Kumulative Dissertation

Managing Innovations in the Digital Age

–

Contributions from a Business Process Management Perspective

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> *If you're competitor-focused, you have to wait until there is a competitor doing something. Being customer-focused allows you to be more pioneering.*

Jeffrey Preston Bezos – Founder of Amazon.com

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Index of Research Papers

This dissertation contains the following 6 research papers:

P1: Afflerbach P, Frank L (2016) Customer Experience Versus Process Efficiency: Towards an Analytical Framework About Ambidextrous BPM

In: *Proceedings of the 37th International Conference on Information Systems (ICIS), Dublin, Ireland, December 2016. (VHB-JOURQUAL 3: Category A)*

P2: Frank (2017) Kundenzentriertes vs. effizientes Prozessdesign in einer digitalen Welt – Auswirkungen von Prozess-Design-Entscheidungen auf die (Digital) Customer Experience.

In: *HMD – Praxis der Wirtschaftsinformatik, 55(1) 2018. (VHB-JOURQUAL 3: Category D)*

P3: Frank L, Rau D, Röglinger M, Rosemann M (2017) Process Redesign Heuristics for the Digital Age – Opportunity-Driven Process Innovation within Ambidextrous BPM.

In preparation for submission to: *Business Process Management Journal. (VHB-JOURQUAL 3: Category C)*

P4: Frank L, Fridgen G, Heger S, Hosseini S (2017) Do Not Forget About Smart Towns – How to Bring Digital Innovation to Rural Areas.

Please note: Paper was accepted in a reworked version at *Business & Information Systems Engineering 60(3) 2018. (VHB-JOURQUAL 3: Category B)*

P5: Frank L, Mette P, Moser F (2017) Selecting the Right Open Innovation Approach for Enterprise Mobile Service Innovations – A Descriptive Case Study.

Working paper

P6: Frank L, Gimpel H, Schmidt M, Schoch M (2017) Emergent User Roles of a Digital Workplace: A Network Analysis Based on Trace Data.

Presented and nominated for "best theory development award" at: 38*th International Conference on Information Systems (ICIS), Seoul, South Korea, December 2017. (*VHB-JOURQUAL 3: Category A)

I Introduction

With the development of technologies like the internet and mobile connected devices, society has entered what is commonly known as the *digital age*. Digital products and services have considerably changed our private and professional daily routines (e.g. Piccinini et al., 2015, Oestreicher-Singer and Zalmanson 2013). To the benefit of private individuals, digitalization brings increased levels of convenience and efficiency, the personalization of products and services, and lower prices (Urbach et al. 2017). Mobile connected devices enable people to engage in transactions such as banking and shopping free from prior temporal and spatial restrictions (Ackx 2014). Moreover, online social networks like Facebook or Instagram, instant messaging services like WhatsApp or Threema, and video conferencing tools like Skype, TeamViewer and GoMeetNow allow us to communicate, connect and interact with people all over the world in real-time. But it is not only peoples' private lives which are affected. Digital technologies also provide rich opportunities in our professional lives (Legner et al. 2017). For instance, new software tools such as social collaboration platforms, enterprise social networks, and new communication tools such as email and instant messaging enable fast and easy communication and collaboration between globally distributed employees (Drakos et al. 2015). From an organizational perspective, digitalization also opens up opportunities to develop innovative products, services, business processes, and ultimately, to formulate entirely new business models (Legner et al. 2017). In short, opportunities for innovations are numerous and varied. Particularly from a business process management (BPM) perspective, digitalization bears vast potential as new technologies enable a virtual integration of different resources, suppliers, employees, customers and other stakeholders can all now be incorporated into innovation and support processes (Chavez et al. 2015, Hoyer et al. 2010, Bolton & Saxena-Iyer 2009). As an example, the provision of innovative enterprise mobile services to employees can increase workflow efficiency via improved mobile data access (Hasan et al 2014). Furthermore, new digital technologies provide the opportunity to quickly analyze data from multiple sources, which enables real time decision-making, allows for data-driven services, and facilitates the development of new business models. In this, new products and services based on technologies such as the Internet of Things (IoT), artificial intelligence, and Big Data, together with an increase in process efficiency, hold huge economic potential (Bughin et al. 2017, Manyika et al. 2016, Hasan et al. 2014).

Yet, from both, an individual and an organizational perspective, digitalization also has some drawbacks. For individuals, the convenience being able to gather information and purchase

goods online is accompanied by an increased threat to personal privacy and data, as is the extensive use of social networks (Alashoor et al. 2016). Organizations, on the other hand, face the challenge of overcoming customers' privacy concerns. After all, the violation of data privacy may result in legal action and damage to the organization's reputation, both of which are likely to have negative financial consequences (Hashem et al. 2015, Hauff et al. 2015, Soh et al. 2006). Another potential concern is the widespread public availability of data which details the quality and pricing of an organization's products and services. The availability of such data leads to increased market transparency, which may in turn lead to increased competition in the market and to price wars between organizations (Urbach et al. 2017). Besides, the rapid and continuous emergence of new digital technologies effects rapid change in customer preferences and behavior, which in turn forces organizations to continually innovate their business processes, products, services, and even their business models (Nüesch et al. 2015, Leimeister et al. 2014, Dreiling and Recker 2013, Priem et al. 2013). Lastly, these technical innovations provide optimal boundary conditions for young digital start-up companies to rapidly develop new ideas with the potential to disrupt established value networks (Gimpel and Röglinger 2015). The combined pressure of shorter product life cycles, increased market competition, rapid changes in customer behavior, and technological progress, means organizations across all industries must manage their innovations successfully in order to remain competitive in the digital age (Dreiling and Recker 2013, Leimeister and Glauner 2008).

One management discipline that is closely related to innovation management is BPM, described as: "the art and science of overseeing how work is performed […] to ensure consistent outcomes and to take advantage of improvement opportunities" (Dumas et al. 2013, p. 1). In the face of ongoing digitalization, the relevance of BPM continues to increase thanks to the fact that BPM brings together knowledge from management and information technology sciences (van der Aalst 2013). Clearly, organizations need both, technological innovations and BPM as they are mutually dependent. On the one hand, new technologies can trigger innovations to processes which increase the processes' efficiency (vom Brocke and Schmiedel 2015). Enterprise mobile services are a good example of technology-enabled process innovations. Mobile connected devices enable the provision of relevant information and data to field representatives, regardless of time and place. On the other hand, the application of new technologies in business processes combined with a clearly structured and well defined innovation process can yield disruptive innovations in products and services (Špaček and Vacík 2016). As illustrated in figure I.1-1, BPM fosters innovations and

innovations enable improved business processes. Thus, BPM "can be considered as a key driver for innovation" (vom Brocke and Schmiedel 2015, p. 4). As a logical consequence, the challenge of managing innovations in a digital age requires examination through the lens of BPM.

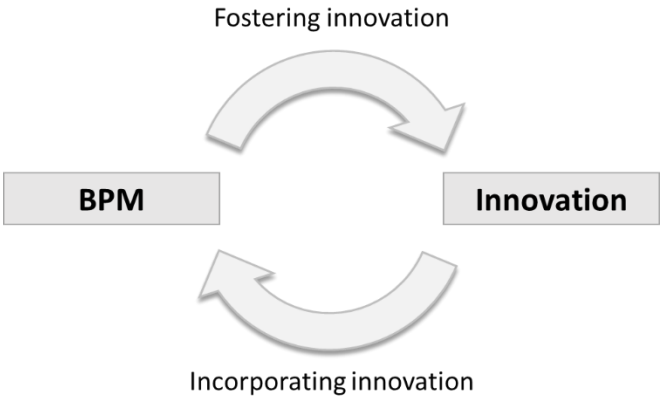

Figure I.2.1-1 *BPM and Innovation on the basis of vom Brocke and Schmiedel (2015)*

Within the BPM research discipline, one of the most popular management concepts is the BPM lifecycle, which comprises six phases: identification, discovery, analysis, redesign, implementation and monitoring (Dumas et al. 2013). Within these phases the highest value is accorded to business process redesign (Zellner 2011). In this regard, for many years BPM research was solely focused on efficiency measures such as costs, outcome and waste (Kerpedzhiev et al. 2017, Soh et al. 2006). Yet, the coming of digitalization means that efficient processes are no longer sufficient. While the importance customer satisfaction for an organization's profitability has long been established (e.g. Gruca and Rego 2005, Anderson and Mittal 2000), digitalization further empowers the role of the customer "since the competitor is just one click away" (Leimeister et al. 2014, p. 255). Thus, organizations are under pressure to achieve high levels of customer satisfaction, and are therefore compelled to put the customer to the center of their activities (Martin 2010). At the same time, increased market transparency stokes competitive pricing (Soh et al. 2006). One consequence of this is an experience-efficiency trade-off in business process redesign, as customer-centric process designs are not necessarily efficient and vice versa. Accordingly, the first step is to develop an understanding of the dependencies between an organization's profitability, customer satisfaction, and business process design. In doing so, organizations must keep in mind the

fact that customers do not only score every single process, but perceive the performance of an organization as a whole. Extant literature addressing this behavior frequently refers to the concept of customer experience. While no common definition of customer experience exists in the literature, this doctoral thesis draws on a widely accepted definition by Verhoef et al. (2009). Accordingly, customer experience is defined as a customer's holistic experience of an organization, comprising all direct and indirect, digital and non-digital interactions over time (Verhoef et al. 2009). According to this definition, organizations have to consider the effect that each individual process design decision may have on the whole customer experience. To accommodate these challenges, the idea of an ambidextrous BPM has recently entered into the BPM research agenda (Rosemann 2014). An ambidextrous BPM enables organizations to simultaneously run their current business processes efficiently (process exploitation) and pursue opportunities to innovation which may arise as a consequence of new technical opportunities or emerging business (process exploration) (Rosemann 2014).

Extant BPM literature has extensively discussed business processes from a perspective which foregrounds exploitation (Kerpedzhiev et al. 2017, Soh et al. 2006). Recently, the changing market environment has encouraged BPM researchers to give equal consideration to exploration, as process innovations which excite the customer got indispensable for an organization's long-term success (Dreiling and Recker 2013). Yet, to date, process innovation has been largely dependent on the creativity of the innovators thanks to a focus on traditional brainstorming and other creativity techniques (Vanwersch et al. 2015, Griesberger et al. 2011). To reduce this dependency, organizations should rely on more systemic approaches that are not fully dependent on the creativity of the innovation team, but which do not excessively restrict their creativity (Valiris and Glykas 1999). Faced with this challenge, one appropriate response may be the use of heuristic rules - short "heuristics" (Reijers and Liman Mansar 2005).

However, restricting the focus to process innovations often falls short. Organizations need to frequently come up with innovative products and services which have the potential to disrupt established value networks to satisfy their customers and compete within the market (Rubera and Kirca 2017). From a BPM perspective, the innovation process itself constitutes a highly relevant object of investigation, as the future competitiveness and success of an organization is closely linked to the effectiveness of its innovation process (Špaček and Vacík 2016). Yet the innovation process should not only be understood, documented, and thoroughly embedded into the organization. In addition, the innovation process should also be effectively monitored

and managed in order to avoid innovation failures (Birkinshaw et al. 2008). With regard to innovation processes, the extant literature basically distinguishes between two types of innovation processes – closed innovation processes and open innovation processes (e.g. Enkel et al. 2009, Chesbrough 2003). Whereas a closed innovation process typically purely relies on the internal resources of the research and development (R&D) department, open innovation (OI) approaches incorporate resources outside the R&D department (Enkel et al. 2009). From a practical perspective, internal approaches to R&D have, to-date, been most common but are costly and do not necessarily lead to results which succeed in the market, often as a result of limited market knowledge. To avoid this inefficiency and reduce innovation failure rates, organizations started to incorporate external stakeholders into the innovation process. The literature reports a significant improvement as new products and services more closely correspond with customer needs (e.g. Patrakosol and Olson 2007, Gruner and Homburg 2000). Moreover, shorter product life cycles, reduced time to market, and new technologies such as social network technologies, are encouraging organizations to leave the traditional closed innovation paradigm and further open up their innovation processes to stakeholders (Enkel et al. 2009, Chesbrough, 2003). This promising new OI paradigm incorporates "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the market for external use of innovation, respectively" (Chesbrough, 2006, p.2). There is evidence from several organizations that the advantages of OI approaches outnumber those of closed innovation approaches, with Procter & Gamble providing one of the most popular examples. A comparison of Procter & Gamble's innovation projects reveals that OI projects have a 70% higher net present value than closed innovation projects (Enkel et al. 2011). Yet even though examples from enterprise environments clearly demonstrate the significant opportunities afforded by OI approaches, the public sector has so far neglected OI. Especially against the backdrop of the emerging digital technologies, OI approaches might help to efficiently find digital solutions for specific problems of cities, towns and even rural areas (Schaffers et al. 2011). As with innovations in enterprise environments, a well-structured and designed innovation process which enables the incorporation of different stakeholders into the process is indispensable. Considering different innovation processes, Dreiling and Recker (2013) derive a generic innovation process comprising the four distinct stages ideation, incubation, implementation and operation. In this regard, most existing OI approaches – for example, innovation contests, lead-user integration, and innovation communities – are designed for use in the ideation phase. Due to the plurality of OI approaches, choosing which approach fits best is still a challenge for many OI projects, and thus offers opportunities for

further investigation. Focusing on crowdsourcing as a popular method in the connection of internet-based innovation communities, Füller et al. (2014) investigate the different user roles which emerge. They argue that an understanding of different user roles and behavior is vital for the successful management of these innovation communities (Füller et al. 2014). Drawing on these findings, the investigation of user roles within a digital workplace (Köffer 2015) provides rich opportunities to better understand the roles and the behavior of internal resources. Gaining insights into user roles might be a good starting point from which to identify creative people willing to contribute to innovation. The same insight may also help, to identify employees who are able to successfully manage, control and implement the whole innovation process from the generation of ideas through to implementation.

Summing up, digitalization leads to increased market transparency, and induces change in the needs and behavior of customers. As a consequence, the pressure on price competition grows and the satisfaction of customers shifts to the center of business activities. Thus, the effective and efficient management of innovations becomes a key challenge. In this context, a BPM perspective provides promising insights to the attempting to master the challenge of innovation management. Accordingly, this doctoral thesis contributes, in particular, to the areas of (i) BPM, and (ii) innovation management, by examining vital aspects of BPM which contribute to successful innovation.

In doing so, section I.1 illustrates in detail the structure and objectives of this doctoral thesis. Section I.2 then embeds the corresponding research papers in their research context and emphasizes the fundamental research questions.

I.1 Objectives and Structure of this Doctoral Thesis

The main objective of this doctoral thesis is to contribute to the fields of (i) business process management and (ii) innovation management by focusing on process innovation, and other vital aspects of the innovation processes, through a BPM lens. Table I.1-1 provides an overview of the dissertation's objectives and its structure.

I	**Introduction**
Objective I.1:	Outlining the objectives and the structure of the doctoral thesis
Objective I.2:	Embedding the included research papers in the context of the doctoral thesis and formulating the fundamental research questions
II	**Customer-centric process design - Setting the prerequisites for profitable processes and innovations (Research Papers P1 and P2)**
Objective II.1:	Providing concrete guidance for strategic process design decisions in customer facing business processes (P1, P2)
Objective II.2:	Identifying relations between customer satisfaction, business value, and business process design (P1)
Objective II.3:	Developing an analytical approach to foster knowledge and understanding as to the impact of efficiency-experience and risk considerations on strategic process design decisions (P1)
Objective II.4:	Stressing the importance of an overarching view on process design decisions by incorporating the concept of (digital) customer experience (P2)
Objective II.5:	Structuring risk in the provision of digital services (P2)

III	**Successfully managing innovations by considering innovation management through a BPM lens (Research Paper P3, P4, P5 and P6)**
Objective III.1:	Providing heuristics for opportunity-driven process innovation in the digital era (P3)
Objective III.2:	Providing a structured approach which enables the exploitation of available digital innovations, in order to foster context specific innovations for towns and rural areas (P4)
Objective III.3:	Developing a context-based innovation process in the light of smart towns to ensure solutions which meet the requirements of a town (P4)
Objective III.4:	Evaluating different open innovation approaches from a cost-benefit perspective (P5)
Objective III.5:	Evaluating the suitability of different open innovation approaches for enterprise mobile services (P5)
Objective III.6:	Developing a new way of analyzing the informal social structure of a digital workplace in order to gain insights into the behavior of different user types within this network (P6)
IV	**Results and Future Research**
Objective IV.1:	Presenting the key findings of this thesis
Objective IV.2:	Identifying and highlighting areas for future research

Table I.2.1-1 *Doctoral thesis objectives and structure*

I.2 Research Context and Research Questions

In the following, the 6 research papers included in this doctoral thesis are embedded in the research context with regard to the above stated objectives and the particular research questions of chapters II & III are motivated.

In this regard chapter II containing P1 and P2 set up the basic understanding from a BPM point of view, to identify processes that need to be innovated. Subsequently, chapter III provides a BPM perspective on innovation management. In this, P3 focuses on opportunities, innovations provide for processes and thus, a method to foster opportunity-driven process innovations is presented. Vice versa, P4 investigates opportunities from BPM to come up with innovative ideas by providing a context based innovation process. Finally, P5 and P6 focus on the identification of the "right" approach and the "right" people to strengthen the innovation process. Figure I.2-1 illustrates the placement of the particular research papers regarding their research context.

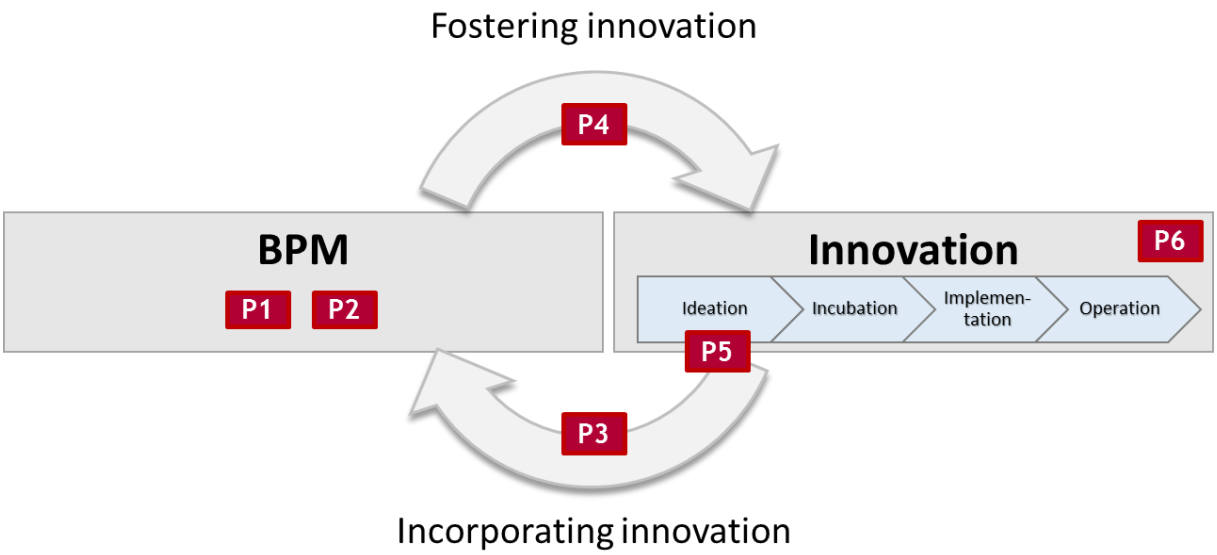

Figure I.2.1-1 *Research Papers Embedded in the Research Context*

I.2.1 Chapter II: Customer-centric process design - Setting the prerequisites for profitable processes and innovations

In times of rapidly changing customer expectations and enormous pressure on the pricing of products and services, organizations need to entice customers by providing superior value propositions at low costs. To manage this trade-off, a thorough understanding of the relationship between profitability and process design decisions is required. Thus, this chapter aims to providing concrete guidance for strategic process design decisions in customer facing business processes.

