes nine main

questions regarding the frequency of group work, knowledge about and usage of digital platforms for collaboration and communication, type of group work, usage of different features, experience with digital platforms, trust in digital platforms for communication and collaboration and elaboration of university platforms. All topics assessed reasons for choosing different options and features to identify why suspected differences occur.

To find interviewees, four groups were categorized that fit with the university lifecycle model. All interviewees are associated with a German university and their studies were related to the discipline of Information Systems. To make sure that representative persons for each group are interviewed, data of the "Statistisches Bundesamt" (Federal Office of Statistics, Statistisches Bundesamt, 2016; Hähnel and Schmiedel, 2016) was consulted and the following categorization was established. Bachelor students should be between 18 and 24 years old and in the 4th till 6th semester of their studies. Master students are 24 to 26 years old, studying in their second or 4th semester. Ph.D. students are aged 27 to 31, employees 35 to 39, both working for at least one year. Two persons of each group were interviewed, one female and one male. Except for the male employee, who was 30 years old, all interviewees fulfilled these standards. All interviews were conducted in face-to-face sessions at the university Duisburg-Essen.

The analysis of the transcribed interviews was based on Mayring's qualitative content analysis (2010). Due to this method, the material is generalized in the first place and then reduced during an abstraction process (Mayring, 2010). The central aspect of qualitative content analysis is the development of a categorical system which helps to identify the aspects that seem necessary for answering the research question from the wealth of the interview material (Vogt and Werner, 2014). To derive an optimal coding guideline, the first 19 categories were extracted from the interview guideline. After the first coding process, eleven inductive topics were added, resulting in overall number of 30 topics. All categories should be distinct. The validity of the first coding process was tested with a second coder. As a decent accordance of the coders was proved (.918), all interviews were finally coded. After analysing all transcripts, two categories (type of features, platform usage of other parties, mobile usage and topic of work) were deleted, since they were irrelevant for most interviews.

Results: Differences in Using Digital Platforms between Cohorts

Overall eight main categories were derived from the previous coding process. Group Tasks, Digital Platforms, Evaluation, Features, Interaction, Experience, Safety and Digital Offering).

Group Tasks: The first main category can be summarized as *group tasks*. The subcategories identified were *frequency of group work, type of group tasks, complex group tasks, less complex group tasks*. While Bachelor students answered that they work in groups "increasingly often", Master students stated they do group work "very often". Employees and the Ph.D. students reported that collaboration and communication tasks are part of their "daily" routine as they usually work in teams. The results show that the frequency of collaboration and communication tasks increases along the university lifecycle, even though there was no increase from Ph.D. students to employees. This goes in line with earlier research, which showed that individuals with higher levels of education are more familiar with professional software and thus use it more frequently (Madadi, Iravani and Nooghabi, 2011). Of course, these differences are related to the academic status and can also be affected by individual factors. Bachelor students mentioned tasks like "exercises", "presentations" or "practice projects" as common tasks to solve in groups. Master students also mentioned "writing reports", "surveys" and "seminar work", which lead into a more scientific direction. The most complex task for them was "writing reports". Ph.D. students and employees showed a lot of overlaps in their answers. They mostly mentioned "writing reports", "publishing papers" and "empirical work" as complex tasks.

Digital Platforms: The category *digital platforms* includes the *knowledge and usage of digital platforms* as well as *reasons for using or not using* those platforms and the *forms of usage*. All participants mentioned a large variety of platforms they know, e.g. social media platforms like Facebook, as well as messengers like WhatsApp. Also, university platforms like Moodle or Basic Support for Collaborative Work (BSCW) were mentioned the majority of participants. Moodle and BSCW are collaboration and communication platforms that are used by various universities to organize seminars and lectures. Cloud storage offers like Dropbox, Google Drive or the university equivalence sciebo (Vogl et al., 2016) are all known, and used by all groups to create and exchange documents. This finding is in line with the research of Stevens et al. (2014) who found information seeking and the managing of content to be essential reasons for using a platform at universities. Bachelor and Master students both mentioned they mainly use Facebook and WhatsApp as communication and collaboration platform. Ph.D. students mostly use those platforms

for private or less sensitive communication, while employees state to know them but do not use them for collaboration. Ph.D. students and employees preferred known and established platforms like Moodle or BSCW because they like to separate private and professional matters. Bachelor and Master students on the other hand prefer social media and messengers, because they want to use a platform they also use for private matters so they do not miss anything due to push messages and mobile applications.

Evaluation of platforms: The *evaluation of platforms* consists of *general evaluations, advantages of platforms* and *disadvantages of platforms*. General evaluations of employees see Moodle and email as the "most important" platforms in the university context. Both are easy to work with, handle and help to separate private and professional matters. Ph.D. students also rate Moodle as a good platform but criticize the "one-sided communication". Bachelor and Master students stated advantages in platforms with higher reach for their communication "[…] for example WhatsApp or Facebook, because you also use it for private matters, so you practically can't miss out on anything". In contrast Ph.D. students and employees want to separate private and professional matters. This makes clear that Bachelor and Master students like to use social media while Ph.D. students and employees don't want to use social media for business collaboration. This finding also accords to the research conducted by Tess (2013) who found social media to transform the ways students communicate and collaborate.

Features: The category *features* includes the subcategories *obstructive features*, *helpful features*, *not used features* and *used features*. Master students criticized that Facebook and Google Drive lack a satisfying representation of files. Ph.D. students stated the inconvenient invitation of members in BSCW, while employees reported that the role assignment on Moodle is obstructive. Bachelor and Master students don't use Moodle and BSCW for communication purposes but mostly for downloading documents. On the other hand, the Ph.D. students upload documents via Moodle and BSCW. Regarding Facebook and WhatsApp Bachelor and Master students appreciate the simple communication and the possibility to exchange files. Ph.D. students don't exchange documents via Facebook. The employees mainly use email for communication purposes and exchange of information and files. In contrast with the Ph.D. students the employees use Google Docs for creating and commenting documents. Remarkable findings are that in contrast to Ph.D. students and employees, Bachelor and Master students are willing to use SNS for university purposes.

Interaction: Regarding the category *interaction with other parties* the Ph.D. students and the employees stated that they like to communicate via Moodle with students, because they can reach all at once. The findings show that both groups of students don't communicate via this platform, which is also reported by a Ph.D. student: "I write something […], but nothing happens. In case they write an email […]." This supports other studies that already showed that the interaction with other people is regarded as reason for the usage of a platform (Guo and Tan, 2007). The Bachelor students mentioned as an advantage that they stayed in contact with their docent on platforms, but named as a disadvantage that the docent could read their communication. So, both groups of students pointed out that they have to pay attention to the tonality of their writings when interacting with employees of the professorship. Recapitulating, these findings show that the presence of different groups on one platform can lead to different consequences for the groups and can be perceived as helpful and restrictive at the same time.

Experience: The category *experience* subdivides into *experience before university activities*, *context of experience* and *chronological order*. The Bachelor, Master and Ph.D. students have rather used communication than collaboration platforms and SNS like Facebook or WhatsApp before their activities in higher education. The groups of Bachelor and Master students have used these SNS already during their school days. The employees named email as a previous used technology. Nearly every participant reported that they first started using collaboration and communication platforms at universities. The fact that both groups of students continued using SNS for university activities since their school days supports the assumption of Fan et al. (2012) where to experience is an important factor for successful collaboration.