Research Paper 1: *"Customer Experience Versus Process Efficiency: Towards an Analytical Framework About Ambidextrous BPM"*

Digitalization comes with higher market transparency for the customer and therefore puts pressure on the pricing of products and services (Loebbecke and Picot 2015). At the same time, the increased interconnectedness of customers, and the perceived interchangeability of products and services, force organizations to deliver a superior customer experience in order to differentiate themselves from their competitors (Mosley 2007). Thus, many organizations need to rethink their strategy. As long time two pure strategies – cost leadership and differentiation – were predominant (Porter 1980) and worked well, organizations now have to offer superior services at a low price. This imposes new challenges to established customer relationship management (CRM) and BPM (Bharadwaj et al. 2013). Quite recently, classic BPM still restricted itself to the optimization of efficiency measures such as costs, time, and waste (Kerpedzhiev et al. 2017), whereas CRM purely focused on customer satisfaction and therefore customer retention (Shankar and Malthouse 2006, Xu et al. 2002, Berger and Nasr 1998). However, this isolated view is no longer sufficient, and organizations need to combine both, an efficiency and an experience point of view. The aim of superior customer experience, however, often opposes the efficiency aim leading to a trade-off. This trade-off is addressed within the field of BPM by Rosemann (2014) who proposes an ambidextrous BPM. This suggests that organizations need to design their business processes customer centric in order to deliver superior customer experience and efficient at one time. Further complicating this challenge, a risk trade-off exists. On the one hand, the need to ensure consistent and accurate process output in order to enable positive customer experience leads to increased costs – e.g. due to quality controls – and therefore an increase in prices. On the other hand, volatile process outputs may cause customer dissatisfaction. Accordingly, organizations can benefit from an analytical framework through which to understand and analyze the connections

between process design and customer experience to ponder their decisions properly. Thus, P1 addresses the following research objectives:

- Identifying relations between customer satisfaction, business value, and business process design
- Developing an analytical approach to foster knowledge and understanding as to the impact of efficiency-experience and risk considerations on strategic process design decisions
- Providing concrete guidance for strategic process design decisions in customer facing business processes

Research Paper 2: *"Kundenzentriertes vs. effizientes Prozessdesign in einer digitalen Welt – Auswirkungen von Prozess-Design-Entscheidungen auf die (Digital) Customer Experience"*

Often process design decisions are performed in an isolated way and interdependencies between several processes as well as the impact of the result of one process on another process are left outside the decision. Accordingly, this approach leads to a poor quality of process design decisions. Making the situation even worse, more and more customers ask for an online provision of services, confronting organizations with major risks that have to be considered, before processes are provided digitally. A comprising overview on those major risks is often lacking within organizations. Building on the idea of the analytical framework in P1, the following research paper P2 aims at a concrete guidance for decisions on the on- and offline provision of processes and addresses the outlined challenges with the following research objectives:

- Stressing the importance of an overarching view on process design decisions by incorporating the concept of (digital) customer experience
- Structuring risk in the provision of digital services

I.2.2 Chapter III: Successfully managing innovations by considering innovation management through a BPM lens

As illustrated above, it is crucial to deliver superior experience to the customer in order to differentiate from competitors. Efficient and effective innovation is key, and, in this regard, BPM and innovation management bolster one another. On the one hand, new and innovative technologies enable opportunity-driven process innovations. On the other hand, well-structured and managed innovation processes and the use of BPM methods during the

innovation process support efficient innovation. As many factors have to interlock efficiently to be an innovative organization (Dreiling and Recker 2013), chapter III addresses vital aspects for both, process innovations and innovation processes.

Research Paper 3: *"Process Redesign Heuristics for the Digital Age – Opportunity-Driven Process Innovation within Ambidextrous BPM."*

Emerging digital technologies not only provide huge potential for innovative products and services, but also provide rich opportunities to innovate business processes. Up until now, organizations struggle in fully exploiting the potential of these new technologies with regard to their business processes (Denner et al. 2017). Often, this is hindered by a lack of structure and guidance in the development of ideas for process improvements. While many approaches in BPM literature, such as redesign best practices or process improvement patterns address this point (Vanwersch et al. 2016, Zellner 2011), most of those approaches restrict creativity. Meanwhile, more traditional creativity techniques like brainstorming often overlook promising areas for improvement and innovation, again due to a lack of structure (Chai et al., 2016; Vanwersch et al. 2015). Thus, a technique is needed that can increase guidance within the exploration of the solution space while simultaneously avoiding excessive restriction on creativity. One technique that might help in this regard are heuristics. Heuristics are an abstraction of observations from real-world examples comparable to stylized facts, which foster ways of thinking to further explore the solution space by an intentional variation in designs (Daly et al. 2012, Reijers and Liman Mansar 2005). To guide organizations within the exploitation of opportunities, given by digital technologies, P3 has the following objective:

- Providing heuristics for opportunity-driven process innovation in the digital era

Research Paper 4: *"Do Not Forget About Smart Towns – How to Bring Digital Innovation to Rural Areas."*

Besides the opportunities provided by the innovation of processes, the innovation process plays a crucial role for the innovativeness of an organization. The high relevance of a robust innovation process for a successful management of innovations has already been acknowledged for many decades (e.g. Špaček and Vacík 2016, Cooper and Kleinschmidt 1986). As previous studies make clear, it is important to integrate customers into the innovation process in order to ensure that the resulting innovations address the customer needs (Patrakosol and Olson 2007, Salomo et al. 2003, Cumming 1998). Depending on the type of innovation, there may be stakeholders other than customers whose needs and opinions

should be taken into account (Ayuso et al. 2011). One opportunity to integrate external stakeholders is the approach of OI (Chesbrough 2003). While this approach has already been successfully applied in enterprise environments, the public sector has so far neglected this opportunity. Accordingly, cities, towns, and rural areas do not fully exploit the high potential offered by technological progression among other things due to a lack of knowledge (Schaffers et al. 2011). Even more, by developing innovations that do not fit the stakeholders' needs they drop money which is missing for investments in infrastructure and public life. Although so called "smart city" concepts are first to address the shortcoming of using digital technologies to improve public life (Albino et al. 2015, Giffinger et al. 2007), these concepts are not necessarily appropriate for smaller towns and rural areas. To address these shortcomings, P3 has the following objectives:

- Providing a structured approach which enables the exploitation of available digital innovations, in order to foster context specific innovations for towns and rural areas
- Developing a context-based innovation process in the light of smart towns to ensure solutions which meet the requirements of a town

Research Paper 5: *"Selecting the Right Open Innovation Approach for Enterprise Mobile Service Innovations – A Descriptive Case Study."*

To turn to ideation as the first phase of the innovation process, the likelihood of successful innovation is improved by the careful selection of an appropriate innovation approach. Moving on from the once common closed innovation approach of R&D departments, von Hippel (1986) was one of the first scholars to propose the integration of so called "lead users" into the development process of new products. As digital technologies enable a broad integration of (potential) customers into the innovation process at low costs, different approaches of integrating customers into innovation processes emerged over time. Chesbrough (2003) was first to summarize those integration approaches under the name OI. In the following, new OI approaches entered the research agenda opening up the innovation process for distinct external innovators besides customers (Mette et al. 2013, Reinhardt et al. 2010, Laursen and Salter 2006, Enkel et al. 2005). Each of these approaches demonstrates the benefits of the particular OI approach but neglects a concrete comparison of the fit to the aim of the innovation. Furthermore, a cost-benefit analysis of the OI approaches is also lacking. To further address those shortcomings, an investigation against the backdrop of enterprise mobile services seems to be appropriate for two reasons: Firstly, stakeholders are already well-versed in the use of mobile services and can thus anticipate the opportunities available

with the technical equipment features of mobile devices (e.g. GPS, camera function). Secondly, enterprise mobile services promise improvements in the efficiency measures of business processes (Hasan et al 2014). Accordingly, P5 addresses the following research objectives:

- Evaluating different open innovation approaches from a cost-benefit perspective
- Evaluating the suitability of different open innovation approaches for enterprise mobile services

Research Paper 6: *"Emergent User Roles of a Digital Workplace: A Network Analysis Based on Trace Data."*

Incorporating the "right" people into the innovation process is considered to be of upmost importance in the innovation context. Organizations need innovative people who are willing to contribute to the development of the organization e.g. by actively participating in innovation communities (Füller et al. 2014). Apart from that, the election of associates that are able to successfully manage and control the innovation process is also crucial. To make the right choice of incorporated people and to manage the innovation process successfully, an understanding of the social structure of an organization is beneficial. In this regard, data on user activity recorded by information systems provide a good opportunity to observe social structures and analyze the roles that users take on within this network (Füller et al. 2014, Howison et al. 2011). In a digital workplace (Köffer 2015), communication and collaboration tools provide information on employee interactions on the same or on different hierarchical levels (Behrendt et al. 2015). Thus, an in depth analysis of this data can help to understand the implicit social structure and therefore help to understand the organization's knowledge capability. Accordingly, P6 addresses the following research objective:

- Developing a new way of analyzing the informal social structure of a digital workplace in order to gain insights into the behavior of different user types within this network

I.2.3 Chapter IV: Results and Future Research

After this introduction, which outlines the objectives and the structure of the doctoral thesis and motivates the research context, the research papers are presented in Chapters II and III. Subsequently, Chapter IV presents the key findings and highlights areas for future research on managing innovations in the digital era.

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II Customer-centric process design - Setting the prerequisites for profitable processes and innovations

An absolute precondition to successfully manage innovations is a deep understanding of the strategic dimension of business processes. On the one hand, efficiency with regard to time, waste and costs is of upmost importance for organizations to offer products and services to a competitive price. On the other hand, the need for innovative and customer-centric processes is rising, as products and services of different providers are perceived as interchangeable by the customer and thus, customers need to be delighted not only by a single product or service, but by every process of an organization they get in touch with. However, within BPM, the aim of customer-centricity is often contradictory to the efficiency aim. Thus, organizations need to understand the contribution of every process to the customer satisfaction to decide, how to design the process. Furthermore, these insights help to filter processes that should be innovated towards customer-centricity and processes that should focus on efficiency. Accordingly, P1 and P2 foster comprehension of the strategic trade-off between efficient and customer-centric process design, point out the consequences of design decisions on the organizational value and come up with strategic guidance for process design decisions.

II.1 Research Paper 1: "Customer Experience Versus Process Efficiency: Towards an Analytical Framework About Ambidextrous BPM"

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Abstract:

Digitalization forces organizations to rethink classic operating models and develop completely new ways about how to run business. This revolution also spills over to the management and design of business processes. New market transparency and the increasing interconnectedness of customers define customer satisfaction and operational efficiency as two equal strategic objectives. Ambidextrous business process management (BPM) demands the symbiosis of exploitative BPM to ensure organizational efficiency and explorative BPM to create process designs that truly excite customers. A key challenge is to properly balance the different capabilities. Therefore, we propose an analytical framework providing an in-depth understanding about effects and interdependencies of this challenge. As justificatory knowledge, we drew from literature on value-based BPM and customer confirmation/disconfirmation paradigm to unite the different perspectives. Based on our framework, we match process and customer types to generic design principles and provide concrete guidance on the establishment of ambidextrous BPM.

Keywords: *Value-based Business Process Management, Ambidextrous Business Process Management, Business Process Redesign, Customer Satisfaction, Customer Process Management*

II.1.1 **Introduction**

Digitalization imposes new challenges to modern business process management (BPM) and customer relationship management (CRM) (Bharadwaj et al. 2013). While the high relevance of customer satisfaction for an organization's profitability is widely accepted (Anderson and Mittal 2000; Gruca and Rego 2005; Heskett et al. 1994), its importance is even increasing with customers becoming ever more interconnected. An impressive example of technology-enabled interconnection is online social networks. About 65 percent of American adults were using at least one social networking site in 2015 compared to only 7 percent in 2005 (Aperrin 2015). This increasing interconnectedness leads to a mutual suggestibility among customers, the so called word-of-mouth-effect (Relling et al. 2016). Positive and negative experiences of customers may cascade through the entire customer base of an organization making customer satisfaction a topic of upmost relevance. In addition, increased market transparency exposes organizations to a more intense competitive pressure on the offered price and therefore also on process efficiencies (Soh et al. 2006). Both developments together confront organizations with a dilemma: Whereas interconnectedness requires organizations to please customers at any costs, transparency demands them to improve process efficiency. We define this issue as the "experience-efficiency trade-off" (E-E trade-off) of process design. In order to survive in this contradictory environment, organizations need an integrated customer-process-strategy and have to design their process portfolio according to these challenges.

Against the background of the described digital challenges, strategic alignment as one success factor of BPM is crucial and new research questions enter the agenda of the BPM discipline (Rosemann and vom Brocke 2015). In this context, Michael Rosemann (2014) emphasizes the need for *ambidextrous BPM* to solve the E-E trade-off. Rosemann (2014) argues that organizations have to stimulate exploitative as well as explorative strengths at the same time. Thereby, exploitation demands cost- and time- efficient fulfillments of basic customer needs (Rosemann 2014). Exploration aims at the development of new and digital "process designs that truly excite customers" (Kohlborn et al. 2014, p. 636). In order to establish the right balance between both paradigms within their process landscape, organizations need to determine the strategic design orientation (customer-centric versus efficient) for every process separately. Even increasing complexity, they additionally have to decide between risk-averse designs following the principle of "better safe than sorry" and risk-taking designs pursuing the idea of "nothing ventured is nothing gained" (Alexandrov 2015, p. 3001). Processes can either be designed "safe" with only few variation in their outputs, often associated with high costs

for quality control or they can be designed risk-taking accepting a wider range of output quality. We define this design question as the "risk trade-off" of process design. Summing up, organizations are continuously facing the question, how to (re-)design their processes. Therefore four archetype strategies exist: 1) *risk-taking and efficient*, 2) *risk-taking and customer-centric*, 3) *risk-averse and efficient and 4) risk-averse and customer-centric*. An ambidextrous process design strategy, defined as the planned coexistence of the 4 archetype strategies reflecting the needs of the organizations business model, as a solution to this dimensional plurality, requires the ex-ante definition of strategic targets for every process. To the best of our knowledge the current state of literature does express the need for ambidextrous BPM, but it does not address the separate prioritization of design targets with respect to ambidextrous BPM. Supported by the high relevance of the topic given the impact of digitalization, we formulate the following research question:

How do risk- and E-E trade-off affect strategic orientation in business process design?

When approaching this research question, one key challenge emerges: Solving the two design trade-offs requires a deep understanding of their mechanics and interdependencies. Therefore it is essential to combine two related, but still different research disciplines: Knowledge from CRM about the effects of customer satisfaction and process design competencies from BPM need to be harmonized. Following this integrative approach, we use analytical modelling and mathematical-deductive analyses as our research method. Thereby, we set up an analytical framework using established CRM and BPM components. By means of this framework, we analyze the interplay of different process and customer types. Finally, we match such process profiles to exploitative and explorative design principles to answer our research question.

Our analyses propose a differentiation into basic-, performance- and excitement processes. Thereby risk-taking designs are beneficial for excitement processes whereas risk-averse designs are favorable for basic and performance processes. For the E-E trade-off, we conclude customer-centric designs for excitement processes if a corresponding redesign can exploit their upside potential and really excite customers. For basic processes, we propose customer-centric designs until an acceptable performance is promised to control for extreme disappointments. Finally, performance processes do not have a "one fits it all" solution and require case-specific analyses. Thus, our article contributes to literature in two ways. First, we provide insights into the interplay of the E-E trade-off and the risk trade-off and point out the importance of an ambidextrous strategy in process design. Second, we derive

recommendations for design decisions within the four archetype strategies, providing organizations with concrete strategic guidance on how to design their processes.

The remainder of this paper is structured as follows. After the brief motivation of our research question, we provide the theoretical background on the relevant BPM and CRM theories in Section 2. On this foundation, we elaborate our framework in Section 3. Section 4 theoretically analyzes and discusses the E-E trade-off and the risk trade-off within the environment of the framework. Finally, we summarize our results, point out limitations and provide opportunities for future research in the concluding Section 5.

II.1.2 **Theoretical Background**

II.1.2.1 *Ambidextrous BPM*

The BPM Lifecycle as probably the most popular management concept of the research discipline can be classified into six phases: identification, discovery, analysis, redesign, implementation and monitoring (Dumas et al. 2013). While every phase has a significant contribution to the success of BPM, the prevalent opinion in literature assigns process redesign the highest value (Zellner 2011). Thereby, the interpretation of the term process design varies with respect to the level of abstraction. It ranges from very high-level interpretations as definitions of how work is performed (Dumas et al. 2013) to very detailed interpretations as process models. According to the strategic scope of this paper, we follow a high-level interpretation of process design. Not surprisingly given the high relevance of this management task, the BPM community developed several different methods to support business process redesign (Harmon and Wolf 2014; van der Aalst 2013; Vanwersch et al. 2015). Despite the diversity of the redesign tool kit, almost every approach begins with setting strategic process objectives (Limam Mansar et al. 2009). Therefore, our framework for strategic process orientation does not add a new mosaic piece to the redesign-literature, but it rather enhances existing approaches to a more holistic concept.

To realize the presumably high value from process design, the set of strategic process objectives have to be in line with the corporate strategy (vom Brocke et al. 2014). When classifying generic corporate strategies, Porter (1980) differentiates between cost leadership and differentiation. In a succeeding paper, Porter and Millar (1985) substantiate these generic strategies for the process level. Cost leadership is the process strategy to sustainably produce on – compared to competitors – lower cost levels, mostly realized by technological advantages in production or by learning effects. In contrast, the differentiation strategy aims at

producing superior product quality or product variety. In the past, organizations could choose between these two archetypes or decide for a niche strategy between the both extremes. Today, organizations need to execute them in parallel and follow ambidextrous strategies. Due to lower switching costs, customer loyalty is hard to achieve (Valvi and Fragkos 2012). Thus, differentiation appears as a promising answer. Moreover, the current trend of digitalization enables customers to be highly interconnected leading to higher market transparency and ultimately to higher competitive pressure. Cost leadership appears beneficial against this development. Strategic singularity is therefore not possible to survive today's extreme situation and ambidexterity becomes mandatory.

Although, ambidexterity is not new to IS literature (Markides 2013; Mithas and Rust 2016; Raisch and Birkinshaw 2008), there is only little attention on ambidexterity in BPM. However, the emergence of the E-E trade-off between customer-centric designs (explorative BPM) and efficient designs (exploitative BPM) exactly requires such an ambidextrous thinking. According to the paradigm of strategic alignment, ambidexterity can only be established on the corporate level when the process designs reflect such a proper mix. Looking at the current focus of BPM research with respect to strategic orientation, most redesign approaches put process performance as their objectives. Thereby, process performance is often considered as a multi-dimensional construct (Limam Mansar and Reijers 2005). As a very popular example, the framework of the devil's quadrangle groups different performance measures into the dimensions time, cost, quality and flexibility and thus, enables a clear analysis of different process redesign alternatives (Limam Mansar and Reijers 2007). The name of the framework reflects the issue that improving process performance in one dimension is always accompanied with impairing in at least one of the other dimensions. The considered dimensions have a strong focus on process-internal dimensions and customers are only addressed indirectly. Whereas process time and costs can be classified as efficiency objectives, process flexibility and quality are at least partly customer-centric. Process flexibility is the ability of a process to cope with contextual changes by adapting its structure and behavior in a goal-oriented manner (Wagner et al. 2011). From an operational perspective, process flexibility splits into functional and volume flexibility (Afflerbach et al. 2014). While volume flexibility enables increasing or decreasing the amount of the process output above or below installed capacity (Goyal and Netessine 2011) and thus follows an efficiency-related interpretation, functional flexibility enables delivering the output variety demanded by the organization's customers (Anupindi et al. 2012) and relates to customer-centric objectives (Hall and Johnson 2009; Hammer and Stanton 1999). Also process quality

can be interpreted as internal process quality and consider error rates or it can follow an external interpretation in terms of quality perceived by customers. As process error rates are more intuitive for operationalization, the internal interpretation is rather dominating. Rosemann (2014) underscores the outlined underrepresentation of explorative components in BPM. Thereby, he criticizes that opportunities of explorative strategies are often neglected and future revenues from innovative, IT-enabled processes are outside the design focus. Due to digitalization, explorative strategies are gaining importance and redesigning processes needs a strategic rethinking towards the co-existence of customer-centric and efficient process designs. In terms of the risk trade-off between safe and unstable process designs, BPM mainly commits to a risk-averse orientation. This commitment is supported by famous concepts like six-sigma (Conger 2010) or value-based BPM (Bolsinger et al. 2011). However, Alexandrov (2015) shows that it is rational for organizations to balance their strategies with risk-taking and risk-averse components. Thus, a strategic rethinking is again required.

II.1.2.2 *Value-based Management as Integration Frame*

With this paper we want to take up Rosemann's (2014) thoughts and develop a quantitative model on how to position within the tension field between exploitative and explorative design. The main challenge of this research objective is to integrate the different but related approaches from CRM and BPM on a common basis. To overcome this challenge, we start with value-based BPM as an accepted research stream in BPM on process design. This stream typically aims at optimizing process cash flows in redesigning processes (Bolsinger 2015). As extension, we ascribe revenues as an essential component of process cash flows to an organization's customers who generate revenues and integrate insights from the Kano model (Kano et al. 1984). Depending on how the process output fulfills the needs of the customers, overall customer satisfaction and simultaneously customer profitability or revenues accordingly increase or decrease (Kano et al. 1984). Especially relevant for this basic idea, is Kano et al.'s (1984) differentiation between three types of customers with respect to the underlying relationships between customer satisfaction and the fulfillment of expectations. For our purpose of connecting Kano et al. (1984) over their results on customer perceptions and process revenues from value-based BPM, we transfer this differentiation concept of customers to processes with respect to their outputs. Thus, so called basic processes should perform with low deviation in their output to avoid dissatisfaction of the customers. Dissatisfaction would lead to a lower retention of the customers and therefore to reduced revenues (Anderson and Mittal 2000; Heskett et al. 1997). Excitement processes may differ in

their output variety as they can only positively affect customer satisfaction and therefore have a high contribution to corporate revenues. This early discussion already shows that customer-centric analyses have also implication on the proper riskiness of the ideal process design. Consequentially, the risk trade-off is not orthogonal to the E-E trade-off but both decisions mutually influence each other. This interdependencies are a key challenge demanding the integration of customer and process perspectives in order to find the right ambidexterity.

Such an integration of CRM and BPM as theoretical underpinnings needs to take place on the conceptual and on the methodological level to achieve a sound framework. On the conceptual level, the process output is the linking element. On the customer side, customer satisfaction and therefore profitability critically depends on the fulfillment of customers' expectations towards the process output. On the process side, the process output is the final result of the underlying business process and therefore also determines its operational efficiency. As a result, the process output does not only integrate the customer and the process perspective, but it also unites the economic opponents of profitability and efficiency.

In order to bring this conceptual integration down to the methodological level, we draw upon the results of value-based management (VBM) because of three reasons: First, VBM abstracts as a paradigm of corporate decision making from domain-specific conditions by taking an economic perspective and by translating problem specifications into the neutral measure of cash flow effects. Taking this neutral perspective enables VBM to take customer, process and integrating perspectives. Whereas customer-centric designs improve the profitability of an organization's customers and thereby also corporate cash inflows, efficient designs decrease process cash outflows sacrificed for the production of the process output. Thus, the residual measure of cash flows constitutes the equivalent to the process output as linking element on the methodological level. Structurally, both designs increase cash flows either by reducing cash outflows (efficient designs) or by increasing cash inflows (customer-centric designs). This structural equivalence makes the effects comparable and integrative. Second, VBM emphasizes risk as the second decisive factor of corporate decision making. Thus, it is directly applicable for the risk trade-off as well. Third, the benefits and the applicability of the paradigm have already been demonstrated in CRM and BPM (Bolsinger 2015; Buhl et al. 2011; Kumar 2009; Kumar and Pansari 2016). Based on this reasoning, we can conclude the suitability of VBM as our methodological integration frame.

In order to further substantiate the suitability of VBM as integration frame, we now outline its theoretical foundation. Within the last decade, VBM has established as the predominant

paradigm for economic research and practice in corporate decisions (Buhl et al. 2011). The success of VBM can be traced back to the incorporation of a long-term perspective of the firm value and the focus on a sustainable increase of the firm value within corporate decisions (Ittner and Larcker 2001; Koller et al. 2015). Basically, VBM represents an extension of the share-holder value approach by (Rappaport 1986) which was elaborated by Copeland et al. (1994) and by Stewart and Stern (1991). The long-term perspective of VBM implicitly results in the completion of the more general stakeholder value approach (Danielson et al. 2008). In order to fully implement VBM in an organization, decisions on all hierarchy levels have to be aligned to a firm value maximizing strategy. Thus, there is a strong need for organizations following the VBM approach to identify and quantify the value contributions – typically measured by the effect on future cash-flows – of every single asset and decision. The basic principle behind this required decomposition is that the firm value can be calculated by aggregating all current and future assets of an organization. For well-founded decisions, additional knowledge about the time value of money, as well as on the risk attitude of a decision-maker is mandatory (Buhl et al. 2011). Besides those parameters, the choice of an appropriate valuation function for determining the value of single assets is crucial. In this choice, the concrete decision situation should be taken into account as investment and decision theory suggest (Buhl et al. 2011; Damodaran 2012). Whereas the net present value (NPV) of future cash flows with a risk-free discount factor is common for decisions under certainty, a more differentiated view is required for a situation with risk. Decisions under risk should be grounded on the NPV method incorporating a risk-free discount factor for risk-neutral decision-makers. In contrast other methods like the certainty equivalent method or the risk-adjusted NPV have to be applied for risk-averse decision makers (Copeland et al. 2005). The applicability of VBM on our research topic requires the compilation of the responsive behavior of customers and processes on different process design strategies into cash flow effects. This cash flow focus ensures the comparability across effects and compatibility to the valuation functions from VBM.

II.1.2.3 *Customer Effects*

Disassembling the E-E trade-off into its singular components, *customer satisfaction* as the experience component plays an important role for the cash inflow perspective. Certainly, customer satisfaction itself is not the objective criterion, but there is evidence that customer satisfaction leads to improved customer retention which ultimately results in increased cash inflows (Anderson and Mittal 2000; Danaher and Rust 1996; Gruca and Rego 2005; Heskett

et al. 1997; Larivière et al. 2016; Parasuraman et al. 1988). Besides, the American Customer Satisfaction Index, supposed by Fornell et al. (1996), the so called Kano model is predominant in customer satisfaction research (Kano et al. 1984; Matzler et al. 1996). Both approaches aim at determining the satisfaction of an organization's customers. The Kano model conceptually manifests the confirmation disconfirmation paradigm (Oliver 1980). According to this paradigm, customer satisfaction evolves from the comparison of a customer's expectations prior to the actually perceived experience about the quality or performance of the product or service (Matzler et al. 2004). If the perceived performance falls short of the customer's expectations, dissatisfaction or under-fulfillment realizes: Correspondingly, customers feel satisfied in the case of over-fulfillment, if the perceived performance exceeds expectations. In case of a balanced relationship between expectations and perceptions, customers will feel moderately satisfied (Matzler et al. 2004). Kano et al. (1984) enhance this theory and further differentiate these findings into three different relationships: Basic, performance and excitement relationships or requirements. The fundamental idea of those different types of requirements can be easily transferred on products or services as they are just the aggregation of different requirements. Thus, products or services that are classified as basic factors – which in turns means that in an aggregated view, basic requirements predominate the product or service – can only negatively influence satisfaction. In the case of under-fulfillment, customers feel extremely dissatisfied and in the case of over-fulfillment they do not feel satisfied. As depicted in Figure II.1-1, basic factors (solid line) show an asymmetric experience-expectation relationship in the shape of a negative exponential function with the fulfillment of expectations on the x-axis and the resulting satisfaction on the y-axis. Figure II.1-1 illustrates the high disappointment potential and the absence of any satisfaction potential for basic factors. The typical example of a basic factor is the cleanliness of a toilet. Excitement factors do not suffer from partly or even total under-fulfillment, but they strongly increase customer satisfaction in case of over-fulfillment of expectations. The corresponding curve (dashed line) is shaped like a positive exponential function illustrating their satisfactory potential and their robustness against under-fulfillment. Performance factors are linearly shaped and translate the fulfillment of expectations directly proportionally into satisfaction or dissatisfaction. Figure II.1-1 depicts the positive influence of over-fulfillment on customer satisfaction and the negative influence on satisfaction in case of bad performance (dotted line).

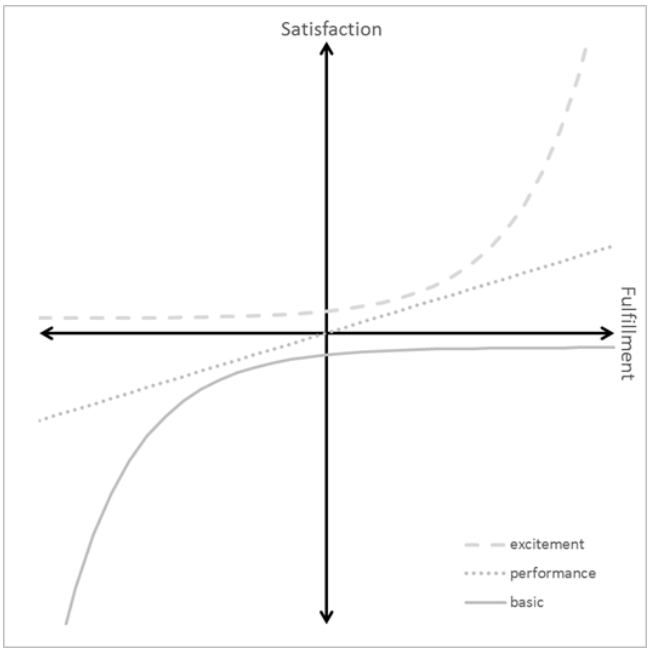


Figure II.1.2-1 *Kano model*

With customer satisfaction directly influencing future cash flows of an organization (Anderson and Mittal 2000; Danaher and Rust 1996; Gruca and Rego 2005; Heskett et al. 1997; Larivière et al. 2016), the role of pleasing customers as a prerequisite for long-term economic success becomes evident. Connecting Kano's (1984) insights about satisfaction-relationships and the outlined relationship between customer satisfaction and future cash flows shows that the cash inflows generated by a process, strongly depend on the classification of the process' outputs as basic, performance or excitement outputs. As Kano's (1984) model points out, processes can exacerbate different dynamics on customer satisfaction. Thus, different risk- and E-E strategies conditioned on the classification of produced output may be beneficial. With respect to our research question "*How do risk- and E-E trade-off affect strategic orientation in business process design?"* we hypothecate, that the exponential relationships for excitement and basic factors may make process fulfillment — defined as the degree to which the customers' expectations are met in their experience — more important as compared to performance processes and their linear dynamics. In addition, the asymmetric risk profiles of excitement processes and basic factors may suggest different risk strategies. We investigate these first hypotheses in the course of this manuscript.

II.1.2.4 *Value-based Process Management*

As already outlined, process costs or cash outflows are the predominant decision criterion in BPM. In the mid-nineties, BPM scholars began to criticize this one-sided view (Kanevsky and Housel 1995) and applied the principles of VBM on process decision making (Bolsinger et al.

2011). Following this paradigm, Gulledge et al. (1997) postulated the equal importance of cash inflow components. Within the last years, this mindset gained ever more importance in the community and the research stream of value-based BPM emerged (vom Brocke and Sonnenberg 2015). The basic idea of value-based BPM is to interpret an organization as a network or portfolio of processes which contribute all together to the firm value of the organization (Bolsinger et al. 2011). In this interpretation, improving processes gets a strong focus on the long-term maximization of the firm value, as the process value is correspondingly defined as its contribution to the corporate value (Buhl et al. 2011). Next to value-based BPM as the "cleanest" application of VBM on process decision making, some closely related approaches like value-focused BPM (Neiger and Churilov 2004; Rotaru et al. 2011), value-oriented BPM (vom Brocke et al. 2010) and value-driven BPM (Franz et al. 2011) exist as well.

Process redesign developed as a problem domain of special interest for the approach of value-based BPM (Bolsinger et al. 2015). Whereas some works focus on the control flow in order to figure out the best design alternatives (Bolsinger 2015; vom Brocke et al. 2010), others concentrate on process performance and process structures (Afflerbach et al. 2014; Linhart et al. 2015). Although, these approaches put process cash inflows into the focus of design questions, the effects of process redesign on this decisive factor are often modeled exogenously. The response of a process' profitability to a redesign initiative is thereby primarily determined by the process behavior. Customer reactions are only considered implicitly. However, exactly the synthesis of CRM and BPM is relevant for strategic decisions about process design as we already motivated in the introductory section.

Summing up, the current state in BPM literature in general and in value-based BPM in particular, mainly focuses on performance tuning and cost-risk optimization (Reijers and Limam Mansar 2005). Recently, BPM begins to discover the explorative perspective and highlights the need for innovative, risk-taking and customer-centric designs (Rosemann 2014). Currently, the outward perspective on customers is underrepresented in BPM literature (Bolsinger et al. 2011; Bolsinger 2015; Reijers and Limam Mansar 2005). The key contribution of this paper lies exactly in integrating the customer and process side for determining proper design objectives and in deriving a quantitative framework which indicates which of both sides should be emphasized.

II.1.3 **Model**

When establishing an ambidextrous design strategy with the E-E trade-off on the one hand and the risk trade-off on the other hand, there arise two key problems: First, organizations have to separately define design principles for each process with respect to their relevant characteristics. Given the large number of processes, this task of strategic alignment suffers from very high complexities. As a response, the development of a strategic framework providing concrete strategic guidance on defining design principles is mandatory to reduce complexity and to foster consistency across the process landscape. Second, the integration of the internal process perspective and the external customer perspective is crucial to holistically investigate the interplay between an organization's business processes and its customers. Accordingly, our units of analysis are so called "value or primary activities", i.e. business processes with a direct interface to customers (Porter and Millar 1985). Please note that the scope of our framework is to provide a better understanding about the strategic effects of process design and the definition of process and customer types, which are relevant for a proper strategic orientation. Our framework should not get confound with a decision model for operative redesign decision as it takes a more high-level, strategic view on business process redesign. Operational redesign decisions require more detailed analyses and should follow our strategic investigations in a second step.

As methodological foundation we draw upon the results of VBM. This famous paradigm is accepted in both, CRM, as concepts like the customer lifetime value illustrate, and BPM, as the concept of value-based BPM demonstrates. A highly acknowledged approach within the tool-kit of VBM is to insert (the NPV of) cash flows into an appropriate valuation function in order to obtain a comparable decision criterion. In our framework, we use the expected value as a typical valuation function from VBM. Although the expected value reflects a risk-neutral decision maker and thereby contradicts the typical assumption of risk-aversion, this simplification enables us to separate effects from the process and customer sides and effects from the decision makers' risk attitudes. As a result, we can derive more general and clearer results. In Section 4 we discuss our findings for risk-averse decision makers and show their robustness against this assumption.

In order to further increase the comprehensibility of our framework, which is crucial for the purpose of our framework, we modify the expected NPV as our objective function in two ways. First, we directly consider cash flows and not their NPV. If the underlying cash flows follow an independent, identical distribution — a very common condition in business process

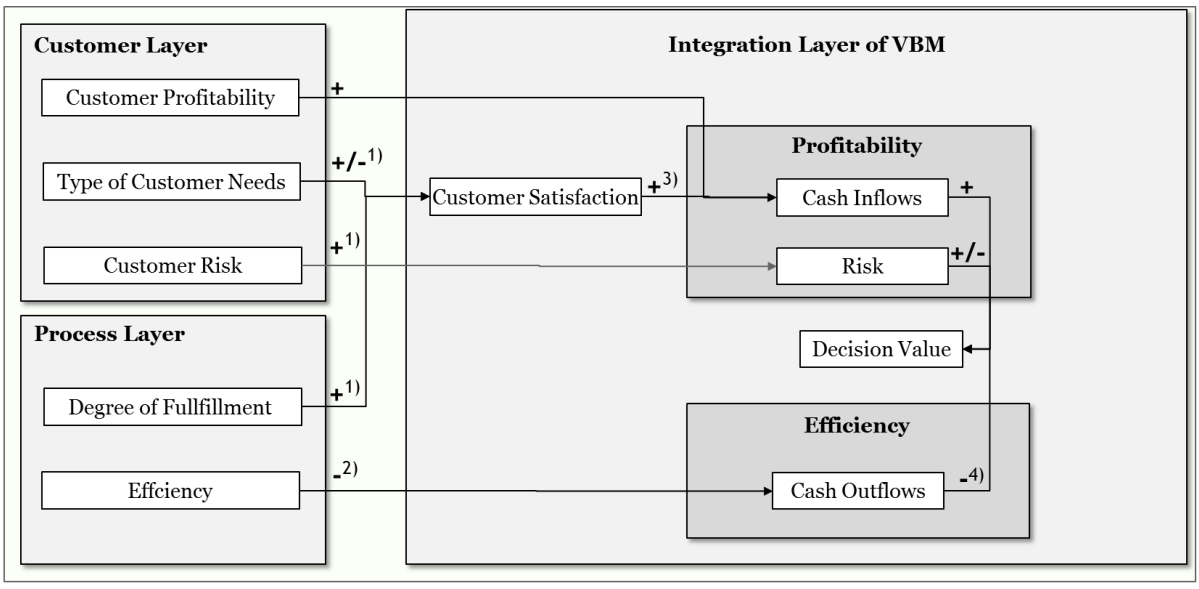
management (see e.g. Bolsinger et al. 2011; Buhl et al. 2011; Murray and Haubl 2011) — the NPV can get reduced to a constant discount factor. As the pure discounting, does not alter decisions and as the scope of our model lies on the strategic decision and not on an accurate value estimation, we can abstract from this complexity and use the periodic cash flows instead as a proxy. Second, we distinguish between cash inflows CI coming from the external customer side and cash outflows CO coming from the process side. The clear assignment of cash inflows to the customers and cash outflows to processes is an approach which considerably increases the comprehensibility of the interplay between both sides. Moreover, it does not influence our results, as the assignment of cash flows to research objects is problem specific in VBM. Whereas the BPM literature traditionally assigns both, cash in- and outflows to processes (e.g. Bolsinger et al. 2011; vom Brocke et al. 2010), CRM literature assigns all cash flows to the customer as its central research object (e.g. Gupta et al. 2006). For our integrative purpose, basically all combinations in between these extreme assignments would theoretically be possible. Accordingly, we have chosen the clearest variant. Using the sum of cash in- and outflows as objective function, increasing cash inflows (or increasing customer satisfaction) and decreasing cash outflows (increasing process efficiency) finally have the same effect. Our objective function V then equals

$$V = E(CI) - E(CO) \quad (1)$$

Equation (1) separately represents the relevant factors for a proper strategic orientation for the focal business process. The expected cash inflows (first term of equation (1)), resulting from selling the process output to the customer, is a measure for customer profitability. The expected cash outflows (second term of equation (1)) resulting from executing the underlying process to produce the process output is a measure for process efficiency. In order to properly compile the cash in- and outflow components, we draw back on the results from CRM for the inflow side and from BPM for the outflow side. As justificatory literature for the process layer, we refer to Bolsinger et al. (2011) who transfer the principles of VBM to BPM in the context of process redesign. The basic idea of their model is the description of process cash (out-) flows on the basis of a stochastic distribution. They show that the value of a process can be calculated by inserting the normal distributed cash flows into the chosen valuation function. Thereby, the process value is completely determined by the expected cash flows (efficiency) and their variances within the integration layer of VBM.

Considering the customer layer, Gruca and Rego (2005) illustrate that operational cash inflows i.e. profitability linearly depend on customer satisfaction. Thus, the substantiation of

the cash inflows requires the compilation of customer satisfaction. For this purpose, we refer to the well-established Kano model (Kano et al. 1984) who differentiate between three types of relationships between the realized customer satisfaction and the degree of fulfillment of the customers' needs towards the process output. At this point, we can again bridge the customer and the process world. The degree of fulfillment is a typical process characteristic, which is closely linked to customer satisfaction and thereby to cash inflows. The higher the expected degree of fulfillment, the higher the expected customer satisfaction and the higher expected cash inflows. To model this casual chain, we begin with the degree of fulfillment. Analogously to the reasoning from Bolsinger et al. (2011) about process cash flows, we can describe the degree of fulfillment also by a normal distributed random variable. In a second step, we transfer the threefold manifesto of Kano (1984) to the process level by differentiating between basic, performance and excitement processes and modeling the different satisfaction mechanics. In a third step, we transform the intermediate result for customer satisfaction into cash flows and insert them into our valuation function. Following this procedure, we describe the customer value on the basis of the expected fulfillment as a measure for customer profitability and the fulfillment variance as a measure for customer risk. Finally, we integrate both sides in the valuation layer within our objective function. Figure II.1-2 illustrates the reasoning above and graphically summarizes our results, whereas the arrows show the direction of influence, the plus/minus indicate a positive or negative influence. Below, we substantiate our objective function in more detail.