Safety: Furthermore, the category *safety* and the subcategories *data safety regulations*, *unsafe platforms* and *safe platforms* were identified. Both groups of Ph.D. students and employees reported that they have to comply with regulations from their professorship which include that sensitive research data must not be revealed to the public. The Ph.D. students further elucidated that the usage of SNS is unwanted due to the named regulation. Nearly every research participant named Facebook as a very unsafe platform. In virtue of hacker attacks Dropbox is also perceived as unsafe as well as Google Drive because the company doesn't operate according to German data protection law. Regarding email the participants disagreed. An employee considered this platform as unsafe, because third parties could inspect it. On the other hand, one Ph.D. student evaluated email as safe due to codification. Nearly every participant assessed Moodle and BSCW as safe platforms.

Recapitulating, the findings reveal that SNS and platforms offered by international, large companies are judged as unsafe platforms, whereas platforms offered by higher education are considered as safe. Based on the fact that some participants mentioned safety concerns by themselves, one can conclude that safety of sensitive data is an important factor for collaboration according to Fan et al. (2012).

Digital Offering: The category *digital offering* subdivides into *evaluation of the digital offering from university* and *optimization of the digital offering from university.* The Bachelor and Master students use the platforms offered from the University of Duisburg-Essen only partially, but rated those as adequate and gave no recommendations for improvement. Concerning the mobile usage of a platform a Bachelor student preferred using the Asana App than the website due to quicker information retrieval, which could be considered as an improvement proposal. Ph.D. students assessed the offering as weak, so they wish for more features and a more attractive design. The employees evaluated the offered platforms as good.

Discussion and Implications

In summary, the research question refers to the differences between different groups of university members concerning their usage of digital platforms. The combined results showed that the four investigated groups can be classified into two main groups due to many similarities and differences. The first group exists of the Bachelor and Master students while the second group includes the Ph.D. students and the employees. Only little differences were found between Bachelor and Master students as well as between Ph.D. students and employees. The main differences were revealed between those two main groups. Obviously, it is common sense that the Bachelor and Master students as well as the Ph.D. students and the employees are corresponding with each other and that their state in the university lifecycle and their kind of work are more similar. Hence it isn’t surprising that the presented results mainly refer to differences between these two main groups. However, the noticeable differences were found in the categories of *group task frequency*, *usage of platforms*, *interaction with other parties* as well as for the *experience* with communication and collaboration platforms.

One main finding is the rise of the frequency of group tasks among the university lifecycle whereupon there is no difference between Ph.D. students and employees. This finding can be attributed to the specification of each state and the associated requirements.

Another essential difference was found in the usage of platforms. Bachelor and Master students prefer the usage of SNS for collaboration and communication while Ph.D. students and employees do not want to use SNS for their work since they prefer to separate private and professional matters. This is especially surprising since all groups assessed SNS as being unsafe. The fact that students nevertheless use those kind of platforms could be caused by the experience they have with the platforms as well as to their familiarity with the platform. Hubona and Whisenand (1995) already showed that the system familiarity significantly affects the usage frequency and volume. Since the group of Ph.D. students and employees grew up with another kind of technology, they are not as familiar with SNS as students are. Furthermore, it seems possible that the Bachelor and Master students possible don't understand the importance of data security and integrity which is possibly why they choose to use social media outlets instead of presumably secure sharing platforms. PhD and professionals might have a deeper commitment to work related research data, since these data build the foundation for any empirical and educational research results (Corti et al., 2014). As indicated by Wilms et al. (2016) professional researchers are increasingly aware of adequate Research Data Management, where to the responsibility in terms of data security is raises. Nevertheless, the results indicate that platforms which are hosted on universities' infrastructure appear safer than platforms hosted by international companies like Facebook or Google. Even email is valued as a safe communication tool. Furthermore, the findings show that there is a difference in the communication with the other party. While Ph.D. students and employees like to communicate with the students on the Moodle platform, the students don't reply via Moodle and prefer email for communication. Bachelor and Master students mentioned that the presence of the other group was perceived as inhibiting which could be a reason for the preferred usage of email. One could argue that the public communication constraints the students. Another possible reason for not actively using the Moodle platform mentioned by a Master student is the missing motivation and the assumption that someone else will ask the same question anyway so that you get the answer without being active yourself. Finally, an important difference was also found regarding the experience with digital platforms for collaboration and communication. Since Bachelor, Master and Ph.D. students stated that they already used SNS before their current employment and Bachelor and Master students already used SNS in their school days, one can assume that the familiarity with a platform fosters the continuing usage of that platform. This assumption is also supported by the statements of the employees who stated email as a previously used platform, which still is one of their main platforms for

communication. The differences in the experience with digital platforms for collaboration and communication can presumably be attributed to the digital transformation.

The results have several implications both for theory and practice. From a theoretical point of view, the present research should serve as a starting point for future research on the usage of communication and collaboration platforms in the university context. There is a need for conducting a long-term study to examine the development of the digital transformation within the next years. The emerging question is whether, i.e. people who are in their bachelor studies by now continue using the platforms they are currently using whenever they become Ph.D. students or employees or whether they adapt their usage of platforms to the state they are in. Another approach, surrendered from the interviews, is the investigation of whether the system familiarity is connected with the usage of a platform, even if beneficial alternatives are known. Earlier research already showed that there is a significant effect of system familiarity on usage frequency and usage volume (Hubona and Whisenand, 1995) and that individuals with higher levels of education are more familiar with professional software and thus use it more frequently (Madadi et al., 2011). Further research showed that the investigated cohorts actively chose a certain type of media to satisfy their needs. All groups expect certain properties from a platform and thus select the appropriate platform that fulfills their expectations. This finding is in line with the Uses and Gratification Theory (Katz, Blumler, and Gurevitch, 1974) which should be considered when conducting future research on the usage of digital platforms for collaboration and communication. One could identify the goals an individual has and examine whether someone's goals are associated with the platform they chose and identify the degree of awareness connected with that choice.

From a practical viewpoint, there are several implications to improve the communication and collaboration processes for different cohorts at the university and to support the communication and the exchange between students and employees. The added value from the present research mostly supports the work of the IT department of the university. The research gives several implications either for the optimization of the Moodle platform or for the development of a new platform. Due to the conducted interviews, several properties which are expected from an optimal platform were generated. These properties mainly reflect the common ground of all groups. First, it is important to be able to manage the access rights, so that both public and private communication within groups is possible. Additionally, a direct communication with the other party must be given. Further a mobile as well as a desktop usage is wished for just as an instant messenger and push

notifications. People also desire a cloud storage and an upload function for documents and files. Precise and clear data protection regulations are also wished for. Finally, all groups mentioned an easy usability and clarity of the platform as well as an attractive design to be essential factors. Although many SNS functions were mentioned, it still must be considered to develop a pure collaboration and communication platform for the university and to have a clear separation of private content.

Conclusion and Outlook to Further Research

In the present research eight interviews were conducted with members of the university, namely Bachelor students, Master students, Ph.D. students and employees. The aim was to identify differences between those groups concerning their usage of digital platforms for collaboration and communication at the university. The transcribed interviews were analyzed using qualitative content analysis. The uncovered differences between the cohorts in the university lifecycle explain why the IT department of the university is constantly confronted with new requirements. Since the digital transformation still takes place, new cohorts will evolve who differ in their preferences and requirements concerning the usage of digital platforms. The IT departments therefore faces the challenge to develop an offering that satisfies the needs of all groups involved in the university.

The presented research shows several limitations. First of all, there were qualitative interviews conducted, which provided an in-depth insight into the usage of digital platforms at the university. However, the insights are limited due to the small number of interviews. There is no guarantee that the analyzed students and employees are representative of the base population. There is a need for further investigation, which can be supported by quantitative research. Also a future survey with a large sample size is required. Further it is necessary to expand the research to other universities with other platforms and to other fields of study. Since the present research concentrated on one university and one course of study, a generalizability of the findings cannot be guaranteed. Both the university as well as the course of study are likely to influence the usage of digital platforms for communication and collaboration and should therefore be examined in future research. The present research revealed essential differences in the usage of SNS for communication and collaboration at university. To validate this finding future research mainly focusing on this aspect may be required in order to identify the impact of the diverse usage of SNS and to assess the possible integration of those platforms into the

platforms offered by the university. In addition, the present research explored that the communication between the group of students and the group of employees somehow is suboptimal. Further research needs to investigate the requests of each group so that deeper insights can be generated and the joint communication can be optimized.

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A.i P9: Wissensaustausch in Unternehmen: Wahrnehmung von Enterprise Social Software als Tool für den Austausch von sicherheitsrelevantem Wissen

Fact Sheet of Publication P9

Title	Wissensaustausch in Unternehmen: Wahrnehmung von Enterprise Social Software als Tool für den Austausch von sicherheitsrelevantem Wissen
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Abstract

Der erfolgreiche Wissensaustausch innerhalb von Unternehmen und Organisationen ist mittlerweile zu einem wichtigen Erfolgsfaktor im Wettbewerb geworden. Um den Wissensaustausch innerhalb der eigenen Grenzen zu fördern und bestehendes Wissen zu bewahren setzten immer mehr Unternehmen daher auf den Einsatz von Kommunikations- und Kollaborationssystemen wie Enterprise Social Software (ESS). Hier zeigt sich, dass MitarbeiterInnen immer noch skeptisch sind was den Einsatz dieser Systeme speziell beim Austausch von sensiblen Informationen und sicherheitsrelevantem Wissen angeht. In diesem Beitrag werden Ergebnisse einer Nutzungsstudie bei dem IT-Dienstleister einer international tätigen Versicherungsgruppe vorgestellt. Im Rahmen der Studie wurden die MitarbeiterInnen nach ihrer Meinung bezüglich Wissensmanagement, zu ihren Sicherheitsbedenken sowie zu ihren Kenntnissen über die Berechtigungen in SharePoint, befragt. Die Ergebnisse zeigen, dass auf Seiten der MitarbeiterInnen ein hohes Maß an Unsicherheit existiert, welche Daten abgelegt, geteilt und verbreitet werden dürfen. Als Folge dessen sinkt die Akzeptanz gegenüber dem Informationssystem, und die Bereitschaft Wissensmanagement zu betreiben sinkt.

Keywords: *Wissensmanagement, Enterprise Social Media, IT Sicherheit, Technologie Akzeptanz, Datenschutz*

Einleitung

Wissen stellt eine wichtige und strategische Ressource für Unternehmen und Organisationen dar und ist zu einem wesentlichen Erfolgsfaktor geworden. Für das Wachstum, die Weiterentwicklung und den Wettbewerb eines Unternehmens ist es heute unabdingbar, den Wissensaustausch innerhalb der eigenen Grenzen zu fördern und bestehendes Wissen zu bewahren. Mit steigender Wissensintensität von Prozessen, aber auch durch mehr Projektarbeit sowie Internationalisierung setzten immer mehr Unternehmen auf den Einsatz von Kommunikations- und Kollaborationssystemen um den Wissensaustausch in den eigenen Reihen effektiv zu gewährleisten. Als besonders geeignet für das Wissensmanagement haben sich dabei Informationssysteme wie Enterprise Social Systems (ESS), beispielsweise Microsoft SharePoint oder IBM Connections, herausgestellt. Durch ihre Architektur stellen ESS eine zentrale Anlaufstelle für die Mitarbeitenden dar und erlauben neben der unkomplizierten Wissensgenerierung

auch die Weitergabe und Erfassung von Expertise. Somit ermöglichen ESS einen effizienten Wissensaustausch und ein effizientes Wissensmanagement (Meske et al. 2014). Während sich die Literatur primär auf den Austausch von allgemeinem Wissen bezieht, existieren bisher nur wenige Erfahrungswerte inwieweit ESS auch für den Austausch von sensiblen Informationen und sicherheitsrelevantem Wissen geeignet sind. Sicherheitsrelevantes Wissen umfasst dabei die Art von Informationen, die für Sicherheitsangriffe prädestiniert sind – also sämtliche Informationen die in irgendeiner Art und Weise die Sicherheit des Unternehmens, eines Projektes, eines Kunden oder einer Person betreffen. Das schließt auch Wissen ein, dass nur für bestimmte Personenkreise innerhalb eines Unternehmens zugänglich sein sollte (z.B. sensible Mitarbeiterinformationen, Gehalts- und Finanzinformationen, etc.). Bezogen auf ESS könnten dies etwa Finanzdaten oder strategische Entscheidungen sein, welche aufgrund innerer Hierarchiestufen nicht jedem Mitarbeiter zugänglich sein sollten. So ist es beispielsweise für Führungskräfte wichtig, dass Dokumente in einer frühen Phase der Bearbeitung zwar in entsprechenden Kreisen zugängig sein müssen, jedoch noch nicht für das gesamte Unternehmen einsehbar sind. Falls eine ESS auf externen Servern gehostet wird besteht zudem die Gefahr eines Datenlecks nach außen (Beuthner 2016).

Nach Pirkkalainen und Pawlowski (2014) können Sicherheitsbedenken bei Mitarbeitenden dazu führen, dass Informationssysteme nicht genutzt werden. Es kann somit angenommen werden, dass Mitarbeitende Bedenken haben sensibles Wissen innerhalb eines Systems zu teilen oder zu speichern, wenn sie dem System nicht vertrauen und/oder unsicher sind, wie die sensiblen Informationen geschützt werden. Auch können Sicherheitsbedenken entstehen, wenn Mitarbeitende nicht wissen, wer Zugriff auf die Informationen hat und wie Berechtigungskonzepte von ESS gehandhabt werden. Im Rahmen dieses Beitrages soll daher die Nutzung von ESS im Kontext von sicherheitsrelevantem Wissen betrachtet werden. Es soll untersucht werden, inwieweit sich Kommunikations- und Kollaborationsinstrumente wie ESS dafür eignen sicherheitsrelevantes Wissen zu verwalten und welche Hürden auf Seiten der Mitarbeitenden bestehen.

In diesem Beitrag werden Ergebnisse einer Nutzungsstudie innerhalb eines IT-Dienstleisters einer international tätigen Versicherungsgruppe mit mehr als 40.000 Mitarbeitenden vorgestellt. Die Versicherungsgruppe betreibt unternehmensweit die Kommunikations- und Kollaborations-Plattform Microsoft SharePoint in der Version 2010, welche als Anwendungsbeispiel für ein ESS im vorliegenden Beitrag dient.

Microsoft SharePoint ist eine Kollaborations-Anwendung, welche neben Intranet, Content-Management und Geschäftsanwendungen die Möglichkeit bietet, Wikis, Blogs, soziales Tagging, persönliche Webseiten und Nutzerprofile anzulegen. Die Daten für die vorliegende Untersuchung wurden durch eine webbasierte Umfrage gewonnen. Die Stichprobengröße umfasst insgesamt 150 ausgefüllte Fragebögen. Im Rahmen der Umfrage wurden die Mitarbeitenden nach ihrer Meinung bezüglich Wissensmanagement, zu ihren Sicherheitsbedenken sowie zu ihren Kenntnissen über die Berechtigungen in SharePoint befragt.