1) Kano et al. 1984; 2) Limam Mansar et al. 2009; 3) Gruca and Rego 2005; 4) Bolsinger et al. 2011;

Figure II.1.3-1 *Basic Idea of CRM-BPM-Framework*

A key result of value-based BPM is, that process cash flows follow a normal distribution (see e.g. Bolsinger et al. 2011; Buhl et al. 2011; Murray and Haubl 2011). This implies that the expected value and the variance of the process cash flows completely define the value of a business process. The central limit theorem and variations from it provide the justification for this result. As the number of process executions n within a single period is sufficiently large and as the other assumptions of identical and independent repetitiveness hold for business processes, the central limit theorem states that process cash flows are normally distributed (Bolsinger et al. 2011). In our case, the expected process cash outflows sacrificed for the production of the process output in a single period $E(CO)$ calculates by multiplying the number of executions n and the expected outflows μ_{CO} per process instance.

$$-E(CO) = -n \cdot \mu_{CO} \tag{2}$$

For compiling process cash inflows, we begin with modeling the degree of fulfillment as the bridging variable between the customer and the process layer. Therefore, we transfer the reasoning about cash flows as the central process characteristic of value-based BPM to the degree of fulfillment as the central process characteristic of CRM. The identical and independent repetitiveness of processes makes the central limit theorem also applicable for the degree of fulfillment. If a process fulfills the needs of an organization's customer to the expected degree μ_F and variance σ_F^2, the total fulfillment of the entire customer base i.e. over the total number of process executions n then also follows a normal distribution with mean $n \cdot \mu_F$ and variance$n \cdot \sigma_F^2$. In order to translate the fulfillment into satisfaction, we need to consider the different mechanics toward the three kinds of process outputs and derive an analytical relationship for each output type. Excitement outputs are ideal for an organization as disappointing customers does not decrease customer satisfaction whereas an over-fulfillment of expectations leads to an exponential increase of satisfaction. In terms of risk, the organization only faces "upside risk" meaning that it can only win and not lose in satisfying their customers. Moreover, their winning potential increases exponentially with the degree of fulfillment. Mathematically, an exponential function $\exp(bF)$ mirrors this ideal relationship between satisfaction and fulfillment F where b is a measure for customer sensitivity towards fulfillment. The higher the sensitivity b the more satisfied feel customers in the case of excitement. Basic outputs follow the same logic in the opposite direction. They are the worst-case type for an organization as over-fulfillment is not rewarded or perceived by customers whereas disappointment leads to an exponential decrease of satisfaction. In terms of risk, the organization only faces "downside risk" meaning that it can only lose and not win

in satisfying their customers and their losing potential is exponential. A negative exponential function $-\exp(-bF)$ mirrors this undesirable relationship. Again b is a measure for customer sensitivity on fulfillment and the higher b the worse the reaction on disappointment. Performance outputs stand in between these extremes. Over- and under-fulfillment are equally perceived and both linearly increase and decrease customer satisfaction. The corresponding mathematical function bF shows this ambiguity. In order to finally transfer our intermediate results into cash inflows, we refer to Gruca and Rego (2005) who empirically illustrate a linear relationship between both constructs. The profitability p monetizes satisfaction and is defined as the exchange rate between satisfaction and cash inflows as illustrated by Gruca and Rego (2005). On this foundations, we can compile the cash inflow components of the objective function. Therefore we integrate the respective cash inflow functions over the density of the fulfillment.

$$E(CI) = \begin{array}{ll} \int p \cdot exp(b \cdot F)\, f(F) dF & \text{e-process} \\ \int p \cdot b \cdot F\, f(F) dF & \text{p-process} \\ \int -p \cdot exp(-b \cdot F)\, f(F) dF & \text{b-process} \end{array} \quad (3)$$

Two things are important to note when solving these integrals. First, the solution for the exponential functions of excitement and basic processes correspond to the expected value of a log-normal distribution and are therefore known in stochastic theory. Second, the linear relationship from the performance factors follows the same logic as for the cash outflow component. Thus, we already know the solution for performance processes as well. Equation (4) shows the complete substantiation for the customer side.

$$E(CI) = \begin{array}{ll} p \cdot exp\left(b \cdot\ n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) & \text{e-process} \\ n \cdot p \cdot b \cdot \mu_F & \text{p-process} \\ -p \cdot exp\left(-b \cdot\ n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) & \text{b-process} \end{array} \quad (4)$$

Synchronizing the process side with the customer side into one equation, we finally get to our final objective function *V* which is illustrated in equation (5).

$$V = \begin{array}{ll} p \cdot exp\left(b \cdot\ n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) - n \cdot \mu_{CO} & \text{e-process} \\ n \cdot p \cdot b \cdot \mu_F \quad - n \cdot \mu_{CO} & \text{p-process} \end{array} \quad (5)$$

$$-p \cdot exp\left(-b \cdot n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) - n \cdot \mu_{CO} \qquad \text{b-process}$$

Equation (5) constitutes a solid foundation to derive solutions for the E-E trade-off and the risk trade-off. It combines different types of customer behaviors and process efficiency on a common theoretical foundation enabling the detailed analysis of the E-E trade-off. Furthermore, risk in form of the variation of the process fulfillment is also implemented providing the analytical basis for the risk trade-off.

Variable	Definition	Origin
V	Decision value	Value Based Management (e.g. Kollar et al. 2015)
μ_{CO}	Expected cash outflow per process execution	Inspired by Bolsinger (2015)
μ_F	Expected degree of fulfillment of customer needs	Inspired by Kano et al. (1984)
σ_F^2	Variance of process output	Inspired by Bolsinger (2015)
p	Profitability of satisfaction	Inspired by Gruca and Rego (2005)
b	Customer sensitivity on fulfillment	Inspired by Kano et al. (1984)
n	Number of executions of a process per period	Bolsinger (2015)

Table II.1.3-1 *Overview Variables*

II.1.4 **Interpretation and Analyses**

II.1.4.1 *Risk Orientation*

Based on our analytical framework from the previous section, we can now define the optimal strategic design of business processes with respect to both trade-offs incorporated in our research objective, namely risk- and E-E trade-off. Beginning with the risk trade-off, we can state that BPM primarily advices risk-averse process designs. Theoretical foundations for this one-sided advice come from the statistical theory of variation and from the typical assumption of risk-averse decision makers in economic research. The statistical theory of variation suggests that process variation causes process outputs to deviate from their target specification and that the elimination of deviations leads to cost savings (Deming 1994). This reasoning is the basis for the popular six sigma approach that demands the continuous reduction of variation as strategic objective. From a more economic view, the typical assumption of risk-averse decision makers leads to the dominance of risk-averse design objectives (Bolsinger et al. 2011). However, when including the customer perspective as a second analytical lens on the risk trade-off, these results demand further differentiation: The different cash inflow dynamics from excitement, basic and performance processes need to be taken into account. As excitement processes promise extremely satisfied customers for high

fulfillments and as they are not exposed to potential disappointments for low fulfillments, an organization faces only upside risk. In this case, risk-taking designs are beneficial as positive extremes are rewarded by additional cash inflows while negative deviances are not punished by lower cash inflows. Correspondingly, more varying excitement processes showing more extreme fulfillments better adopt this asymmetric risk mechanics and thereby show a higher profitability. For basic processes the opposing argumentation holds. They face extremely disappointed and unprofitable customers for low fulfillments and cannot benefit from profitability increases in the cases of high fulfillments. In other words, basic processes only face downside risk. Risk-averse designs are advantageous as positive extremes are not rewarded by additional cash inflows while negative deviances are punished by lower cash inflows. Consequentially, more stable basic process show a smaller exposure to the described downside risk and promise a higher profitability. Considering performance processes, we can state that the symmetric satisfaction mechanics neither favors a risk-taking nor a risk-averse orientation and that a risk-neutral orientation should be followed.

In order to mathematically prove this argumentation within our framework, we derive the objective functions (equation (5)) with respect to the variance of the fulfillment and show that the derivative (equation (6)) for excitement processes is strictly positive, that the derivative for basic processes is strictly negative and that the derivative for performance processes equals zero indicating risk-taking, risk-averse and risk-neutral designs as beneficial. Accordingly, we can confirm our hypothesis that risk strategy is dependent on the process type.

$$\frac{\partial V}{\partial \sigma_F} = \begin{cases} p \cdot b^2 \cdot n \cdot \sigma_F^2 \cdot exp\left(b \cdot n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) > 0 & \text{e-process} \\ 0 & \text{p-process} \\ -p \cdot b^2 \cdot n \cdot \sigma_F^2 \cdot exp\left(-b \cdot n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) < 0 & \text{b-process} \end{cases} \quad (6)$$

For excitement processes, the derivative of the objective function with respect to the fulfillment variance is strictly positive. This is because all parameters are defined on a positive definition range and because the exponential function has a strictly positive value range. For basic processes, the same argumentation holds, but the minus sign makes the derivative strictly negative. As performance processes do not display the fulfillment variance in their value function, the derivative equals zero.

As we intentionally applied the expected value as our valuation function and thereby assumed a risk-neutral decision maker, we now discuss our results for risk-averse decision makers. As the process and customer characteristics do not show a risk preference for performance factors, the risk aversion originating from the attitude of the decision maker becomes decisive. Thus, risk-averse decision makers should concentrate on risk-averse designs for performance processes. In the case of basic processes, the risk aversion from the customer and process side is reinforced by the decision maker's attitude and again risk-averse designs are favorable. For excitement processes, the preference for risk-taking designs is countered by the risk aversion of the decision maker and we cannot directly make a clear statement. However, we can put forward two qualitative arguments to support risk-taking designs. First, the positive effect of process variance originating from the upside risk of excitement processes exponentially increases process profitability. In the BPM literature, the negative effects of process variance resulting from the decision maker's risk attitude are often modeled as linear and thereby less influential than the exponential benefits from risk-taking designs on the customer side (see e.g. Bolsinger et al. 2011; Buhl et al. 2011). Second, economic theory often interprets risk as two-sided and thereby combines upside and downside exposures while neglecting the one-sided potential of the case at hand. Thus, the typical conceptualization of risk aversion does not fit the conditions of excitement processes. More differentiated interpretations of risk can be found in advanced performance measures like the Shadwick Omega (Shadwick and Keating 2002) which directly addresses this conceptual drawback. On this basis, we argue that the interpretation of risk aversion is not suitable for excitement processes and state that the preference of risk-taking designs also holds for risk-averse decision makers. Summing all up, we showed that organizations should follow an ambidextrous design strategy with respect to the risk orientation of their processes. For excitement processes, risk-taking designs are beneficial as they better absorb the asymmetric profitability mechanics. For basic and performance processes, the more traditional, risk-averse orientation can be maintained.

II.1.4.2 *Experience-Efficiency Trade-Off*

Existing redesign approaches like for example Limam Mansar et al. (2009) or the Devil's Quadrangle from Brand and van der Kolk (1995) put operational process performance and therefore efficiency as their central objectives. Redesign approaches from the research stream of value-based BPM strongly request the additional consideration of cash inflows but do not explicitly include customer behavior as the decisive force. In this section, we relate process efficiency represented by the cash outflows and customer orientation represented by the cash inflows within our framework to fill this research gap.

Again the different mechanics of basic and excitement processes with their asymmetric customer perceptions on the one side and the linear perception of performance processes on the other side demand the ambidexterity of design objectives. Analyzing the different structures qualitatively, we derive three key-results: First, organizations need to ensure a saturation degree of fulfillment μ_{SAT} for basic processes. In other words, customer-centric designs are favorable until very disappointed customers are prevented. Once that saturation fulfillment is reached, efficient designs become more favorable even if the fulfillment stays moderate. A generic design strategy would be: "Prevent extreme disappointments at possibly low process costs". This two-sided strategy is a direct consequence from the asymmetry of the customer behavior. As customers of basic processes become only disappointed for large underperformances, only these extreme cases have to be prevented (Kano et al. 1984). In all other cases, efficiency promises to be more valuable than additionally boosting process fulfillment. Second, excitement processes need a minimum level of fulfillment μ_{MIN} to prefer customer-centricity over efficiency. In the right accelerating branch of the satisfaction curve, i.e. in the area of high over-fulfillment, (see Figure II.1-1) customer-centric designs unfold their true potential. According to Kano (1984), true excitement requires unexpectedly high fulfillments. If customer-centric designs cannot bring the process in this excitement area, efficient alternatives are the better strategy. Third, the effects of customer-centricity and efficiency are about equally strong across different levels of fulfillment for performance processes.

In order to show these qualitative propositions mathematically, we introduce the experience-efficiency-ratio (E-E-ratio) as the relation between the derivative of the objective function with respect to the expected degree of fulfillment and its derivative with respect to the expected cash outflows. If processes exhibit an E-E-ratio larger than one, their values react more sensitively on customer-centric redesigns. For ratios smaller than one, efficient redesigns become more valuable. This inequality can be rewritten into the minimum level of fulfillment for excitement processes and the saturation level of fulfillment for basic processes.

$$E-E-ratio= \begin{cases} p \cdot b \cdot exp\left(b \cdot\ n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) > 1 & \\ \rightarrow \mu_F > -\frac{ln(p \cdot b)}{b \cdot n} - \frac{b}{2} \cdot \sigma_F^2 = \mu_{MIN} & \text{e-process} \\ p \cdot b > 1 & \text{p-process} \\ p \cdot b \cdot exp\left(-b \cdot\ n \cdot \mu_F + \frac{b^2}{2} \cdot n \cdot \sigma_F^2\right) > 1 & \text{b-process} \end{cases} \quad (7)$$

$$\rightarrow \mu_F < \frac{ln(p \cdot b)}{b \cdot n} + \frac{b}{2} \cdot \sigma_F^2 = \mu_{SAT}$$

Further substantiating these findings, we conduct sensitivity analyses of the E-E-ratio against customer sensitivity b and the degree of expected fulfillment μ_F. In a first step, we set up a basic calibration for all variables of the E-E-ratio (cf. table II.1-2 – basic calibration). The parameter values of this calibration are in a common range and enable a comparable illustration of the mathematical results. Naturally, values are strongly dependent on the investigated industry and organizations, so we decided to choose moderate or average values for each parameter. Thus, as values for p and n linearly influence the E-E-ratio, we standardize them to 100. Furthermore, μ_F and σ_F can take on values between 0 and 1, thus we took moderate values as starting point for our sensitivity analysis to allow for adequate variations into both directions. Customer sensitivity is probably most difficult to operationalize (we add a corresponding discussion in the conclusive section). Analytically, the form of the Kano functions resemble exponential utility functions from VBM. Accordingly, we took a plausible value inspired by values reported in VBM literature (Bolsinger 2015; Buhl et al. 2011).

customer profitability p	customer sensitivity b	number of customers n	expected degree of fulfillment μ_F	std. deviation of fulfillment σ_F
100	0.015	100	0.4	0.2

Table II.1.4-1 *basic calibration*

For customer sensitivity b we started with 0.005 slightly increasing in steps of 0.0001 up to 0.015. Figure II.1-3 shows that customer-centric designs gain importance with more sensitive reactions of customers on fulfillment. The less sensitive customers react on a given level of fulfillment, the less desirable are customer-centric process designs, as customers do not reward the invested effort with higher satisfaction and profitability. This is directly reflected by the linear increase of the E-E-ratio for performance processes. For excitement processes, customer-centric designs are highly recommended from a minimum level of customer sensitivity on. Thus, organizations should aim at high fulfillments and even accept drawbacks in process efficiency, if the customer sensitivity is that high, that customers really reward their redesign efforts with excitement and therefore profitability. Basic processes have to be efficient as the E-E-ratio stays smaller than one. In other words, basic processes should follow lean and efficient designs as the marginal costs of non-fulfillment are always lower than the marginal process costs. This is because the expected degree of fulfillment is with 0.4 in a

moderate range, preventing extreme disappointments and favoring efficiency. Overall the illustration transports two key messages: First, higher customer sensitivities favor customer–centric designs. Second, with moderate expected fulfillments, excitement processes should be designed to excite and basic processes should be designed possibly efficient.

In a second step, we vary the degree of fulfillment μ_F (values ranging from 0 to 0.9 with steps of 0.01) to illustrate the asymmetry of optimal process designs across different degrees of current fulfillment (cf. Figure II.1-4). Whereas our first analysis indicates, that efficient process designs are favorable for basic processes in any case, we can now refine this recommendation in line with our mathematical results. Indeed, our second analysis illustrates the saturation degree of fulfillment which should be reached by customer-centric designs. From this saturation level on, organizations should focus on efficient process design. Although concrete values for the saturation level strongly depend on the chosen customer sensitivity in the basic calibration, we can generally state, that organizations should fulfill the saturation level for basic processes possibly efficient. As already shown mathematically in equation 7, the optimal design orientation of performance processes, does not vary across different degrees of fulfillment. Finally, excitement processes should prefer customer-centric designs with higher fulfillments. This can be substantiated by the parametrization of customer sensitivity rate in our basic calibration. As the chosen customer sensitivity makes excitement possible, efforts for higher fulfillment and thus higher customer satisfaction pay out.

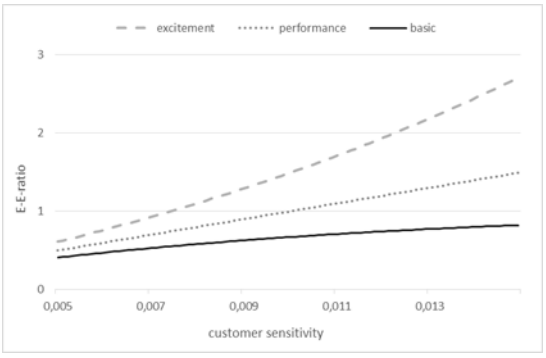


Figure II.1.4-1 *Variation of customer sensitivity of fulfillment*

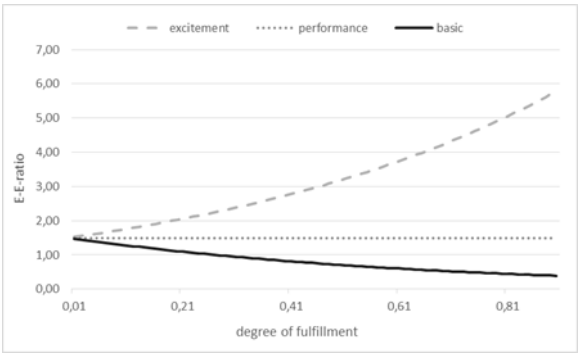


Figure II.1.4-2 *Variation of degree of fulfillment*

The presented theoretically based framework is by nature a bit abstract and up to now not tested empirically. Thus, we want to illustrate the practical relevance, using an example from the automotive industry. For our example, we draw back on a comparison of the two car manufacturer Toyota and BMW. The Japanese car manufacturer Toyota is actually the largest car manufacturer in the world as measured by cars produced in 2015 (Schmitt 2016) and therefore produces *mass-market vehicles*. In contrast, BMW is a bit more focused on the

luxury vehicle market. Accordingly, the widespread image of Toyota is a – compared to the German manufacturer BMW – auspicious car manufacturer, but still producing good quality cars. Deriving from these images, Toyota's mass-market customers can be declared as comparably easy, whereas BMW's luxury customers are more demanding. Besides the customer side, we need to investigate the process side in order to apply the presented framework. Therefore the production process fits well to illustrate the mechanism of the framework. As high fulfillment in the production process leads to a high car quality and therefore higher customer satisfaction, whereas low fulfillment causes low car quality and dissatisfaction, we declare it as a performance process.

Starting with Toyota, we recognize a consequent lean six sigma approach in its production process (Pepper and Spedding 2010), combining efficient process design with a certain level of quality control. Measured by the American Customer Satisfaction Index (ACSI), this strategy pays out as Toyota holds the second rank for customer satisfaction in the category "mass-market vehicles" in the ACSI Automobile Report (American Customer Satisfaction Index 2016). This is in line with the proposed design strategy of our framework which is a risk-averse and exploitative design for performance processes with easy customers. In contrast, BMW with demanding luxury vehicle customers should focus more on the customers in order to meet their needs. Thus, BMW has a more complex production process, offering greater variety of interior and equipment options. Additionally, strict quality controls are necessary. Exactly this strategy is proposed by our model recommending a risk-averse and explorative strategy for performance processes with demanding customers. Again, the strategy pays out for BMW with the second rank for customer satisfaction in the category "luxury vehicles" (American Customer Satisfaction Index 2016). In order to validate these results, we propose to conduct a cross-case analysis in a next step.

II.1.5 **Conclusion and Discussion**

At the center of this paper stands the necessity of a two-dimensional, ambidextrous strategy for business process design. Thus, organizations have to find the right balance between risk-taking and risk-averse process designs (risk trade-off) as well as between explorative and exploitative process designs (E-E trade-off).Even if an organization accepts the necessity of design ambidexterity, the key problem is still to decide which of the archetype designs their processes should follow. This decision is very complex as it requires detailed knowledge about customer and process behavior. Moreover, it needs to be taken for every process

separately. Given this complexity, organizations have a deep need for concrete, practical guidance on how to decide the strategic orientation of their business processes.

In order to meet this requirement the presented framework integrates the customer and the process perspectives to provide a holistic understanding about the interplay of the trade-offs. We connect established theories from BPM in form of value-based BPM and CRM in form of the Kano model, incorporating a strong VBM focus as our methodological bracket. In doing so, we do not claim to give in-depth guidelines for the design of a singular process, we rather aim at an improved understanding of the decisive forces and at providing high-level design guidelines for all Kano process types. Therefore, the contribution of our framework is two-fold. First, we enhance existing redesign approaches like Limam Mansar et al. (2009) and others who operate on a given set of strategic redesign objectives. These approaches focus on prioritizing different redesign ideas on a defined strategic evaluation scheme. With deriving such an evaluation scheme, we complement existing approaches to a holistic redesign framework. Second, we support the rethinking of the BPM community in the direction of ambidextrous BPM as initiated by Rosemann (2014). The predominant strategic objective of BPM is improving process performance which typically follows a more efficiency-orientated connotation. We demonstrate that customer orientation and the inclusion of the customer perspective is a second strategic objective that should stand equally next to operational performance.

Based on our framework, we prioritize design strategies with respect to different process and customer characteristics. For business processes, current expected fulfillment, the variance of current fulfillment and current efficiency are the decisive characteristics. On the customer side, customer sensitivity towards fulfillment and the classification of their perceptions as excitement, basic or performance processes are relevant. Our comparative analyses propose risk-taking designs for excitement processes and risk-averse designs for basic and performance processes. The basic reasoning behind this result is to leverage the asymmetric upside potential of excitement process to excite while simultaneously managing the risk of under-fulfillment for performance and basic processes. For the E-E trade-off, we conclude customer-centric designs for excitement processes with moderate and high fulfillments to fully exploit their upside potential. Furthermore, we propose efficient designs for excitement processes with low fulfillment, as efficiency savings outweigh further selling potential stimulated by an increased customer satisfaction. For basic processes, we propose customer-centric designs until an acceptable fulfillment is promised and the risk of extreme

disappointments is mitigated. Once such a saturation degree of fulfillment is ensured, we recommend switching to efficient design alternatives to achieve this saturation state as efficient as possible. For performance processes, our framework gives the differentiated advices to use efficient designs in case of "easy" customers, which are customers that are not sensitive to (non)-fulfillment of their needs, whereas customer-centric designs are promising for sensitive customers that strongly react on good or bad performances. Table II.1-3 summarizes our results and proposes which of the 4 archetype strategies should be used dependent on process characteristics. The 4 archetype strategies are: 1) *risk-taking and efficient,* 2) *risk-taking and customer-centric,* 3) *risk-averse and efficient and 4) risk-averse and customer-centric.*

	Low fulfillments	**Moderate fulfillments**	**High fulfillments**
Basic processes	4) Risk-averse and explorative design	3) Risk-averse and exploitative design	3) Risk-averse and exploitative design
Performance processes with "easy" customers	3) Risk-averse and exploitative design	3) Risk-averse and exploitative design	3) Risk-averse and exploitative design
Performance processes with "demanding" customers	4) Risk-averse and explorative design	4) Risk-averse and explorative design	4) Risk-averse and explorative design
Excitement processes	2) Risk-taking and exploitative design	1) Risk-taking and explorative design	1) Risk-taking and explorative design

Table II.1.5-1 *Process design principles*

Readdressing our primary research objective of supporting practical decision makers in defining the proper design strategy, we now discuss the applicability of our model, especially the gathering of the required input data. Whereas organizations may obtain typical process data on expected process cash outflows or fulfillment (e.g. process error rate) from their ERP system or the accounting department, information on customer behavior needs a more thorough discussion. As for the most important information, organizations need to determine as what Kano type customers perceive their process outputs. Therefore, a customer survey

needs to be conducted. For a proper classification method as excitement, basic or performance process, we refer to the questionnaire of Matzler et al. (1996). Concerning customer profitability and the number of customers, CRM systems might provide a proper orientation. The most abstract variable is customer sensitivity towards fulfillment. Calibrating this variable should either be achieved in line with the conducted customer survey in form of scenario descriptions or by expert estimations. However, customer sensitivity only matters for performance processes where it decides between exploitative and explorative design strategies. We suggest that practitioners should trust in their feelings whether they have demanding or easy customers and decide accordingly. Addressing a second point of applicability, we want to discuss the practical relevance of our model as a *black-box approach.* In BPM, academia typically differentiates three kinds of redesign approaches: creative, structured and enhanced structured (Limam Mansar and Reijers 2005). The creative approach identifies new process designs relying on brainstorming sessions of human decision makers. The degree of improvement in this approach thereby heavily relies on the intuition of decision makers and leverages their knowledge bases. The strengths of this approach lie in the high creativity and the innovative power allowed to the decision makers, but often leads to biased prioritizations (Limam Mansar et al. 2009). The structured approach uses quantitative models for redesigning processes. Although this approach is less biased and avoids neglecting promising design candidates, it is less creative and more industrial. As an intersection between both extremes, Limam Mansar et al. (2009) propose an improved redesign process. They propose a two-step approach, where quantitative models make propositions which are then evaluated by a design committee (Limam Mansar et al. 2009). This is also where we see the strength of our model. It should not be applied blindly, but the proposed design strategy should be validated by the process decision makers. The model should help and support decision makers to understand the interplay of different effects to provide them a reasonable basis for making good redesign decisions.

Our framework and our managerial implications are beset with limitations that demand future research. First, we restricted our framework to so called primary activities (Porter and Millar 1985), also known as core processes (cf. Dumas et al. 2013) which are business processes with direct interfaces to the end-customers of an organization. As a result, our framework is not directly applicable for support and management processes which aim at ensuring the proper functioning of primary activities. To transfer our results on these types of processes, their insuring effects and their perceptions by the end-customers need to be quantified. However, given the indirectness of effects a strong dominance of efficient designs is to be

expected. Second, we cannot depict robust values for the saturation and minimum degree of expected fulfillment to completely describe the conditions for customer-centric designs. Although, we can conceptually and analytically prove the existence of these conditions and determine the asymmetric customer behavior as comprehensive reason, further empirical research is needed to provide decisive values. As we can determine customer sensitivity fulfillment variance, profitability and the number of executions as influencing variables on the degrees of fulfillment, we provide a suitable base for future empirical analyses. Third, solving the question about proper strategic orientation for redesign initiatives is only one task in the complete redesign process (Limam Mansar et al. 2009). Other tasks like the identification of redesign patterns or their evaluation against the strategic objectives is outside our research scope. We encourage future work to address this drawback and to implement our strategic reasoning into existing redesign approaches. Thereby, a holistic redesign tool could emerge. Fourth, the model operates on a kind of consensus of customer base on the classification of the process into the three categories. Criticizing this ternary classification is reasonable but it represents the essential of the acknowledged Kano model. Besides, our model could be adjusted to more flexible classifications. Therefore, users need to divide their customer base into three customer types respective to their attitudes toward the process output, parameterize our model for all three process types and build the weighted average of the intermediate process values with respect to the proportion of the customer types on the entire customer base. If one customer type dominates the other types, let's say with a proportion of 75% or more, users can use the respective dominant class as representative for the entire base.

Summing up, there is still need for further research at the interface of BPM and CRM. However, the mindset of a strong value focus in designing business processes combined with the knowledge about the presented trade-offs and its implications on design principles, empowers organizations to improve their value on the long run.

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II.1.6 **References**

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II.2 Research Paper 2: "Kundenzentriertes vs. effizientes Prozessdesign in einer digitalen Welt - Auswirkungen von Prozess-Design-Entscheidungen auf die (Digital) Customer Experience

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Abstract:

Digital transformation and growing global networking lead to increasing worldwide competition of businesses, which poses huge challenges to many companies. Products and services of different providers are perceived by customers as (equal and) interchangeable. At the same time, companies are forced to offer cheap prices due to high market transparency enabled by online marketplaces. Thus, there is a strong need for companies to pursue efficient business process designs. In the same vein, the only possibility for differentiation from competitors is providing superior customer experience. In practice, the aim of superior customer experience is often contradictory to efficient business process designs, forcing companies to decide which of both they should give priority. Moreover, complexity increases due to the needs of a growing number of so-called Digital Natives, demanding for an extension of business processes to the online world. Therefore, companies have to evaluate for every process whether it should be offered online and/or offline. In the end, companies more and more recognize the importance of customers as value co-creators, who strongly contribute to value creation if they are involved properly. Against this backdrop, this article points out an assessment scheme for business processes with a direct interface to customers, aiming to support companies in evaluating different business process designs with respect to their chances and risks. Furthermore, a discussion of specific risks related to providing business processes online should enable businesses to comprehensively evaluate different business process design alternatives.

Keywords: *customer experience, digital customer experience, digitization, customer satisfaction, business process design*

II.2.1 Zwischen Experience und Effizienz - Herausforderungen bei der Wahl des richtigen Prozessdesigns im Zeitalter der Digitalisierung

Die schnell voranschreitende Digitalisierung bringt für Unternehmen mit Bereitschaft zur digitalen Transformation viele Chancen mit sich, birgt aber auch einige Risiken (Gimpel und Röglinger 2015). Der stark zunehmende Einsatz neuer Informationstechnologien zwingt Unternehmen nicht nur dazu, die Ausgestaltung ihrer Geschäftsprozesse zu hinterfragen, sondern bedroht im Extremfall sogar etablierte Geschäftsmodelle (Urbach und Ahlemann 2016). Betrachtet man die Gestaltung der Geschäftsprozesse genauer, sind Unternehmen durch eine mit der Digitalisierung einhergehende hohe Markttransparenz gezwungen, ihre Prozesse möglichst kosten- und zeiteffizient zu gestalten, um mit den am globalen Markt geltenden günstigen Preisen konkurrieren zu können. Gleichzeitig stellt sich jedoch die Herausforderung, dass Produkte und Dienstleitungen verschiedener Anbieter vom Kunden als gleichwertig und austauschbar wahrgenommen werden und sich Unternehmen somit nicht mehr durch ihr Produkt, sondern durch das Erschaffen einer herausragenden *Customer Experience* (CX) von Wettbewerbern differenzieren müssen (Enger und Vollhardt 2016).

Eine weitere Herausforderung ist, dass insbesondere die heranwachsende Generation der sogenannten *Digital Natives* auf viele Angebote, die bisher nur offline verfügbar waren, nun auch online zugreifen möchte. Dadurch gewinnt die *Digital Customer Experience* (DCX) zunehmend an Bedeutung. Auf Grund der weiterhin großen Kundengruppe der *Digital Immigrants*, die nach wie vor Wert auf persönlichen Kontakt legen, sind jedoch auch die Offline-Kanäle nicht zu vernachlässigen. Die Komplexität wird dabei sogar noch dadurch erhöht, dass Kunden immer häufiger während des Kaufprozesses zwischen Online- und Offline-Kanälen wechseln und somit nicht mehr strikt zwischen Online- und Offline-Welt unterschieden werden kann, sondern beide Kanäle integriert betrachtet werden müssen (Heinemann und Gaiser 2015). Unternehmen sind somit gezwungen, sowohl auf Online- als auch auf Offline-Kanälen anzubieten und dabei eine kanalübergreifend gute CX sicherzustellen. Dabei ist sowohl für die DCX als auch für die Non-Digital CX insbesondere die Ausgestaltung aller Prozesse mit Schnittstelle zum Kunden – sogenannte Customer Touch Points – von entscheidender Bedeutung. Die große Bedeutung der Kunden, respektive der Schnittstelle zum Kunden, erkennen auch immer mehr Unternehmen. Das Verständnis des Kunden als „Value Co-Creator“ etabliert sich mehr und mehr, und Unternehmen binden die Kunden stärker in ihre bisher internen Prozesse mit ein. Selbst Unternehmen der klassischen Güterindustrie setzen auf das Wissen und die Fähigkeiten des Kunden, sei es beispielsweise

als Ideengeber im Innovationsprozess oder als Designer in der individuellen Ausgestaltung der Produkte (Mass Customization), um so gemeinsam mit dem Kunden größtmöglichen Wert zu erschaffen. Der Kunde bringt sich jedoch nur dann in die Wertschöpfung ein, wenn er die Erfahrung gemacht hat, dass seine Bedürfnisse möglichst weitgehend erfüllt werden – sprich seine CX besonders gut war.

Blickt man auf die unterschiedlichen Ausgestaltungsmöglichkeiten der Kundenprozesse, stehen kundenzentrierte und somit auf positive CX ausgerichtete Prozessdesigns (PD) jedoch häufig im Widerspruch zu kosteneffizienten PD (Afflerbach und Frank 2016). Folglich stellt sich für Unternehmen zum einen die Frage, welche Angebote und Services unter Kosten-Nutzen-Aspekten online als auch offline angeboten werden sollten, und zum anderen ist abzuwägen, wie die Prozesse hinsichtlich des Spannungsverhältnisses zwischen Effizienz und CX ausgestaltet sein sollten. Dabei ist für jeden einzelnen Prozess die Frage zu stellen, ob Effizienzvorteile in der Prozessausgestaltung die Abstriche in der CX rechtfertigen oder ob die Vorteile eines zeit- und kostenintensiveren, dafür aber kundenzentrierten PD überwiegen.

Im digitalen Zeitalter sind die Folgen solcher Design-Entscheidungen weitreichend, da Kunden durch die Onlinebereitstellung von Dienstleistungen und Services innerhalb kurzer Zeit breit gefächert über den gesamten Kundenstamm hinweg auf diese Angebote zugreifen. Eine schlechte Performance von Online-Angeboten verbreitet sich auf diese Weise schnell im gesamten Kundenstamm und führt zu Unzufriedenheit unter den Kunden. Überdies sprechen sich negative Online-Erfahrungen durch eine starke Vernetzung der Kunden über Onlineportale und Online Social Networks schnell herum, was als *electronical Word of Mouth* (eWoM) bezeichnet wird. Negatives eWoM kann dabei verheerende Folgen für den Ruf und somit den Erfolg eines Unternehmens haben. Des Weiteren gehen mit der Digitalisierung bzw. Onlinebereitstellung einzelner Prozesse zusätzliche Risiken wie beispielsweise Fragen der Datensicherheit einher, die von Entscheidern beleuchtet werden müssen, bevor die Entscheidung über PD getroffen wird.

Um Unternehmen hinsichtlich der Entscheidung zu unterstützen, ob Prozesse online bereitgestellt werden sollten oder nicht, und um ein besseres Verständnis der Auswirkungen von PD-Entscheidungen im Spannungsfeld zwischen Effizienz und CX zu ermöglichen, wird ein transparenzschaffendes Rahmenwerk benötigt. Mithilfe dieses Rahmenwerks sollen Entscheider befähigt werden, Chancen und Risiken einzelner PD-Entscheidungen zu erkennen und diese zu bewerten. Daneben soll die Beleuchtung großer Risiken bei der

Onlinebereitstellung von Kundenprozessen die Unternehmen befähigen, eine integrierte Chancen- und Risikobewertung einzelner PD-Alternativen vorzunehmen.

II.2.2 Digital und Non-Digital Customer Experience und deren Auswirkungen auf den Unternehmenserfolg

Bevor eine Bewertung unterschiedlicher PD-Alternativen vorgenommen werden kann, ist es notwendig, ein Verständnis dafür zu schaffen, welche Faktoren die CX und DCX beinhalten und welche Folgen positive oder negative (D)CX hat.

Blickt man in die wissenschaftliche Literatur, definieren Verhoef et al. (2009) die CX als das holistische Erlebnis, welches ein Kunde mit einem Unternehmen hat. Dabei spielen alle emotionalen, rationalen, physischen, sensorischen und sozialen Erlebnisse des Kunden mit dem Unternehmen in die CX hinein. So kann die CX als Summe aller Erlebnisse des Kunden mit dem Unternehmen – sei es durch direkte Interaktion mit dessen Mitarbeitern oder auf indirektem Wege durch Erzählungen von Bekannten und Freunden – gesehen werden.

Demzufolge ist die DCX eine Teilmenge der gesamten CX und beschränkt sich auf alle Unternehmenseindrücke und - erlebnisse, die der Kunde auf digitalen Kanälen sammelt bzw. gesammelt hat. Wichtig ist hierbei das Verständnis, dass in der (D)CX nicht nur das aktuell Erlebte enthalten ist, sondern auch bereits zurückliegende Erlebnisse mit dem Unternehmen auf die gesamte (D)CX „einzahlen“ und diese beeinflussen, wenngleich mit weniger Gewicht als aktuelle Erlebnisse (Verhoef et al. 2009). Das bedeutet also, dass ein negatives Erlebnis – sei es direkt oder indirekt – nachhaltigen Einfluss auf die (D)CX hat und somit möglichst vermieden werden sollte.

Abbildung 1 zeigt die Bestandteile der CX nach Verhoef et al. (2009) und verdeutlicht, dass in die CX sowohl Bestandteile aus dem digitalen als auch aus dem nicht-digitalen Kontakt des Kunden mit dem Unternehmen einfließen.

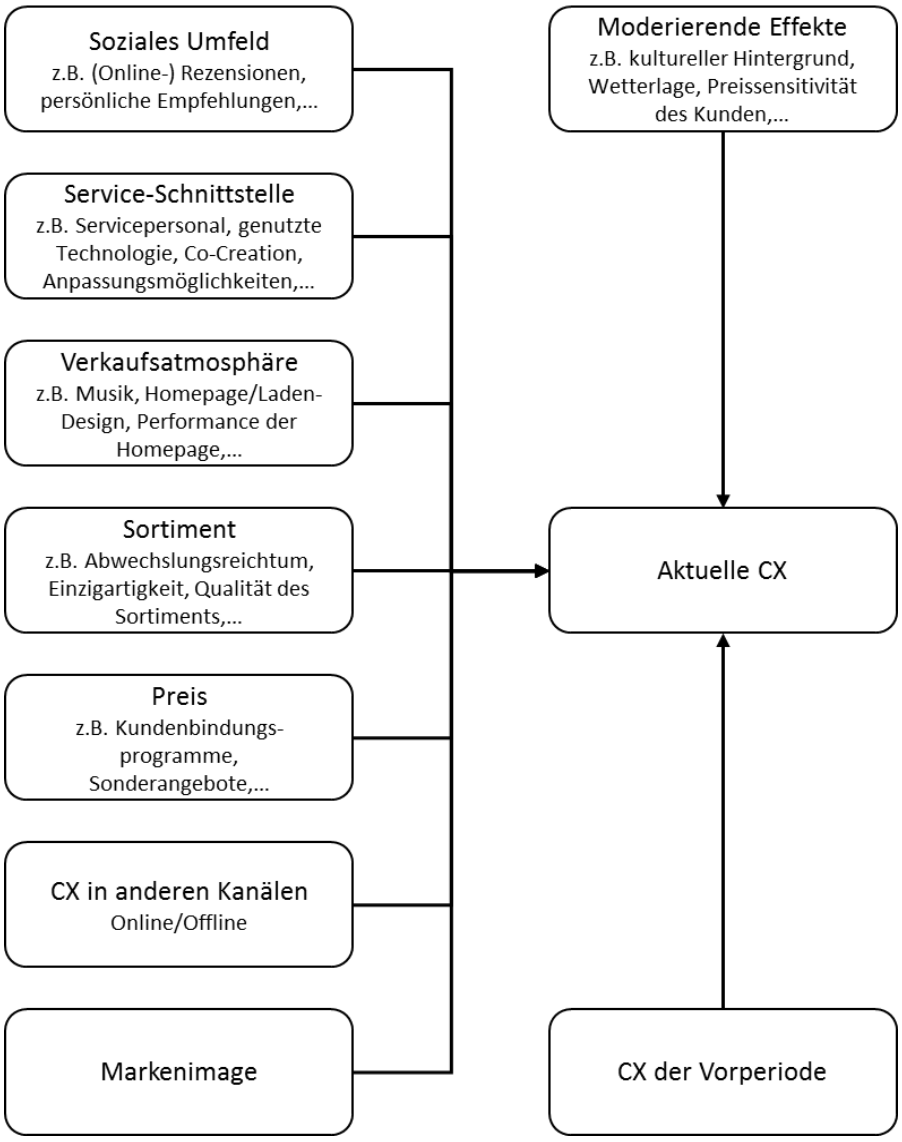

Abb. II.2-1 *Entstehung der CS, angelehnt an Verhoef et al. (2009)*

Mit diesem Verständnis der CX wird klar, dass eine strikte Trennung von DCX und CX nicht sinnvoll oder sogar unmöglich ist, da das „Gesamtpaket" für den Kunden stimmen muss. Auch mit Blick auf den von Kunden immer häufiger betriebenen Wechsel zwischen Online- und Offline-Kanälen während des Kaufprozesses ist von einer reinen Optimierung der DCX abzuraten. Daher wird im Folgenden die CX als Ganzes betrachtet und eine Entscheidungsunterstützung bei der Fragestellung nach dem ganzheitlich richtigen Prozessangebot sowie der richtigen Prozessausgestaltung gegeben.