Die Autoren stellen auf Basis der in der Studie gewonnenen Erkenntnisse konkrete und übertragbare Lösungsansätze für die Praxis im Kontext des Digital Workplace vor. Die Ergebnisse zeigen auf, welche Probleme und Schwächen die Mitarbeitenden in der Nutzung von ESS im Kontext sicherheitsrelevanter Daten sehen. Zudem werden Handlungsempfehlungen aufgezeigt, wie ESS in Zukunft benutzt werden können, und wie Mitarbeitende im Umgang mit sicherheitsbezogenem Wissen geschult werden können. Die Ergebnisse sollen dabei helfen, das Wissensmanagement in Unternehmen weitreichend zu verbessern und das Potential von ESS umfangreicher auszuschöpfen.

Stand der Praxis und Forschung

Akzeptanz und Nutzung von Enterprise Social Software zum Wissensaustausch

Um den Wissensaustausch zu fördern und zu erleichtern, führen immer mehr Unternehmen Enterprise Social Systems (ESS) ein. Bekannte und häufig verwendete ESS Plattformen sind IBM Connections, Jive sowie Microsoft SharePoint. Aus theoretischer Sicht versteht man unter Enterprise Social Systems webbasierte Intranet Plattformen, die es den Mitarbeitenden ermöglicht, Inhalte zur Verfügung zu stellen, Antworten zu verfassen und die Vernetzung sowie den Austausch unter den Mitarbeitenden zu unterstützen (Kügler & Smolnik, 2014). ESS beinhalten i.d.R. Tools wie Blogs, soziale Netzwerke oder Wikis, die auf den Plattformen gebündelt angeboten werden. Ausgewählten Mitarbeitenden können Projektdokumente bereitgestellt werden und es lassen sich gemeinsam Inhalte erstellen sowie bearbeiten (Leonardi et al., 2013). In ESS werden alle Aktivitäten gesammelt und sind für Mitarbeitende zeitunabhängig erreichbar (Leonardi et al., 2013).

Die Einsatzgebiete von ESS in Unternehmen sind vielseitig: Durch ihre Architektur bieten ESS eine ganzheitliche Lösung, da verschiedene Anwendungen gebündelt werden und somit eine zentrale Anlaufstelle für die Mitarbeitenden darstellen. So eignen sich ESS zum unkomplizierten Austausch von Informationen sowie der Weitergabe von Expertise und ermöglichen somit einen effizienten Wissensaustausch sowie Wissensmanagement. ESS können dabei helfen, Barrieren des Wissensaustausches abzubauen. Studien zeigen, dass es Mitarbeitenden deutlich leichter fällt, innerhalb eines ESS zwischen den einzelnen Hierarchieebenen eines Unternehmens hinweg zu kommunizieren und Wissen auszutauschen (Riemer et al., 2014). Ferner ermöglichen ESS eine Kommunikation abseits von Meetings, wodurch die Wissensverteilung gefördert wird. Wissen beschreibt nach Probst und Kollegen *„[..] die Gesamtheit der Kenntnisse und Fähigkeiten, die Individuen zur Lösung von Problemen einsetzen. Dies umfasst sowohl theoretische Erkenntnisse als auch praktische Alltagsregeln und Handlungsanweisungen. Wissen stützt sich auf Daten und Informationen, ist im Gegensatz zu diesen jedoch immer an Personen gebunden. Es wird von Individuen konstruiert und repräsentiert deren Erwartungen über Ursache-Wirkungs-Zusammenhänge.“* (Probst et al., 2013, S.23).

Trotz zahlreicher Vorteile von ESS ist eine adäquate und effiziente Nutzung der Systeme innerhalb eines Unternehmens nicht zuletzt von einer aktiven Partizipation der Mitarbeitenden abhängig. Unternehmen können Wissensressourcen nur dann effektiv verwalten, wenn Mitarbeitende dazu bereit sind, Wissen mit anderen zu teilen. Grade in klassischen Organisationsformen ist es nicht unüblich, das eigene Wissen für sich zu behalten, gemäß der Einstellung „Wissen ist Macht“ (Schütt, 2016). So stellt Wissen für die Mitarbeitenden eine wertvolle Ressource dar, die geschützt werden soll. Durch das Teilen von Wissen und fachspezifischem Know-how wird diese Ressource jedoch frei verfügbar. Aktuelle Forschungsergebnisse aus verwandten Kontexten zeigen, dass Individuen häufig nicht dazu bereit sind jene wissensbasierten Ressourcen zu teilen, da sie u.a. befürchten, ihren Wissensvorteil zu verlieren (Wilms et al., 2018). Unternehmen selbst begünstigen ein solches Verhalten oft, indem künstliche Wissensvorsprünge geschaffen werden.

Enterprise Social Software im Kontext von sensiblem und sicherheitsbezogenem Wissen

Als weiteres Hindernis bei der Nutzung von ESS zum Austausch von Wissen gelten die Sicherheitsbestimmungen. Sicherheit bezieht sich dabei auf den Schutz von

Informationen innerhalb des Systems. Beim Einsatz von ESS muss der Schutz von Daten, Informationen und Wissen jederzeit gewährleistet sein. Grundsätzlich gilt es, rechtliche Rahmenbedingungen zu beachten. Hier lassen sich auch die primären Schutzziele der Informationssicherheit anführen. Daten in ESS müssen vor dem Zugriff durch unbefugte Dritte (Vertraulichkeit) sowie gegen unberechtigte Änderungen und Löschung (Integrität) geschützt werden und für berechtigte Personen sowohl verfügbar als auch nutzbar sein (Verfügbarkeit) (Beuthner, 2016). Hervorzuheben ist insbesondere die Rolle personenbezogener Daten. Da ESS auf der aktiven Teilnahme einzelner Personen sowie sozialer Interaktionen basieren, rücken die Mitarbeitenden in den Fokus. In Deutschland zählt der Schutz personenbezogener Daten zu den Kernanforderungen von Experten (vgl. Expert on Group, 2014). Bei der Verarbeitung von personenbezogenen Daten in sozialen Technologien, wie beispielsweise ESS, sind Maßnahmen zur adäquaten Sicherung der Daten gemäß § 9 BDSG durchzuführen. Darunter fallen u.a. die Zugriffskontrolle sowie die Einhaltung von Löschungsfristen (Ulbricht, 2016). Ferner verweist Schütt (2013) auf die Berücksichtigung der Globalisierung, da bei der Zusammenarbeit mit anderen Ländern die unterschiedlichen gesetzlichen Anforderungen bedacht werden müssen. Die im Mai 2018 in Kraft getretene Datenschutz-Grundverordnung (DSGVO) auf Ebene der Europäischen Union hat das Thema in den Blickpunkt der Öffentlichkeit geholt und die Brisanz der Diskussion verschärft. Insbesondere die Verwaltung personenbezogener Informationen auf eigenen oder extern gehosteten Servern hat hierdurch eine größere rechtliche Relevanz bekommen. So erschwert etwa das in der DSGVO aufgeführte Recht auf Löschung personenbezogener Daten die allgemeine Verwaltung und Erfassung von Mitarbeiterdaten in ESS.

Aus Sicht der verwaltenden Mitarbeitenden stellen sensible Daten bzw. sensibles Wissen eine zusätzliche Herausforderung dar. Bei der Verarbeitung der Daten innerhalb des ESS muss daher gewährleistet sein, dass die Daten nicht in die Hände unbefugter Dritter gelangen. Auch wenn ESS der umfassenden Kommunikation dienen, darf die Schaffung von Transparenz bezüglich der Informationen des Unternehmens nur einen bestimmten Grad erreichen. Probst et al. (2013) verdeutlichen, dass nicht alle Mitarbeitenden alles wissen müssen, sondern nur eine gezielte Wissensverbreitung sinnvoll ist. Mitarbeitende sollen nur Zugriff auf die für ihre Aufgabenstellung relevanten Wissensbestände besitzen. Zudem wird betont, dass die Schutzwürdigkeit bestimmter Wissensbestände eine natürliche Grenze für den Wissensaustausch darstellt. Da in ESS auch sicherheitsrelevante Informationen und Daten ausgetauscht werden, sind diese besonders

schützenswert (Beuthner, 2016). So müssen beispielswiese Führungskräfte in der Lage sein, Dokumente über geplante Umstrukturierungen oder neue strategische Ausrichtungen miteinander zu teilen, ohne dass diese in einer frühen Phase einem größeren Mitarbeiterkreis zugängig sind. Häufig bieten ESS hier die Möglichkeit, Daten nur für begrenzte Nutzergruppen einsehbar zu machen. Diese Funktionalitäten sind allerdings nicht immer leicht nachzuvollziehen. Mitarbeitende kennen nicht zwangsläufig die Berechtigungsstufen anderer Mitarbeitenden und können nur schwer beurteilen, wer tatsächlich Zugang zu den Daten hat.

Neben der Sichtbarkeit der Daten für spezielle Nutzergruppen ist auch die Haltbarkeit der Daten ein kritischer Aspekt bei der Archivierung. Ein Verlust von Daten kann zu erheblichen Wissensverlusten führen, was wiederum finanzielle Schäden auslösen kann. Sicherheitsbedenken sind oftmals die Hauptsorge von Mitarbeitenden bei der Nutzung von ESS. Wie Pirkkalainen, & Pawlowski (2014) argumentieren, herrscht auf Seiten der Mitarbeitenden oftmals ein geringes technisches Vertrauen gegenüber der Technologie. Noch heute herrscht das Vorurteil, dass Daten am sichersten auf der eigenen Festplatte oder einem externen Speicher (z.B. HDD oder USB) aufbewahrt werden (Wilms et al., 2016). Dass Cloud-basierte Lösungen eine längerfristige Speicherung und Sicherung der Daten gewährleisten können als lokale Backups, deren Haltbarkeit oft mit der Intaktheit eines einzigen Speichermediums verbunden sind, ist vielen Mitarbeitenden nicht bewusst.

Erkenntnisse aus dem Praxisunternehmen

Vorstellung des Praxisunternehmens

Im Rahmen der vorliegenden Arbeit möchten wir versuchen, die Akzeptanz und die Meinung von Mitarbeitenden gegenüber ESS zu untersuchen. Speziell betrachten wir dabei, inwieweit Mitarbeitende ESS nutzen und im Kontext des Austauschs von sicherheitsrelevantem Wissen beurteilen. Dazu wurde eine Untersuchung bei einem IT-Dienstleister einer international tätigen Versicherungsgruppe durchgeführt. Die Versicherungsgruppe ist eine der größten in Europa und weltweit in über 30 Ländern vertreten. Der IT-Dienstleister beschäftigt in Deutschland ca. 1.400 Mitarbeitende. Seit über 15 Jahren entwickelt und implementiert er IT-Lösungen und Innovationen sowie IT-Strategien und Dienstleistungskonzepte für das In- und Ausland. In der gesamten Versicherungsgruppe kommt Microsoft SharePoint in der Version 2010 zum Einsatz,

sodass SharePoint als Anwendungsbeispiel für ein ESS in der vorliegenden Arbeit dient. Microsoft SharePoint ist eine Kollaborations-Anwendung für Unternehmen, welche fünf Einsatzszenarien abdeckt:

- **Zusammenarbeit:** Steuerung von Projekten und Aufgaben
- **Soziale Netzwerke:** Persönliche Website, Diskussionsgruppen und Blogs
- **Intranet-Portale:** Verschiedene Website-Funktionen
- **Content-Management:** Dokumentenmanagement, benutzerdefinierte Suche und Metadaten
- **Geschäftsanwendungen:** z.B. Geschäftsprozesse abbilden

Microsoft selbst nennt sechs Funktionsbereiche: Sites, Communities, Content, Search, Composites, Insights. Sites strukturieren und stellen Inhalte dar. Unter Communities fallen Wikis, Blogs, soziales Tagging, persönliche Websites und Nutzerprofile. Sie dienen der Kommunikation. Hinter dem Begriff Content verbirgt sich vor allem das Dokumentenmanagement. Beispielsweise ist es möglich, Dokumente mit Metadaten zu versehen. Man kann sich u.a. per E-Mail über Änderungen informieren lassen. Die benutzerdefinierte Suche ermöglicht ein schnelles Auffinden von Informationen. Composites und Insights sind für die vorliegende Arbeit nicht relevant. Darüber hinaus können in SharePoint verschiedene Berechtigungen mit Hilfe von Gruppen vergeben werden. Es gibt drei Standard-Gruppen: Besitzer, die den Vollzugriff haben und somit auch administrative Rechte besitzen. Mitglieder, die Inhalte bearbeiten können und zuletzt Besucher, die Lesezugriff besitzen. Diese Möglichkeiten sind für das Teilen von sicherheitsrelevantem Wissen von besonderem Interesse. Somit lässt sich festhalten: SharePoint bietet unter einer einheitlichen Weboberfläche eine Lösungsplattform für die Optimierung der Zusammenarbeit von Mitarbeitenden. Die Plattform ermöglicht eine zentrale Ablage, Darstellung und Weiterverarbeitung von Informationen in Echtzeit und lässt sich individuell anpassen.

Erstmals wurde Microsoft Office SharePoint Server 2007 bei der Versicherungsgruppe eingeführt. Microsoft SharePoint in der Version 2010 wurde 2012 eingeführt und wird On-Premise genutzt. Das Ziel der Einführung war eine einfache und unternehmensweite Zusammenarbeit in Team- bzw. Projektseiten. Von Projekten und Abteilungen wird es

vorwiegend zum Dokumentenmanagement mit Hilfe von Dokumentenbibliotheken eingesetzt. Darüber hinaus werden Aufgaben verwaltet und Kalender gepflegt. Auch das Intranet, welches Neuigkeiten und Informationen für Mitarbeitende aufbereitet, basiert auf SharePoint. Dort werden auch Blogs und Wikis gepflegt. Weiterhin besitzen die Mitarbeitenden eine persönliche Seite (*Mysite)*. Dort können Informationen organisiert und Social Features, wie Newsfeed, Followed Sites oder ein User Profil gepflegt werden. Bei Durchführung einer Suche werden auch diese Inhalte angezeigt, sodass man beispielsweise gezielt einen Experten findet. Es lässt sich festhalten, dass SharePoint die zentrale Schnittstelle für das Wissensmanagement der Versicherungsgruppe bildet. Zum Informieren und Aufklären der Mitarbeitenden über SharePoint gibt es eine eigene Intranet-Seite. Dort befinden sich Nutzungshinweise bezüglich des Intranets, Links zum Thema Berechtigungen sowie ein Link zum Informationsschutz mit dem Hinweis, dass Sicherheit wichtig und ein sicherer Umgang mit Daten elementar ist. Folglich stehen den Mitarbeitenden Informationen zum Thema Sicherheit im Kontext von SharePoint zur Verfügung.

Umfrage zum Thema Wissensmanagement in ESS

Die Daten für die vorliegende Untersuchung wurden durch eine webbasierte Umfrage gewonnen. Die Umfrage wurde auf einer speziell für diese Arbeit erstellten SharePoint Seite eingepflegt und war vom 11. Dezember 2017 bis zum 12. Januar 2018 zugänglich. Voraussetzung für die Teilnahme war, dass die Mitarbeitenden SharePoint zuvor bereits genutzt haben.