Ziel einer positiven CX ist dabei immer, den Kunden an das Unternehmen zu binden und ihn zu einem loyalen Kunden zu wandeln, der auch bereit dazu ist, seinen Teil zum Produkt bzw. zur Dienstleistung beizutragen. Dabei wird der Kunde analog zur Service Dominant Logic (SDL) (vgl. Lusch und Vargo 2006) als „Value Co-Creator" und somit Teil des Gesamtsystems gesehen, der durch die Bereitstellung u.a. seiner Daten, Interessen,

Bedürfnisse und Fähigkeiten gemeinsam mit dem Unternehmen den Wert erzeugt. Das Unternehmen schafft also alleine durch die Bereitstellung eines Produkts oder einer Dienstleistung noch keinen Wert, sondern dieser entsteht erst in dem Moment des Konsums oder der Nutzung durch den Kunden (sog. „Value-in-Use“ bzw. „Value-in-Interaction“). Beispielsweise realisiert sich bei einer Onlineüberweisung der Wert erst in dem Moment, da der Kunde die Überweisungsmaske nutzt und durch Eingabe der Überweisungsdaten zur Wertschöpfung beiträgt. Um hierbei die Wahrscheinlichkeit zu erhöhen, dass die Bedürfnisse des Kunden erfüllt werden und positive CX entsteht, ist eine Integration des Kunden in der Entwicklung des Produktangebots sinnvoll. Eine positive CX animiert den Kunden dabei dazu, auch in Zukunft die Produkte oder Dienstleistungen des Unternehmens zu nutzen und weiter als Value Co-Creator Wert zu generieren. Somit stellt die CX einen wichtigen Pfeiler für nachhaltigen Unternehmenserfolg dar.

Indem der Kunde durch CX animiert wird dem Unternehmen weiterhin loyal zu bleiben, entstehen viele Vorteile für ein Unternehmen, wie höhere Wiederkaufwahrscheinlichkeiten, das Ausschöpfen von Up- und Cross-Selling-Potentialen und positives (e)WoM, um nur einige zu nennen. Ein Paradebeispiel für die Erschaffung einer positiven ganzheitlichen CX und den dadurch realisierbaren Nutzen stellt Apple dar (John 2016). Bei objektiver Betrachtung der Funktionalitäten der Apple-Geräte sind diese kaum von den Devices anderer Anbieter wie LG, Samsung oder Sony zu unterscheiden. Jedoch hat es Apple durch eine durchgängige und positive CX geschafft, nicht nur einen festen Stamm an Kunden zu generieren, sondern sogar eine große Fan-Community zu etablieren. Diese Fan-Community ist auf Grund der positiven CX einerseits dazu bereit, hohe Preise für neu auf den Markt kommende Nachfolger-Geräte zu bezahlen, welche mehr Leistung, Speicherplatz oder neue Features mitbringen (Up-Selling). Andererseits wird am Beispiel Apple das große Cross-Selling Potential erkennbar, welches sich durch die positive CX stimulieren lässt: Viele der „Apple-Jünger“ haben nicht nur ein Smartphone oder Tablet der Marke, sondern nutzen inklusive Smart Watch und Heim-PC die volle Produktpalette, um die volle Synergie zwischen den Geräten zu nutzen und maximale CX zu erfahren. Nicht zuletzt lässt ein Blick in Internetforen zum Thema Smartphone und Tablets schnell erkennen, dass die Fan-Gemeinde auch stets versucht, die Marke Apple in positivem Licht darzustellen und durch positive Bewertungen auf Kaufportalen gleichzeitig Neukunden akquiriert (positives eWoM). Anhand dieses Beispiels wird deutlich, wie durch eine gute CX der Unternehmenswert langfristig und nachhaltig gesteigert werden kann. Dennoch ist immer zu prüfen, ob die nicht selten beträchtlichen Kosten zur Erreichung der positiven CX nicht deren Nutzen übersteigen.

II.2.3 **Bewertungsschema für Prozesse mit direkter Kundenschnittstelle**

Für eine Abwägung, welcher Prozess auf welchem Kanal angeboten werden soll und ob es sinnvoll ist, eine Erhöhung der CX durch eine Investition in den einzelnen Kanal anzustreben, müssen mehrere Aspekte berücksichtigt werden. So ist im ersten Schritt für jeden Prozess zu hinterfragen, welchen potentiellen Beitrag dieser zur CX und somit zur Wertschöpfung beisteuern kann. Im zweiten Schritt sollte eine detaillierte Kosten-Nutzen-Analyse der einzelnen PD-Alternativen vorgenommen werden. Da vielen Entscheidern insbesondere die jeweiligen Risiken nicht oder nicht ausreichend bewusst sind, die in Verbindung mit der Digitalisierung bzw. Onlinebereitstellung von Prozessen einhergehen, werden diese in einem dritten Schritt nochmals explizit beleuchtet, bevor schließlich eine Entscheidung getroffen wird, welche Prozesse auf welchem Kanal angeboten und wie diese ausgestaltet werden sollten.

Abbildung 2 gibt einen Überblick über die Bewertungsschritte und stellt mögliche Herangehensweisen dar.

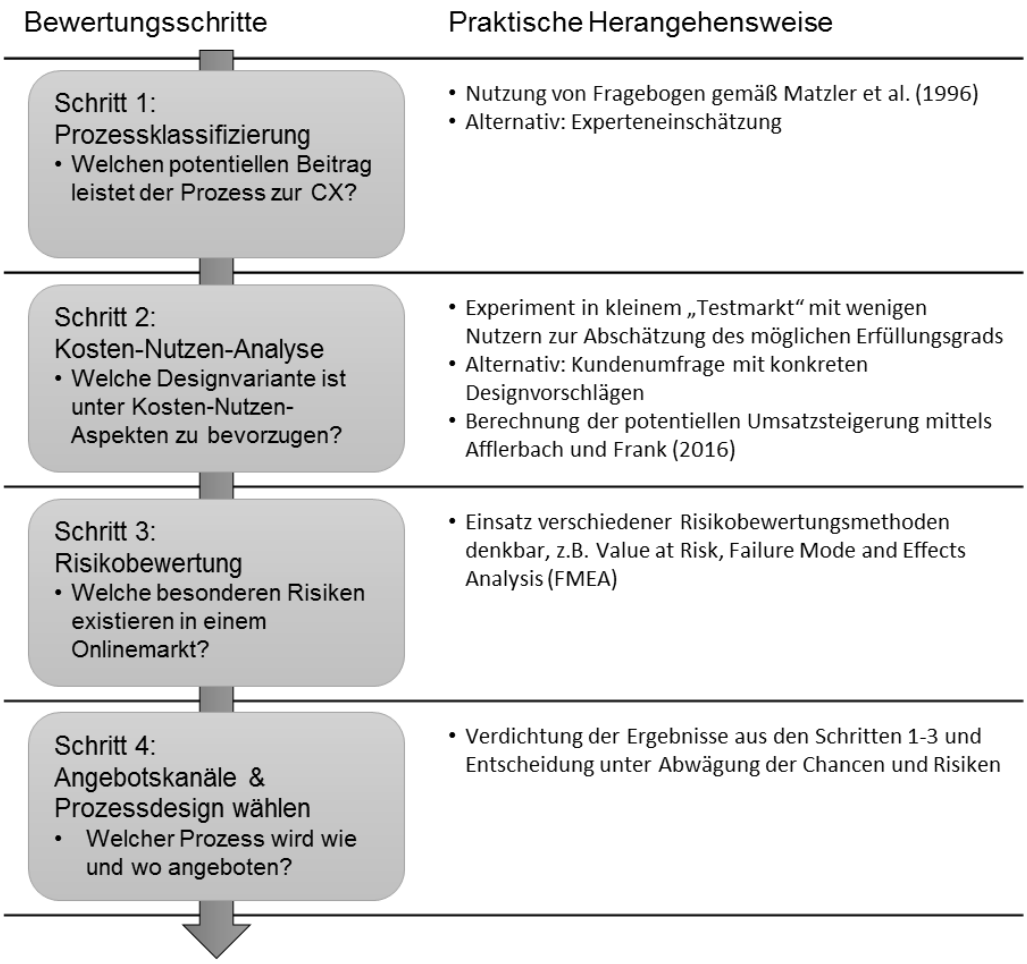

***Abb. II.2-2** Überblick Bewertungsschema*

1. [Schritt 1 – Prozessklassifizierung] – Klassifizierung von Prozessen hinsichtlich deren potentiellen Beitrags zur CX

Da eine direkte Messung der CX nicht ohne weiteres möglich ist, wird häufig die Kundenzufriedenheit als Indikator für die CX verwendet. Mit hoher Kundenzufriedenheit gehen viele positive Effekte einher, wie beispielsweise eine hohe Kundenbindung und in der Folge erhöhte Umsätze. Dementsprechend liegt das Augenmerk in Schritt eins auf der Kundenzufriedenheit und insbesondere auf dem potentiellen Beitrag einzelner Prozesse hierzu. Dabei kann Kundenzufriedenheit zwar ex post durch Kundenbefragungen gemessen werden, jedoch ist es ex ante oft schwierig, für einen Entscheider einzuschätzen, wie wichtig ein einzelner Prozess für die Gesamtzufriedenheit des Kunden ist. Um diese Einschätzung ex ante treffen zu können, wird daher auf das Modell von Kano et al. (1984) bzw. auf die Übertragung dieses Modells auf Prozesse nach Afflerbach und Frank (2016) zurückgegriffen.

Der Grundgedanke des Modells basiert auf dem sogenannten „Confirmation-Disconfirmation-Paradigm“. Laut dieser Theorie bildet sich jeder Kunde vor der Inanspruchnahme eines Prozesses bzw. einer Leistung implizit eine gewisse Erwartung bezüglich der Qualität des Prozesses. Nachdem der Prozess abgelaufen ist, vergleicht er das Ergebnis mit seiner ursprünglichen Erwartung und sieht diese entweder genau erfüllt, enttäuscht oder übertroffen. In der Folge ist der Kunde dann zufrieden oder unzufrieden, wobei die Auswirkung auf die gesamte Kundenzufriedenheit je nach Art des Prozesses unterschiedlich stark ausfallen kann. Kano et al. (1984) unterscheidet in die drei Kategorien *Basis-, Leistungs- und Begeisterungsfaktoren* bzw. –prozesse (vgl. auch Afflerbach und Frank 2016).

Hierbei müssen *Basisprozesse* – sofern sie angeboten werden – in jedem Fall die Kundenerwartungen erfüllen, da sonst negative Auswirkungen auf die Kundenzufriedenheit entstehen. Einen positiven Effekt auf die Kundenzufriedenheit können Basisprozesse jedoch selbst beim Übertreffen der Erwartungen des Kunden nicht haben. Sie können somit bestenfalls neutral auf die Kundenzufriedenheit wirken. Ein weit verbreitetes Beispiel für solche Prozesse ist eine saubere Toilette im Restaurant (Afflerbach und Frank 2016): Ist diese nicht sauber, fällt es dem Kunden negativ auf und er ist unzufrieden. Ist diese sauber, sieht der Kunde dies als selbstverständlich an und ist daher nicht notwendigerweise zufrieden, geschweige denn begeistert.

Begeisterungsprozesse wirken entgegengesetzt zu Basisprozessen und können die Kundenzufriedenheit bei Übererfüllung der Erwartungen stark positiv beeinflussen, wohingegen eine schlechte Leistung nicht zu Unzufriedenheit des Kunden führt. Meist

handelt es sich hierbei um Prozesse, die vom Kunden eigentlich gar nicht erwartet werden, sodass ein Fernbleiben nicht negativ ins Gewicht fällt und der Kunde positiv überrascht ist, wenn das Angebot doch vorhanden ist.

Als letzte Kategorie können *Leistungsprozesse* sowohl positiv als auch negativ auf die Kundenzufriedenheit wirken, je nachdem ob die Erwartungen des Kunden übertroffen werden konnten oder nicht. Der Einfluss der drei Prozess-Typen auf die Kundenzufriedenheit und der Zusammenhang mit dem Erfüllungsgrad der Kundenerwartungen sind in Abbildung 3 dargestellt.

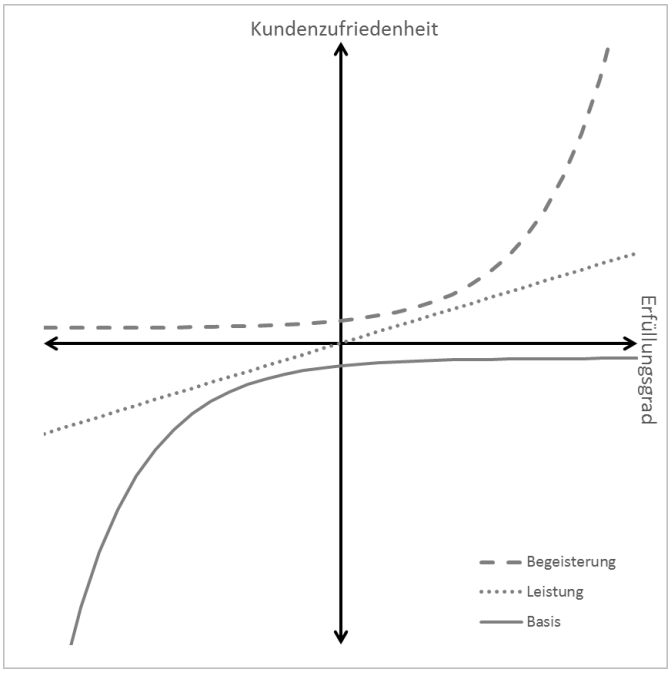

Abb. II.2-3 *Adaptiertes Kanomodell*

Bei der operativen Klassifizierung einzelner Prozesse kann ein Entscheider entweder auf seine Erfahrung bauen oder er greift auf die etwas aufwändigere Klassifizierung durch eine Umfrage nach Matzler et al. (1996) zurück. Hierbei werden unter Verwendung einer Likert-Skala positive und negative Fragen zum jeweiligen Prozess gestellt, etwa: „Wie zufrieden wären Sie, wenn Prozess X angeboten würde?“ (positive Frage) bzw. „Wie unzufrieden wären Sie, wenn Prozess X nicht angeboten würde?“ (negative Frage). Mithilfe der Kundenaussage kann der Prozess dann klassifiziert werden.

Als Ergebnis des ersten Schritts erhalten wir somit eine Klassifikation des betrachteten Prozesses in eine der drei Kategorien Basis-, Leistungs- oder Begeisterungsprozess.

2. [Schritt 2 – Kosten-Nutzen-Analyse] – Das Spannungsfeld zwischen Effizienz – CX im PD

Nachdem nun der Prozess entsprechend seines potentiellen Beitrags zur Kundenzufriedenheit klassifiziert wurde, muss im nächsten Schritt unter Berücksichtigung der Kosten entschieden werden, welcher Erfüllungsgrad angestrebt werden soll. Da kundenzentrierte Prozesse jedoch nicht notgedrungen effizient sind, kann es dabei zu Spannungsverhältnissen kommen. So tritt häufig der Fall auf, dass der Entscheider entweder Einbußen in der Kosteneffizienz des Prozesses hinnehmen muss oder das Potential des Prozesses hinsichtlich des möglichen Kundenerlebnisses nicht voll ausschöpfen kann um Kosten zu sparen (Afflerbach und Frank 2016). Eine Steigerung der Kundenzufriedenheit wirkt sich allerdings direkt proportional auf zukünftige Umsätze aus (Afflerbach und Frank 2016). Um eine sinnvolle Einschätzung hinsichtlich der Vorteilhaftigkeit einer PD-Alternative geben zu können, wird hierbei davon ausgegangen, dass dem Entscheider mehrere konkrete PD-Alternativen inklusive Kostenschätzung vorliegen. Dadurch kann eine direkte Kosten-Nutzen-Abwägung getroffen werden.

Wurde in Schritt eins festgestellt, dass es sich um einen Begeisterungsprozess handelt, ist es sinnvoll, den Prozess möglichst effizient anzubieten, sofern keine Chance besteht, mit vertretbarem finanziellen Aufwand in den Bereich vorzustoßen, in dem die Kundenzufriedenheit überproportional ansteigt. Sobald für einen Begeisterungsprozess der überproportional ansteigende Bereich erreicht werden kann, ist es sinnvoll, einen möglichst hohen Erfüllungsgrad anzustreben, es sei denn, die Kostensteigerung ist noch stärker als die Zufriedenheitssteigerung (Afflerbach und Frank 2016). Als plakative Regel könnte man formulieren: „Begeistere Deinen Kunden, wenn es mit angemessenen Kosten möglich ist, und vermeide Kosten, sofern du deinen Kunden nicht begeistern kannst."

Für Basisprozesse gestaltet es sich genau entgegengesetzt: Hier ist ein Erfüllungsgrad anzustreben, der mit möglichst geringen Implementierungskosten umgesetzt werden kann und gleichzeitig für den Kunden einen annehmbaren Erfüllungsgrad vorweist. Eine darüber hinausgehende Investition in den Prozess ist dann nicht mehr sinnvoll, da dadurch keine zusätzliche Kundenzufriedenheit und somit kein zusätzlicher Umsatz erreicht werden kann (Afflerbach und Frank 2016). Die einfache Regel wäre hier: „Vermeide Unzufriedenheit des Kunden bei möglichst geringem Investment."

Für die dritte Kategorie der Leistungsprozesse ist keine pauschale Aussage über die Ausgestaltung des Prozesses möglich, da diese sehr stark von der Sensibilität der Kunden auf

PD abhängt. Diese zeigt sich im Graphen für Leistungsprozesse in Abbildung 4 in der Steigung der Geraden: Je sensibler Kunden auf das PD reagieren, desto steiler ist die Steigung der Geraden und vice versa (Afflerbach und Frank 2016). Je nachdem, ob die Kosten stärker steigen als die Kundenzufriedenheit, kann es also sinnvoll sein effizient oder kundenzentriert zu designen. Es kann keine pauschale Aussage getroffen werden.