Zunächst wurden die Teilnehmenden zu ihrem allgemeinen Nutzungsverhalten von SharePoint sowie zu ihren Motiven der Nutzung befragt. Weiterführend wurden sie nach ihrer Meinung bezüglich Wissensmanagement, zu ihren Kenntnissen über die Berechtigungen in SharePoint, zu ihren Sicherheitsbedenken sowie zu der Intention, sicherheitsrelevantes Wissen in SharePoint zu teilen, befragt. Am Ende der Befragung wurde um die Angabe soziodemographischer Daten gebeten und die Möglichkeit geboten, Anmerkungen zur Umfrage zu machen. Die Stichprobengröße beträgt 150 (N=150). 47,3 % der Teilnehmenden ist zwischen 46 und 55 Jahre alt und 14% sind über 55 Jahre alt. Es lässt sich festhalten, dass ein Drittel der Stichprobe männlich und zwischen 46-55 Jahre alt ist. Außerdem weist die Stichprobe einen hohen Bildungsgrad auf. 89% der Teilnehmenden verfügen über Abitur oder einen höheren Bildungsabschluss. Ferner liegt innerhalb der Stichprobe eine lange

Betriebszugehörigkeit vor. 72 % der Teilnehmenden arbeiten seit über zehn Jahren beim IT-Dienstleister der Versicherungsgruppe.

Neben den soziodemographischen Daten wurden die Mitarbeitenden bezüglich ihrer SharePoint Nutzung befragt. Rund 61% der Mitarbeitenden nutzt SharePoint seit über fünf Jahren. Knapp die Hälfte der Teilnehmenden gab an, gut bzw. sehr gut mit dem System zurecht zu kommen. Gut zwei Drittel der Teilnehmenden (66%) nutzen täglich SharePoint.

Vor allem für die Suche von Informationen sowie Dokumenten wird SharePoint genutzt, dicht gefolgt vom Teilen der Dokumente bzw. Informationen sowie dem Ablegen von Dokumenten. Tabelle 1 gibt eine Übersicht über die Häufigkeit der verschiedenen Nutzungsbedürfnisse an.

Tabelle 1 Nutzungshäufigkeit für bestimmte Zwecke

Wie häufig nutzen Sie SharePoint für folgende Zwecke?	**M**	**Häufigkeit der Antworten**				
		(1) Nie	**(2)**	**(3) Mehrmals im Monat**	**(4)**	**(5) täglich**
Suche von Dokumenten	4	1	14	42	40	53
Suche von Informationen	4	3	15	43	39	50
Ablegen von Dokumenten	4	10	30	28	35	47
Teilen von Dokumenten	4	16	27	31	35	41
Teilen von Informationen	3	18	32	28	33	39
Kommunikation	2	49	43	30	14	14
Suche von Expertise	2	57	50	31	8	4

[1] Abgefragt wurde auf einer Skala von 1-5, wobei galt: 1 = nie, 3 = Mehrmals im Monat, 5 = täglich.
[2] M = Median.

Neben den Nutzungszwecken wurde zudem erhoben, welche Funktionen innerhalb des ESS wie häufig genutzt werden. Anhand der Mittelwerte lassen sich das Dokumentenmanagement, die Suchfunktion sowie die Möglichkeiten der Zusammenarbeit (– z.B. Verwalten von Projekten, Koordination von Aufgaben) als die drei wichtigsten Funktionen von SharePoint für die vorliegende Stichprobe festhalten. Soziale Features wie soziale Netzwerke oder Mitarbeiterprofile werden aktuell weniger genutzt und für weniger wichtig empfunden (vgl. Tabelle 2). Neben SharePoint nutzen

die Befragten vor allem E-Mail (*Median* = 5) und das Telefon (*Median* = 5) sowie File-Laufwerke (*Median* = 5) im Arbeitsalltag.

Tabelle 2 Wichtigkeit einzelner Funktionen

Wie wichtig sind Ihnen folgende Funktionen von SharePoint?	**M**	**Häufigkeit der Antworten**				
		(1) überhaupt nicht wichtig	**(2)**	**(3) Mittelmäßig wichtig**	**(4)**	**(5) sehr wichtig**
Dokumentenmanagement	5	3	4	14	46	83
Suchfunktion	4	5	6	20	48	71
Zusammenarbeit	4	3	9	22	48	69
Wissensaustausch	4	5	16	34	53	42
Intranetportale	4	14	11	42	50	33
Wikis	4	8	26	37	48	31
Prozesse abbilden/ Workflows	3	24	31	34	37	23
Mitarbeiterportal/Profile	2	40	46	43	15	6
Soziale Netzwerke	2	47	44	32	17	10

[1] Abgefragt wurde auf einer Skala von 1-5, wobei galt: 1 = überhaupt nicht wichtig, 3 = mittelmäßig wichtig, 5 = sehr wichtig.
[2] M = Median.

Weiterhin wurden die Mitarbeitenden nach ihrer Meinung bezüglich des Wissensmanagements, zu ihren Sicherheitsbedenken sowie zu ihren Kenntnissen über die Berechtigungen in SharePoint befragt. Ein Großteil der Mitarbeitenden gab an, dass Wissensmanagement eine zunehmende Bedeutung für sie hat (*M* = 4) und das ein Bedarf darin besteht, schnell auf verfügbares Wissen zugreifen zu können (*M* = 4). Überdurchschnittlich hoch war allerdings auch die Anzahl der Nutzer die angaben, viel Zeit mit der Suche nach Informationen zu verbringen (*M* = 4). Abgefragt wurde auf einer Skala von 1-5. Dabei galt 1 als „Stimme überhaupt nicht zu“ und 5 als „Stimme voll und ganz zu“.

Während klar erkennbar ist, dass Wissensmanagement als ein wichtiges Thema empfunden wird, fällt die Einschätzung des Wissensmanagements im Unternehmen dennoch eher mittelmäßig aus. So gaben die Teilnehmenden an, nur bedingt über ausreichend Zeit zu verfügen um Wissen zu teilen bzw. zu dokumentieren. Zudem gaben die Mitarbeitenden an, dass Fachwissen häufig verloren geht sobald Mitarbeitende das Unternehmen verlassen. Tabelle 3 zeigt die Häufigkeit der Antworten.

Tabelle 3 **Einschätzung Wissensmanagement**

Einschätzung Wissensmanagement	**M**	**Häufigkeit der Antworten**				
		(1) Stimme überhaupt nicht zu	**(2)**	**(3)**	**(4)**	**(5) Stimme voll und ganz zu**
Bei uns helfen sich die Mitarbeitenden gegenseitig und geben Wissen weiter.	4	3	6	34	63	44
Ich habe genügend Zeit, um mein Arbeitswissen aktuell zu halten.	3	8	45	54	32	11
Ich habe genügend Zeit, um mein Wissen zu teilen bzw. zu dokumentieren.	3	12	48	59	27	4
Beim Verlassen von Mitarbeitern bleibt das Fachwissen im Unternehmen.	2	46	65	29	9	1

[1] Abgefragt wurde auf einer Skala von 1-5, wobei galt: 1 = überhaupt nicht wichtig, 3 = mittelmäßig wichtig, 5 = sehr wichtig.
[2] M = Median.

In der Stichprobe liegen darüber hinaus mittelmäßige bis schlechte Kenntnisse über Berechtigungen im System vor. So gaben ca. 25% der Teilnehmenden an, dass sie keine Kenntnisse darüber hätten, wer auf den eigenen Arbeitsbereich in SharePoint Zugriff hat. Auf die Frage, ob die Mitarbeitenden die Berechtigungsstruktur von SharePoint gut nachvollziehen können, stimmten nur ca. 25% zu (Median >=4). Tabelle 4 veranschaulicht die Häufigkeiten der Antworten, welche die Berechtigungskenntnisse erfassen.

Tabelle 4 Berechtigungskenntnisse

Kenntnisse über Berechtigungen	M	Häufigkeit der Antworten				
		(1) Stimme überhaupt nicht zu	(2)	(3)	(4)	(5) Stimme voll und ganz zu
Ich weiß, wie ich Dokumente/Seiten/Inhalte in SharePoint freigeben kann.	3	23	32	23	36	36
Ich weiß, welche Personen auf meinen Arbeitsbereich in SharePoint Zugriff haben.	3	37	23	23	33	34
Ich weiß, welche Informationen/Dokumente ich in SharePoint teilen darf.	3	28	27	29	44	22
Ich weiß, welche Berechtigungsstufen in SharePoint existieren.	3	36	25	25	33	31
Die Berechtigungsstruktur von SharePoint kann ich gut nachvollziehen	2	39	38	35	23	15

[1] Abgefragt wurde auf einer Skala von 1-5, wobei galt: 1 = „Stimme überhaupt nicht zu“; 5 = „Stimme voll und ganz zu“.
[2] M = Median.

Um herauszufinden, ob die Kenntnisse über Berechtigungsstrukturen in SharePoint einen Einfluss auf andere Faktoren wie z.B. Sicherheitsbedenken haben, wurde die Stichprobe für die weitere Analyse in zwei Gruppen unterteilt. Dazu wurde zunächst für jeden Teilnehmenden ein Gesamtmittelwert über alle fünf Fragen bzgl. der Kenntnisse über Berechtigungen gebildet. Alle Probanden mit einem Gesamtmittelwert (= Median der Berechtigungskenntnisse) >3 wurden der Experten-Gruppe zugewiesen. Alle Probanden mit einem Gesamtmittelwert ≤3 wurden der Gruppe „Nicht-Experte“ zugeteilt. Beide Gruppen enthielten jeweils 75 Probanden.

Im weiteren Verlauf des Fragebogens wurden zunächst die beiden Dimensionen "Sicherheitsbedenken“ und „Intention sicherheitsrelevantes Wissen in SP zu teilen“ erhoben. Um zu überprüfen, ob und inwiefern die Kenntnisse über Berechtigungen der Mitarbeitenden einen Einfluss auf die beiden Dimensionen haben, wurden die Antworthäufigkeiten getrennt voneinander betrachtet. Tabelle 5 und 6 zeigen die Antworthäufigkeiten je Gruppe (E=Experte; N.E.= Nicht-Experte).

Tabelle 5 Sicherheitsbedenken der Mitarbeiter

Sicherheitsbedenken	Gruppe	M	Häufigkeit der Antworten				
			(1) Stimme überhaupt nicht zu	(2)	(3)	(4)	(5) Stimme voll und ganz zu
Ich fühle mich sicher, wenn ich sensible Informationen über SharePoint versende.	E.	3	7	13	20	22	13
	N.E.	3	15	17	31	10	2
Die Sicherheit sensibler Informationen ist ein Haupthindernis für meine Verwendung von SharePoint.	E.	2	32	23	14	3	3
	N.E.	3	24	11	28	7	5
Insgesamt ist SharePoint ein sicherer Ort, an dem ich sensible Informationen speichern kann.	E.	3	15	12	21	19	8
	N.E.	3	20	16	30	7	2

[1] Abgefragt wurde auf einer Skala von 1-5, wobei galt: 1 = „Stimme überhaupt nicht zu“; 5 = „Stimme voll und ganz zu“.
[2] M = Median, E = Experten Gruppe, N.E. = Nicht-Experten Gruppe.

Tabelle 6 Intention SharePoint zum Austausch von sicherheitsrelevantem Wissen zu nutzen

Intention sicherheitsrelevantes Wissen zu teilen	Gruppe	M	Häufigkeit der Antworten				
			(1) Stimme überhaupt nicht zu	(2)	(3)	(4)	(5) Stimme voll und ganz zu
Ich werde in Zukunft sicherheitsrelevantes Wissen in SP teilen.	E.	3	8	13	29	18	7
	N.E.	2	22	21	22	9	1
Ich werde meine sicherheitsrelevanten Arbeitsberichte und offiziellen Dokumente in Zukunft häufiger über SP austauschen.	E.	3	11	11	35	13	5
	N.E.	2	21	24	24	5	1
Ich beabsichtige meine sicherheitsrelevanten Erfahrungen oder mein sicherheitsrelevantes Know-How häufiger über SP auszutauschen.	E.	3	13	14	36	9	3
	N.E.	2	25	21	22	5	2
Ich werde mein sicherheitsrelevantes Wissen immer auf Wunsch anderer über SP zur Verfügung stellen.	E.	3	12	16	27	15	5
	N.E.	2	20	18	23	12	2

[1] Abgefragt wurde auf einer Skala von 1-5, wobei galt: 1 = „Stimme überhaupt nicht zu“; 5 = „Stimme voll und ganz zu“.
[2] M = Median, E = Experten Gruppe, N.E. = Nicht-Experten Gruppe.

Die Ergebnisse zeigen, dass Mitarbeitende, welche bessere Kenntnisse bzgl. der Berechtigungen besitzen, eher angeben, dass sie sich beim Versenden sensibler Informationen über SharePoint sicher fühlen. Ebenso geben die als Experten eingeordneten Mitarbeitenden häufiger an, dass SharePoint ein sicherer Ort ist, an dem sensible Informationen abgespeichert werden können (vgl. Tabelle 5).

Bezüglich der Intention sicherheitsrelevantes Wissen zu teilen zeigten sich klare Unterschiede hinsichtlich des Mittelwertes zwischen den beiden Gruppen. Mitarbeitende mit guten Kenntnissen bzgl. der Berechtigungsstrukturen sind demnach häufiger bereit sicherheitsrelevante Informationen über SharePoint zu teilen (vgl. Tabelle 5). Neben den Kenntnissen zu Berechtigungen in SharePoint wurde weiterhin überprüft, ob die Sicherheitsbedenken und die Intention Wissen zu teilen von den Faktoren Alter und Geschlecht beeinflusst werden. Hier konnte jedoch kein signifikanter Einfluss nachgewiesen werden.

Implikationen für Unternehmen

Auf Grundlage der Ergebnisse dieser Arbeit lassen sich verschiedene Implikationen für Unternehmen herleiten. Wie die Ergebnisse der Umfrage zeigen, liegen bei der Stichprobe der befragten Mitarbeitenden sehr unterschiedliche Kenntnisse bzgl. der Berechtigungsstufen innerhalb von SharePoint vor (vgl. Tabelle 4). Generell ist es denkbar, dass durch mangelnde Kenntnisse und/oder ein falsches Verständnis eine negative Einstellung bzgl. des Sicherheitsempfindens hervorgerufen wird. Diese Annahme wird durch die Ergebnisse in Tabelle 5 gestützt, die zeigen, dass Mitarbeitende mit geringen Berechtigungskenntnissen sich beim Versenden sensibler Informationen über SharePoint unsicher fühlen.

Gleichzeitig kann mangelndes Wissen über die Berechtigungsstufen und die Berechtigungsstruktur in SharePoint zu einer Hemmschwelle bei der Nutzung von SharePoint führen (vgl. Tabelle 6). Diese Beobachtungen werden durch einen Kommentar eines Mitarbeitenden gestützt. Es wird angegeben, dass „die meisten Mitarbeiter im Unternehmen […] nicht einsehen [können], wer auf Dokumente Zugriff hat“

und es deswegen „heikel“ ist, „kritische Dinge“ abzulegen. Unternehmen sollten einer Hemmschwelle aufgrund mangelnder Kenntnisse vorbeugen. Warum unterschiedliche Kenntnisse bezüglich der Berechtigungen vorliegen, ist unklar. Wie bereits im Kapitel *Vorstellung des Praxisunternehmens* aufgeführt, stehen den Mitarbeitenden Informationen zum Thema Sicherheit im Kontext von SharePoint zur Verfügung. Möglicherweise reichen diese jedoch nicht aus.