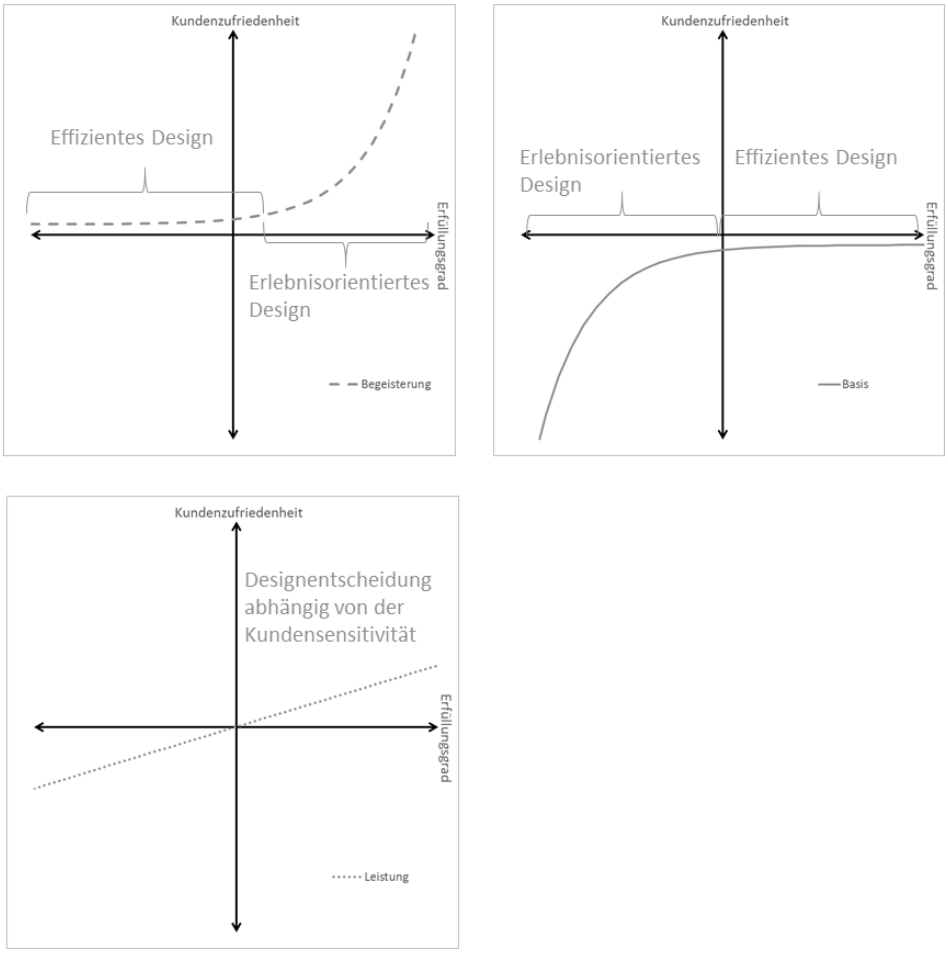

Abb. II.2-4 *Designempfehlungen in Abhängigkeit des Prozesstyps*

An dieser Stelle muss in der Praxis herausgefunden werden, mit welcher Designvariante welcher Erfüllungsgrad erreicht werden kann. Auch hier empfiehlt sich eine kurze Umfrage bei Bestandskunden und potentiellen Kunden unter Vorlage der konkreten Umsetzungsalternativen um eine bessere Einschätzung hinsichtlich des erzielbaren Erfüllungsgrades je PD-Alternative zu erhalten. Alternativ kann in einem kleinen, auf wenige Nutzer beschränkten Testmarkt, die Auswirkung einzelner PD-Alternativen getestet werden.

Auf Basis dieser Daten kann dann die unter Kosten-Nutzen-Aspekten beste Alternative gewählt werden. Dabei ist unbedingt zu berücksichtigen, dass in der Praxis die Kundenzufriedenheit selbst durch Begeisterungsfaktoren nicht ins Unendliche gesteigert

werden kann, sodass hier nicht rein auf mathematische Formeln wie etwa aus (Afflerbach und Frank 2016) vertraut werden sollte, sondern durch den Entscheider eine kritische Plausibilitätsprüfung vorgenommen werden muss.

3. [Schritt 3 – Risikobewertung] – Bewertung potentieller Risiken bei der Onlinebereitstellung von Prozessen

Nach Durchführung der ersten beiden Schritte ist einerseits klar, welches PD auf welcher Plattform zu bevorzugen ist und welchen potentiellen Wertbeitrag ein Angebot des Prozesses auf der jeweiligen Plattform mit sich bringen würde. Bevor jedoch die finale Entscheidung getroffen wird, ob ein Prozess a) nur online, b) nur offline, c) online und offline oder d) gar nicht angeboten werden sollte, müssen noch besondere Risiken bedacht werden, die eine Onlinebereitstellung von Prozessen mit sich bringt. Eine vollständige Erfassung aller potentiellen Risiken im Zusammenhang mit der Onlinebereitstellung ist aufgrund der hohen Komplexität und der schnell fortschreitenden technologischen Entwicklung nur schwer möglich, wenn nicht gar unmöglich. Ebenso werden Risiken etwa regulatorischer Natur, welche nicht spezifisch für die Onlinebereitstellung gelten, in diesem Artikel nicht näher beleuchtet. Die nachfolgenden drei Kategorien von Risiken werden jedoch exemplarisch herausgegriffen, da diese sich im Dialog mit Digitalisierungsexperten aus der Unternehmenspraxis im Zusammenhang mit der Auswahl des richtigen PD als besonders relevant herausgestellt haben: *i) Personenbezogene Risiken, ii) Technikbezogene Risiken* und *iii) Risiken an der Schnittstelle zwischen Mensch und Maschine* (vgl. Abbildung 5). Erst nach sorgfältiger Abwägung von Chancen (vgl. Schritte eins und zwei) und Risiken (Schritt drei) sollte im letzten Schritt eine Entscheidung für das Angebot eines Prozesses getroffen werden. Für die konkrete Bewertung der Risiken wird ein Rückgriff auf Risikobewertungsmethoden wie z.B. den Value at Risk (VaR) oder die Failure Mode and Effects Analysis (FMEA) empfohlen.

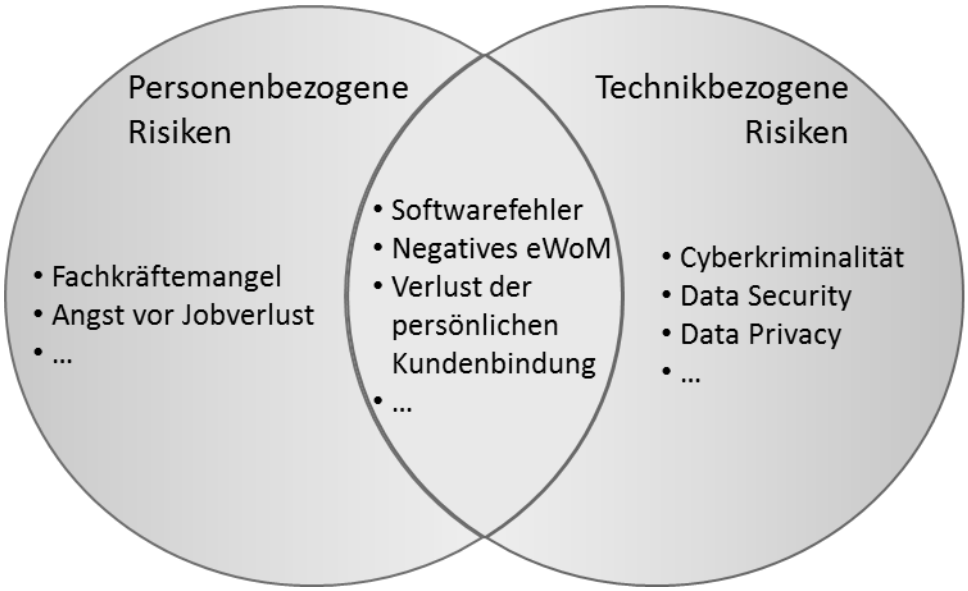

Abb. II.2-5 Bedeutende Risiken im Onlinekontext

i) Personenbezogene Risiken:

Mit zunehmendem Grad der Digitalisierung eines Unternehmens steigt die Angst der Mitarbeiter vor einem Jobverlust, da befürchtet wird, dass die eigene Arbeit durch Automatisierung überflüssig wird. Dies kann zur Demotivation der Mitarbeiter führen, was in geringere Sorgfalt bei der Ausführung der Arbeiten münden und somit die Fehlerquote erhöhen und zu Unzufriedenheit bei den Kunden führen kann. Zudem ist es möglich, dass die Arbeitsgeschwindigkeit der Mitarbeiter abnimmt und somit Effizienzverluste eintreten. Ein weiteres personenbezogenes Risiko liegt im potentiellen Mangel an Fachkräften, welche durch ihre Fähigkeiten einen reibungslosen Ablauf der online angebotenen Prozesse gewährleisten können (Spitzer et al. 2013). Bereits seit einigen Jahren wird dieser Mangel an Fachkräften u.a. in der Informationstechnologie-Branche als „War for Talents“ bezeichnet; eine weitere Verschärfung ist durch die fortschreitende Digitalisierung absehbar.

ii) Technikbezogene Risiken:

Blickt man auf die technikbezogenen Risiken, die mit einer Onlinebereitstellung von Prozessen einhergehen, so ist die größte Gefahr die sogenannte Cyberkriminalität (Risk.net 2017). Diese kann eine Vielzahl unterschiedlicher Formen annehmen. So kann es zu großen Hackerangriffen auf die Systeme von Unternehmen kommen, die das System zum Erliegen bringen und das Ziel haben, eine Art „Lösegeld“ von den Unternehmen einzufordern. So waren kürzlich weltweit Unternehmen, darunter auch Renault, von einem großen Angriff betroffen, wodurch teilweise sogar die Produktion bei Renault gestoppt werden musste.

Daneben wird häufig versucht, durch sogenanntes „Pishing“ z.B. Zugangsdaten zu Bankkonten von Kunden zu erlangen und so den Kunden direkten wirtschaftlichen Schaden zuzufügen. Neben den direkten negativen finanziellen Folgen für Unternehmen wie Produktionsausfall und Schadensersatzzahlungen an Kunden kann das Unternehmensimage unter diesen Angriffen leiden, wodurch nachhaltige negative Folgen für das Unternehmen entstehen.

Daneben spielen die Themen Data Security und Data Privacy eine große Rolle bei online bereitgestellten Services. Hierbei besteht das Problem, dass die Wahrung der privaten Daten und der Privatsphäre von Kunden bei der Onlinebereitstellung von Prozessen ungemein schwerer ist als dies offline der Fall wäre. Da den Kunden der Schutz ihrer Daten und Privatsphäre jedoch sehr wichtig ist, müssen hier aufwendige Sicherungsmaßnahmen ergriffen werden. Zudem bestehen für den Datenschutz strenge gesetzliche Anforderungen.

iii) Risiken an der Schnittstelle zwischen Mensch und Maschine:

Als weitere relevante Gruppe ist jene der Risiken an der Schnittstelle zwischen Mensch und Maschine zu nennen. Hier gilt es, die Gefahr von Fehlern in der Software zu berücksichtigen. Kleine Fehler in der Programmierung durch einzelne Mitarbeiter verbreiten sich online sehr schnell in der gesamten Kundengruppe, da viele Kunden gleichzeitig auf das Online-Angebot zugreifen können. Das bedeutet, dass die Auswirkungen von Fehlern einzelner Mitarbeiter bei der Onlinebereitstellung von Prozessen deutlich weitreichender sind als dies bei Offline-Prozessen der Fall wäre. Negatives eWoM bzw. sogar sogenannte „Shitstorms“ können die Folge sein und haben starken Einfluss auf das Image eines Unternehmens, was wiederum nachhaltig negative Folgen haben kann. Ein letztes Risiko, welches insbesondere bei Dienstleistungen ins Gewicht fällt, ist der drohende Verlust der persönlichen Bindung zwischen Kunden und Dienstleistungsanbietern. Dies erschwert den Aufbau einer starken Kundenbindung enorm und kann zur Senkung der Kundenloyalität führen.

4. [Schritt 4 – Angebotskanäle & PD wählen] Entscheidung über Angebotskanäle und PD

Mit der vollständigen Information über Chancen und Risiken der einzelnen Prozesse aus den ersten drei Schritten kann nun abschließend die Entscheidung getroffen werden, welche Prozesse a) nur online, b) nur offline, c) online und offline oder d) gar nicht angeboten werden sollten. Hierbei gilt die einfache Entscheidungsregel, dass lediglich Prozesse angeboten werden sollten, die entweder vom Kunden auf dem jeweiligen Kanal als unverzichtbar eingestuft werden oder bei entsprechender Umsetzung einen im Vergleich zu

den Kosten und den zu erwartenden Risiken überproportionalen Beitrag zur Kundenzufriedenheit und somit zum Umsatz haben. Als Bewertungsverfahren bietet sich hier beispielsweise eine Kapitalwertrechnung für einzelne Prozesse an, die einen PD spezifischen Risikoabschlag enthält.

II.2.4 **Beispielhafte Erläuterung anhand der Finanzdienstleistungsbranche**

Wie in vielen anderen Branchen zeigt sich insbesondere auch in der Finanzdienstleistungsbranche der durch die Digitalisierung angestoßene Umbruch in den Geschäftsprozessen. Gerade bei Banken ist eine Differenzierung von Wettbewerbern auf Produktbasis schwer, so dass die Auswahl und Qualität der angebotenen Services und somit die CX im Fokus stehen. Besonders ausgeprägt bei Banken ist zudem die sehr breite Fächerung in der Altersstruktur der Kunden. Somit besteht einerseits der Wunsch älterer Menschen nach persönlichem Kontakt in einer Filiale, während die jüngere Generation der *Digital Natives* teils sogar gänzlich auf Filialen verzichten kann. Zuletzt sind bei Banken die Anforderungen bezüglich Datensicherheit und Datenschutz besonders hoch, so dass diese zur Illustration besonders geeignet sind. Als Beispiel soll nun der Prozess „Überweisung“ bei einer Bank genauer beleuchtet werden. Mit Blick auf die Klassifikation nach Afflerbach und Frank (2016), ist in einer reinen Offline-Welt dieser Prozess als Basisprozess einzuordnen, der die Kunden selbst bei reibungslosem Ablauf nicht begeistern kann, jedoch im Falle eines Fehlers, wie z.B. einer Fehlüberweisung an einen anderen Empfänger, erheblich verärgern kann. Im Online-Angebot kann eine Überweisung jedoch auch ein Begeisterungsfaktor sein, wie die Möglichkeit der sogenannten Fotoüberweisung bei der Deutschen Kreditbank AG (DKB), sowie bei diversen Sparkassen zeigt. Durch ein einfaches Abfotografieren und Hochladen der beim Kunden befindlichen Rechnung werden die Überweisungsdaten direkt in das System übernommen und der Kunde muss nur noch mit einer TAN die Eingabe bestätigen. Dies senkt den Eingabe- und Zeitaufwand für den Kunden und führt somit zu einer positiven CX. Durch die Eintragung der Bankverbindung des Empfängers im Zahlschein bzw. durch Abfotografieren der Rechnung bringt der Kunde sein Wissen in Form von Bankverbindungsdaten mit in den Prozess ein und trägt somit zum Gelingen der Überweisung bei. Ohne diese Daten könnte die gesamte Transaktion nicht durchgeführt werden und es würde kein Wert entstehen, was die Bedeutung des Kunden als Value Co-Creator im Wertschöpfungsprozess nochmals verdeutlicht. In einer Kosten-Nutzen-Sicht der beiden PD-Alternativen hieße dies, dass der Offline-Prozess möglichst kosteneffizient durchgeführt werden muss, wenngleich sichergestellt sein muss, dass die Überweisung den korrekten Adressaten erreicht. Im Online-Prozess hingegen sollte selbst bei vergleichbar höheren

Kosten eine gute Qualitätskontrolle durchgeführt, sowie hoher Aufwand in die Entwicklung einer fehlerfreien, übersichtlichen und einfach zu bedienenden Software investiert werden, um einen reibungslosen und für den Kunden möglichst angenehmen Überweisungsablauf zu gewährleisten. Mit der Bereitstellung des Überweisungsdienstes über den Online-Kanal gehen jedoch hohe Cyberkriminalitäts-Risiken einher, die insbesondere im Bankensektor zu hohen Schäden führen können. Dementsprechend müssen online anbietende Banken wie die DKB, großes Augenmerk auf entsprechende Sicherungsmaßnahmen legen und neben den hohen Entwicklungskosten die damit einhergehenden, hohen Kosten in Kauf nehmen, um eine hohe CX zu erreichen. Wie im Bankensektor zu beobachten ist, entscheiden sich dennoch auch viele eher konservative Geschäftsbanken wie z.B. Sparkassen trotz Kosten und Risiken dafür, neben dem Offline-Kanal auch online anzubieten, um eine ganzheitliche CX sicherzustellen und den Kundenkontakt zu einer heranwachsenden Generation von *Digital Natives* nicht zu verlieren.

II.2.5 **Implikationen für die Praxis**

Im vorliegenden Beitrag wird Verständnis dafür geschaffen, dass CX nicht ein kurzfristiges „Erlebnis“ des Kunden ist, sondern die CX ein holistisches, perioden- und kanalübergreifendes Konstrukt darstellt. Für eine positive CX ist es demnach entscheidend, jeden Customer Touch Point für jeden Kunden möglichst positiv zu gestalten. Dabei ist es unter Einbeziehung einer Kosten- und Risikobetrachtung jedoch nicht immer sinnvoll, die CX zu maximieren. Vielmehr muss eine prozessspezifische Abwägung getroffen werden. Zu diesem Zweck wird ein generisches Bewertungsschema für die Ausgestaltung von Prozessen mit Schnittstelle zum Kunden entwickelt. Einerseits sollen Unternehmen dadurch bei der Entscheidung unterstützt werden, welche Prozesse auf welchen Kanälen angeboten werden. Andererseits soll das Bewertungsschema dabei helfen, die richtige Designalternative von Prozessen im Spannungsverhältnis zwischen Effizienz und CX zu wählen, um langfristig erfolgreich im Markt bestehen zu können. Mit Blick auf die gesamte CX ist es hierbei von sehr großer Bedeutung, weder den Online- noch den Offline-Kanal zu vernachlässigen, da beide Kanäle auf die gesamte CX einzahlen und sich somit gegenseitig beeinflussen. Des Weiteren ist es für Unternehmen entscheidend, regelmäßig die eigenen Angebote und Prozessausgestaltungen zu hinterfragen und nötige Anpassungen vorzunehmen, um den u.a. durch die Digitalisierung getriebenen schnellen Veränderungen der Kundenwünsche gerecht zu werden.

Zuletzt ist festzuhalten, dass befeuert durch die Digitalisierung auch in der Wahrnehmung der Unternehmen die Bedeutung des Kunden in der Wertschöpfung immer weiter zunimmt. Die Rolle des Kunden, welcher bisher lediglich als Käufer und Konsument gesehen wurde, hat sich verändert und wandelt sich immer mehr zu einem gleichgestellten Value Co-Creator, der maßgeblich durch das Einbringen seiner Ideen und Fähigkeiten zur Wertschöpfung beiträgt. Unternehmen sollten dabei nicht nur bestehende Prozesse optimieren und für den Kunden öffnen. Vielmehr müssen alte Geschäftsmodelle stetig überdacht und mit neuen innovativen Ideen angereichert werden. Nicht selten müssen Unternehmen sich sogar stetig neu erfinden, um nicht der disruptiven Kraft der Digitalisierung zu erliegen (Gimpel und Röglinger 2015).

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III Successfully managing innovations by considering innovation management through a BPM lens

With this knowledge on the strategic relevance of business processes as a basis, organizations are able to select the processes that should be innovated. But still, the challenge exists "how to innovate" processes, products and services in an efficient way. To examine this question, a BPM point of view on innovation management is auxiliary, as innovation management and BPM are mutually dependent. On the one hand, it is indispensable to incorporate e.g. technological innovations into the business processes of an organization to either make them more efficient or to enhance the process to foster higher customer satisfaction. Therefore, P3 investigates a way to strengthen the procedure of opportunity-driven process innovations. On the other hand, an effective and efficient innovation process is a precondition for good innovation management. Thus, P4 particularly addresses the innovation process itself.

However, a good process on its own does not come up with innovations. People involved during the process and the applied methods during the innovation process play a crucial role for the success of an innovation. Accordingly P5 further investigates differences of several OI approaches, before P6 presents a method to select the right people for an innovational team based on their behavior within a social network.