Ein Lösungsansatz könnte sein, dass Mitarbeitende in Zukunft die Möglichkeit besitzen, sich erneut zu informieren und Rückfragen zu stellen. Zum Beispiel kann ein Support eingeführt oder freiwillige Weiterbildungen angeboten werden. Es gilt zu beachten, dass das Management als Vorbild dient und die Mitarbeitenden geschult, informiert und aufgeklärt werden müssen um einen optimierten Einsatz von ESS zum sicherheitsrelevanten Wissensaustausch zu ermöglichen. Ein Mitarbeitender verdeutlicht, dass für den vorliegenden Anwendungsfall SharePoint „hervorragend geeignet“ ist um sicherheitsrelevantes Wissen auszutauschen, „sofern man die Berechtigungsstruktur verinnerlicht hat“. Auch die Einführung eines Entscheidungsmodells könnte Mitarbeitenden dabei helfen, die Einsehbarkeit von Informationen intuitiver zu steuern. Auf Grundlage verschiedener Kriterien und Parameter, die den Informationen/Daten zugrunde liegen, könnte ein Entscheidungsmodell die verantwortlichen Mitarbeitenden bei der Festlegung der Berechtigungsparameter unterstützen.

Zudem wurde in der vorliegenden Arbeit deutlich, dass es notwendig ist, möglichen Bedenken bezüglich der Sicherheit vorzubeugen. Falls Sicherheitsbedenken vorliegen, sollten diese auf ein Minimum reduziert werden. Um Bedenken und mangelnden Kenntnissen vorzubeugen oder diese zu beseitigen, sind insbesondere Schulungen als sinnvolle Maßnahme einzuordnen (Beuthner, 2016). Insbesondere neue Mitarbeitende sollten in ESS eingearbeitet werden. Darüber hinaus sollten Mitarbeitende die Möglichkeit besitzen, sich zu informieren (Beuthner, 2016). Insbesondere sollte klar und transparent kommuniziert werden, welche Inhalte wo und wann geteilt werden dürfen. Durch die Möglichkeit, ein rollenbasiertes Rechtemanagement einzuführen, eignen sich ESS für den sicherheitsrelevanten Wissensaustausch. Es ist unabdingbar den Mitarbeitenden die Möglichkeiten des Rechtemanagements zu erläutern. Auch wenn sie über keine Rechte verfügen diese zu steuern und/oder einzurichten, trägt das Verständnis darüber dazu bei, dass Bedenken und Unsicherheit minimiert oder beseitigt werden. Hier

eignen sich Schulungen, um die Handhabung der Mitarbeitenden zu verbessern. Festzuhalten ist, dass ohne ausreichende Kenntnisse seitens der Mitarbeitenden ein risikofreier und effektiver Einsatz von ESS nicht möglich ist.

Neben Sicherheit und Rechtemanagement wollen wir kurz die sozialen Komponenten innerhalb des ESS betrachten. Wie die Ergebnisse zeigen, werden soziale Komponenten wie soziale Netzwerke und Profilseiten zwar genutzt, allerdings bilden diese Features nicht den Hauptgrund für die Nutzung des Systems. Dies ist aus Unternehmenssicht zunächst positiv zu betrachten. Die sozialen Features sollen jedoch genutzt werden um die Kommunikation und den Austausch innerhalb von SharePoint zu fördern und einen gewissen „Spaß-Faktor“ während den Nutzung zu bieten, was zusätzlich durch Gamification-Elemente gefördert werden kann (Meske et al. 2016). Forschende sind zudem der Meinung, dass das Vergnügen ein herausragender Faktor bei der Förderung des Wissensaustauschs zwischen Mitarbeitenden darstellt (Lin, 2007). Aus diesem Grund sollten Unternehmen dafür sorgen, dass Mitarbeitende bei der Nutzung des Systems Vergnügen empfinden. Während die Effektivität zwar im Vordergrund steht, können Gamification-Elemente (bspw. Abzeichen für bestimmte Aktivitäten) dazu beitragen, dass ESS kontinuierlich genutzt werden (Meske, 2016). Hierbei sind Schulungen, die die weiteren Möglichkeiten (vor allem Social Features) näherbringen und das Tool somit attraktiver machen (Einstellung) eine sinnvolle Maßnahme.

Insgesamt lässt sich festhalten, dass Unternehmen eine positive Einstellung von Mitarbeitenden bezüglich des sicherheitsrelevanten Wissensaustauschs fördern sollten, damit Mitarbeitende ESS zum sicherheitsrelevanten Wissensaustausch nutzen. Durch eine transparente Kommunikation können Unternehmen die Vorteile und den Nutzen von ESS herausstellen und somit die wahrgenommene Nützlichkeit seitens der Mitarbeitenden erhöhen. Insbesondere sollten hier die sicherheitsrelevanten Aspekte genannt werden, wie das Rechtemanagement, wodurch nur berechtigte Personen Zugriff erhalten. Gleichzeitig gilt es Ängste und Unsicherheiten auf Seiten der Mitarbeitenden zu reduzieren und somit die Motivation, Wissen zu teilen, auf Seiten der Mitarbeitenden zu erhöhen. Hierbei spielt das Management eine tragende Rolle. Dieses sollte motivierend in Richtung der neuen Ausrichtung agieren (Schütt, 2016).

Zusammenfassung

Die vorgestellte Literatur zeigt, dass Wissen im heutigen Wettbewerb eine entscheidende Ressource ist und ESS effizientes Wissensmanagement unterstützen können (Probst et al., 2013, Rode, 2016). Nur durch den Austausch des individuellen Wissens kann das organisationale Wissen wachsen. Dies wiederum erfordert die Bereitschaft der Mitarbeitenden ihr Wissen zu teilen (Jarvenpaa & Staples, 2000). Die Ergebnisse einer unternehmensinternen Umfrage konnten zunächst zeigen, dass der Bedarf von Wissensaustausch als hoch angesehen wird. Gleichzeitig zeigen die Ergebnisse jedoch, dass insbesondere die Verwaltung von sensiblen Daten innerhalb von ESS für Mitarbeitende ein Problem darstellt. Als Gründe werden unzureichende Kenntnisse über die Berechtigungsstufen und -Strukturen aufgeführt. Das Wissen, wer welche Daten tatsächlich einsehen und nutzen kann, fehlt. Demnach müssen Unternehmen dafür sorgen, dass Mitarbeitende im Umgang mit den Sicherheitsstufen von ESS geschult und motiviert werden. Ein effizienter Einsatz von ESS ermöglicht eine Einhaltung sämtlicher Schutzziele im Unternehmen. In Zukunft gilt es somit, die Sicherheitsbedenken von Mitarbeitenden bezüglich der Nutzung von ESS näher zu betrachten und folglich zu reduzieren. Welche spezifischen Faktoren die Sicherheitsbedenken beeinflussen und worauf diese zurückzuführen sind, sollte Gegenstand weiterer Untersuchungen sein.

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B Declaration of Authorship

I hereby declare that, to the best of my knowledge and belief, this Dissertation titled "**A Multidimensional Perspective on the Acceptance of Organizational Communication and Collaboration Systems**" is my own work. I confirm that each significant contribution to and quotation in this thesis that originates from the work or works of others is indicated by proper use of citation and references.

Duisburg, 14 June 2019

Konstantin Lennart Wilms

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