III.1 Research Paper 3: Frank L, Rau D, Röglinger M, Rosemann M (2017) Process Redesign Heuristics for the Digital Age – Opportunity-Driven Process Innovation within Ambidextrous BPM.

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Abstract:

Purpose *– The purpose of this paper is to provide stimuli for the generation of opportunity-driven business process redesign ideas that particularly take into account the opportunities created by digital technologies.*

Design/methodology/approach *– Innovations of start-ups built on digital technologies are analyzed and decoupled from the start-ups' specific contexts to transform the underlying thoughts into stylized heuristics for explorative business process redesign. All heuristics are validated in a focus group and applied in experimental workshops. The outcome of the workshops is further evaluated by practitioners.*

Findings *– The major finding of this paper are 17 process redesign heuristics. Applied in workshops, participants generated more than twice as many ideas with the heuristics, compared to traditional brainstorming. However, the workshop participants perceived the application of the process redesign heuristics with no additional effort. The assessment of all generated ideas by practitioners indicates that ideas of the group utilizing this paper's*

heuristics generated two to three times as many ideas with high excitement and economic potential as the brainstorming group.

Practical implications *– This research fuels the adoption of digital technologies within organizations as it highlights specific opportunities how digital technologies can be employed to redesign business processes in a forward-looking manner.*

Originality/value *– In line with the thought of ambidextrous BPM, this paper augments the set of existing BPM methods, which predominantly follow an exploitative approach, with an explorative perspective that encourages to lever possibilities created by digital technologies.*

Keywords: *Ambidextrous BPM, digitalization, digital technologies, heuristics, innovation, process improvement, explorative process redesign, start-ups.*

III.1.1 **Introduction**

An unprecedented wave of digitalization currently hits business and society as emerging digital technologies penetrate all aspects of our professional and private lives (Legner *et al.*, 2017). Digital technologies do not only reshape customer expectations, they also simplify customer processes such as the comparison of prices, add customer value to traditional products and services, and facilitate the emergence of data-driven companies with new value propositions for customers (Ackx, 2014). With the empowerment of the customer and the even faster adoption of digital technologies, digitalization disrupts established business rules (Gimpel and Röglinger, 2017) and unleashes huge amounts of economic value. For instance, the potential economic value of the Internet of Things adds up to USD 11.1 trillion a year by 2025 (Manyika *et al.*, 2016), though the Internet of Things with its core idea of an interconnected network of sensors and actuators is only one technology that drives the digitalization (Sebastian *et al.*, 2017). As a further exemplary digital technology, artificial intelligence attracted up to USD 39 billion investments in 2016 – an amount that tripled within three years (Bughin *et al.*, 2017). All organizations are affected by the transformational power of digital technologies that challenge competitive positions across industries (Fitzgerald *et al.*, 2013). Hence, the ability to keep pace with the speed of digitalization and innovate business processes, products, services, and entire business models has become a critical factor for companies' long-term success (Dreiling and Recker, 2013). Indeed, researchers of the MIT Center for Digital Business and Capgemini Consulting revealed that "many companies still struggle to gain transformational effects from new digital technologies" (Fitzgerald *et al.*, 2013, p. 2). Among the respondents of an international cross-industry survey, almost half of the businesses only had limited or very few digital investments in place (Dell Technologies, 2017). To retain and strengthen their competitive position, organizations however need to fuel innovation that is enabled by digital technologies and centered on customers. This implies not only a redesign of products and services, but also of business processes. A typical business process redesign initiative comprises three phases: the documentation of the as-is process, the identification of weaknesses in the process, and the development of process improvements (Netjes *et al.*, 2010; Vanwersch *et al.*, 2015). Traditional business process management (BPM) provides a broad variety of methods and tools to describe and analyze existing processes (van der Aalst *et al.*, 2016) such as the six sigma strategy that focuses on deviance measurement in the outcome of a process (Harry, 1998), workflow patterns that contribute to process automation with the aim of decreased

human labor intensity (Van der Aalst *et al.*, 2003), or process enhancement patterns that provide orientation for changes in the logic order of activities within a process (Recker and Rosemann, 2015). The abovementioned methods are only a subset of the well-established BPM toolbox. Nevertheless, the majority of BPM methods focuses on the description and analysis of processes based on an exploitative and problem-driven approach (La Rosa, 2016). Actual process improvement ideas are still often the result of traditional brainstorming or the use of other creativity techniques in one or a few workshops (Griesberger *et al.*, 2011; Limam Mansar *et al.*, 2009; Netjes *et al.*, 2006; Vanwersch *et al.*, 2015). Traditional creativity techniques such as brainstorming do not guarantee a systemic exploration of the full process redesign solution space and therefore tend to lead to biased outcomes regarding the considered process improvement ideas that potentially neglect improvement areas worthwhile to consider (Chai *et al.*, 2016; Vanwersch *et al.*, 2015). While academic literature illustrates how the digitalization potential of business processes can be exploited (Denner *et al.*, 2017), there is little knowledge that provides guidance in the explorative generation of process improvements specifically taking into account the opportunities of digital technologies. To fulfill the improvement potential of process redesign initiatives we recommend more orientation for the actual generation of innovative ideas. Inspiration can be provided by start-ups that typically operate at the spearhead of innovation. We therefore raise the research question: *What can we learn about opportunity-driven business process redesign from innovative start-ups based on digital technologies?*

To answer this research question, we propose 17 opportunity-driven and future-oriented process redesign heuristics that represent stimuli to conceptualize innovative business processes in the digital age. All heuristics are derived from innovations of recently founded start-ups that are supported by innovation programs of top universities worldwide. In a focus group, all heuristics were validated regarding their comprehensibility. To evaluate the applicability of our process redesign heuristics, we conducted innovation workshops with subject matter experts and asked practitioners of a European mid-sized business to assess the resulting process improvement ideas in comparison to the outcome of traditional brainstorming.

The remainder of this paper is structured as follows. In section 2, we present background on our research domain. In section 3, we outline our research method and evaluation strategy. Section 4 introduces our proposed process redesign heuristics based on digital technologies. In section 5, the results of the heuristics' evaluation with subject matter experts and

practitioners are presented. Section 6 discusses the findings and limitations of this work. In Section 7, we conclude this paper with a brief summary and an outline of future research opportunities.

III.1.2 **Background**

III.1.2.1 *Digitalization and Digital Technologies*

The term "digitalization" is often used interchangeably with "digitization". Legner *et al.* (2017, p. 301) describe digitization as "the technical process of converting analog signals into a digital form, and ultimately into binary digits". Digitization is therefore inherently linked to technologies employed to convert signals. In contrast, digitalization describes the socio-economical phenomenon of "adopting and using these technologies in broader individual, organizational, and societal contexts" (Legner *et al.*, 2017, p. 301). For individuals, digitalization comes with new value propositions such as higher convenience, simpler purchase procedures, personalization of products and services, or lower prices (Urbach *et al.*, 2017). Mobile connected devices allow users to shop, bank, research, network, and communicate online almost independent from temporal or spatial restrictions (Ackx, 2014). The access to novel data sources and the convergence of the physical and digital world however threaten individuals' privacy and data protection (Alashoor *et al.*, 2016). In the context of organizations, digitalization changes products, services, business processes, and entire business models (Gartner Research, 2017b; Matt *et al.*, 2015) and therefore presents both opportunities and challenges. On the one hand, digitalization provides the opportunity to develop digital business models with new value propositions for customers, personalize products and service offerings to build a closer customer relationship, analyze data from manifold sources to support decision-making, and finally redesign business processes to deliver new value to customers (Fitzgerald *et al.*, 2013; Gartner Research, 2015; Hess *et al.*, 2016; Matt *et al.*, 2015; Wulf *et al.*, 2017). On the other hand, digitalization challenges well-established enterprises as digital start-ups with strong innovational strength and short time-to-market force incumbents to transform their business rapidly in order to stay competitive. Crossing organizational boundaries, digitalization has the potential to disrupt established value networks across industries (Gimpel and Röglinger, 2017). Rethinking the company's strategy, extending its capabilities, and the aspiration after agility hence become key elements for sustaining success in the digital age (Urbach *et al.*, 2017).

The key drivers of digitalization are digital technologies. Though extant literature provides no widely accepted definition for digital technologies, Yoo *et al.* (2010) propose three unique characteristics that demarcate digital technologies from earlier technologies: (1) re-programmability that allows separating functional logic from the executing device, (2) homogenization of all data enabling flexible storage, transmission, and processing, and (3) a self-referencing nature that accelerates the creation of digital devices and contents. A more specific summary of digital technologies is provided by the widely used acronym SMAC that refers to social, mobile, analytics, and cloud (Ackx, 2014; Cole, 2013; Legner *et al.*, 2017; Luftman *et al.*, 2015). Social features change the way how individuals collaborate and communicate, mobile devices allow for ubiquitous computing independent from time and location, analytical methods provide valuable insights into new quantities and qualities of data, and cloud computing influences the way how information is accessed and services are delivered (Ackx, 2014; Cole, 2013). Sebastian *et al.* (2017) extend the acronym to SMACIT (pronounced "smack it") by including the Internet of Things (IoT) as an additional digital technology. At the same time, the authors argue that there are more digital technologies than those subsumed by the SMACIT acronym. Particularly adding artificial intelligence, blockchain, robotics, and virtual reality, they assert that SMACIT "is intended as shorthand for the entire set of powerful, readily accessible digital technologies" (Sebastian *et al.*, 2017, p. 197). The market research company Gartner annually publishes its hype cycle methodology of emerging technologies ranging from brain-computer interfaces to autonomous vehicles, most of which can be considered as digital technologies (Gartner Research, 2017a, 2017c). Though many of the digital technologies are not individually disruptive, they unfold their innovative strength and transformational power in their combination and widespread use (Urbach *et al.*, 2017).

III.1.2.2 *Ambidextrous BPM and Process Redesign*

Business Process Management (BPM) aims to increase an organization's efficiency and effectiveness by combining business and IT perspectives to improve and continuously reengineer its business operations (Vom Brocke *et al.*, 2014). Depending on the individual organization, an improvement of business operations can relate to objectives such as cost decreases, reductions in error rates, or an increase in processing speed (Dumas *et al.*, 2013). BPM is therefore about managing processes that consist of "entire chains of events, activities, and decisions that ultimately add value to the organization and its customers" (Dumas *et al.*, 2013, p. 1). Over the last two decades, the BPM discipline substantially matured and

developed a well-established set of tools, methods, and frameworks around its inherent purpose of improving business processes (Kohlborn *et al.*, 2014; van der Aalst *et al.*, 2016).

In recent years however, a discussion around the ambidextrous nature of BPM arose. Hess *et al.* (2016) describe ambidexterity in the domain of organizational transformation as an adequate balance of exploitation and exploration of a firm's resources that leads to organizational agility, which in turn is a precondition for successful business transformation and the retention of a firm's competitiveness (Wade and Hulland, 2004). While an exploitative approach is necessary for an organization's short-term success, an explorative approach is required to secure its existence in the long run (Gibson and Birkinshaw, 2004; Markides, 2013; O'Reilly and Tushman, 2008). Afflerbach and Frank (2016) highlight the importance of ambidexterity in context of organizational transformation and propose an analytical framework for an in-depth understanding of interdependencies between exploitation and exploration. Some researchers argue that the research community thus far predominantly focused on the exploitative nature of BPM represented by a mainly problem-driven approach of reducing risks, deviance (Six Sigma; Harry, 1998), and waste (Lean Management; Krafcik, 1988), automating labor (workflow management; Van der Aalst *et al.*, 2003), and increasing efficiency (Kohlborn *et al.*, 2014). In contrast, comparatively low attention has been paid to the body of knowledge about explorative BPM that facilitates an opportunity-driven approach to innovate business processes aiming at real customer excitement (La Rosa, 2016). Rosemann (2014) therefore suggests future research to also deeply investigate explorative BPM. Following his thought of proactive environmental scanning, explorative BPM could analyze external trends such as the Internet of Things or data analytics to evaluate their ability in terms of business process innovation (Kohlborn *et al.*, 2014).

Ever since, the innovation and redesign of business processes has been a prerequisite for companies to retain their competitive market position (Osborne, 1997). Various methods and tools for the redesign of business processes have been suggested by the research community, most of which can be considered as being of exploitative nature. Some recommend the use of a repository with process reference models (Klein and Petti, 2006; Malone *et al.*, 1999; Margherita *et al.*, 2007) while others consolidate best practices (Reijers and Limam Mansar, 2005) or propose generic thinking styles for systemic ideation (Recker and Rosemann, 2015). For instance, Malone *et al.* (1999) compiled a handbook of process reference models by collecting similar business processes from exemplary organizations. The authors structured all process variants based on individual characteristics of each process. Practitioners responsible

for the redesign of business processes could use the process handbook as an inspirational reference for different variants of a single business process. Based on the process handbook by Malone *et al.* (1999), Klein and Petti (2006) developed and applied a structured methodology and Margherita *et al.* (2007) extended the handbook by a metric system. Not linked to the process handbook, Reijers and Limam Mansar (2005) consolidated 29 best practices in business process redesign from several authors and independent from specific business processes. The authors then evaluated qualitatively all best practices with regard to their time, cost, quality, and flexibility impact. Though some of these best practices relate to technology, most do not. Completely independent from technologies, Recker and Rosemann (2015) suggest a combination of the exploitative and explorative business redesign approaches. They propose four generic thinking styles for organizational ideation and the redesign of business processes: the enhancement of current practices by the systemic use of patterns, the derivation of better practices from organizations of other industries, the utilization of untapped or under-utilized resources, and the co-ideation with customers. For the exploitative thinking style of enhancement, Recker and Rosemann (2015) present specific process enhancement patterns that mainly focus on the logic and order of activities within a single process. For the remaining three thinking styles, the authors only describe high-level strategies and procedures. Beside the mentioned studies, there is a vast amount of literature available in the field of business transformation and process redesign (e.g., Chai *et al.*, 2016; Janzon *et al.*, 1997; Nissen, 2000; Shahzad and Giannoulis, 2011; Vanwersch *et al.*, 2015). Most of the methods pursue an exploitative approach of business process redesign resulting in decreased costs, reduced error rates, or increased processing speed (Dumas *et al.*, 2013).

III.1.3 **Research Method**

III.1.3.1 *Method Overview*

In order to elaborate future-oriented heuristics for business process redesign in the digital age, we chose an explorative approach based on real-world data from different databases and structured our research method and evaluation strategy in six phases: (1) we collected 658 start-ups from innovation programs of international top universities and (2) filtered the list to 90 start-ups based on a founding or funding year between 2014 and 2017, a sufficient amount of information available in the Internet, and the use of digital technologies. (3) From the final set of start-ups, we derived 17 process redesign heuristics grouped into 6 categories, (4) refined and validated all heuristics in a focus group with around 30 researchers, and (5) conducted two workshops where participants were instructed to generate process redesign

ideas in an opportunity-driven manner and based on a real-world company scenario. One workshop group solely used traditional brainstorming, whereas the other group of participants was first introduced into our process redesign heuristics. (6) For an evaluation, we asked practitioners to assess all process redesign ideas from the workshops and compared the results. Figure 1 summarizes all phases of the research method and evaluation strategy.

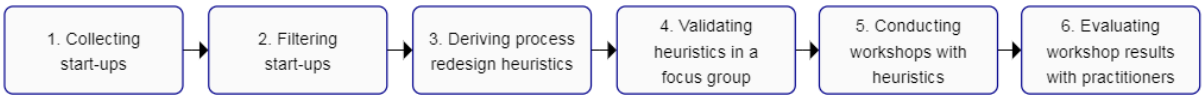

Figure III.1.3-1 *Six phases of the research method including an evaluation strategy*

III.1.3.2 *Phase 1: Collecting Start-ups*

In the first phase, a dataset of innovative start-ups that is later used as a basis for the analysis to identify relevant heuristic was collected. This special focus on start-ups is well-founded, as these newly established companies are usually operating at the spearhead of innovation breaking fresh ground to satisfy known and unknown customer expectations. To collect relevant start-ups, a structured online search for start-ups that are funded by members of the top 3 universities according to Times Higher Education World University ranking 2016-2017, was performed. The Times Higher Education ranking is the biggest international league table and the only global ranking that provides the most comprehensive evaluation of the universities' performance in research, knowledge transfer, international outlook, and teaching with 13 carefully calibrated performance indicators (Times Higher Education, 2017). University of Oxford, California Institute of Technology, and Stanford University are ranked top 3. All three universities offer special programs where innovative ideas of smart students flourish in an entrepreneurial environment. To find specific start-ups of these programs, the following online search terms logic was used:

```
<university name> AND {{{innovation OR idea} AND {fund OR winner OR
contest OR competition}} OR business idea OR start-up}
```

The result is a list of 6 different contests and programs of the top 3 universities that support 658 start-ups (table III.1.3-1). With 356 start-ups, the StartX program of Stanford University forms the largest share of the dataset. In contrast, the Humanities Innovation Challenge Competition at University of Oxford contributes no start-ups as this new competition hasn't announced winners at the time of the data collection.

Program name	University	Start-ups	Share
StartX	Stanford University	356	54,1%
Caltech Startups	California Institute of Technology	160	24,3%
Skoll Centre for Social Entrepreneurship	University of Oxford	96	14,6%
Start-up Incubator	University of Oxford	27	4,1%
FLoW	California Institute of Technology	19	2,9%
Humanities Innovation Challenge Competition	University of Oxford	0	0,0%

Table III.1.3-1 *Innovation programs of top 3 universities and number of supported start-ups*

III.1.3.3 *Phase 2: Filtering Start-ups*

Subsequently, in phase 2, the list of 658 start-ups was filtered to a final dataset of 90 innovative start-ups. Thereby the filtering process was based on three criteria. First, the start-up had to be founded between 2014 and 2017 (~20% of all start-ups). Against the backdrop of the rapid progress in digitalization, this filter was applied in order to mainly capture recent trends and innovation in business operations. In case of a lack of a clear founding year, alternatively the year when the start-up was supported by the respective university program was considered. As most university programs support start-ups in their initial foundation phase, the year of the university program admission was assumed to be a reliable proxy for the foundation year of a start-up. Second, detailed information about the start-up and its service had to be publicly available (~88% of the remaining start-ups) in order to derive process redesign heuristics. If information about a start-up was scarce, the start-up was not further considered. The two main reasons for insufficient information were either business closure or a stealth mode of the start-up, i.e. a state of secretiveness typically observable after the foundation of a company or prior to important product launches to avoid information disclosure towards competitors. Third, digital technologies such as the Internet, mobile computing, or IoT had to be a core element of the business model or business operations (~82% of the remaining start-ups) to factor out non-digital innovations as, for instance, plainly mechanical products such as an innovative prosthesis. Applying those three filtering criteria, resulted in a final dataset of 90 innovative start-ups (~14% of all collected start-ups) distributed across university programs as shown by table III.1.3-2.

Program	Start-ups	Share
StartX, Stanford University	81	90%
Start-up Incubator, University of Oxford	5	5,6%
Skoll Centre for Social Entrepreneurship, University of Oxford	4	4,4%

Table III.1.3-2 *Distribution of filtered start-ups across university programs*

Not all of the initial six innovation programs of the top 3 universities are represented by the filtered list of start-ups. “Caltech Startups” from California Institute of Technology is not represented, because their database only contains start-ups with founding dates until 2013. “FLoW” competition winners from California Institute of Technology are missing the use of digital technologies as a core element of their business. And the “Humanities Innovation Challenge Competition” is a new program that did not yet state winners. Hence, no start-up of the mentioned three programs was further considered for the derivation of process redesign heuristics. The following table III.1.3-3 states the founding or funding years of all filtered start-ups.

Year	Start-ups	Share
2014	49	54.4%
2015	24	26.7%
2016	6	6.7%
unknown	11	12.2%

Table III.1.3-3 *Founding or funding years of considered start-ups*

The filtered list of start-ups contains eleven entries with unknown founding or funding year. A start-ups’ founding year is labeled “unknown” if different statements about the founding year of the start-up is provided. In addition, start-ups from the university programs are considered if no information about the founding year was available, but the business idea was assumed to be developed in recent years between 2014 and 2017. This is the case for start-ups such as “roc connect” that develops smart home devices and offers an enterprise platform that enables white labelled smart home solutions or for “Pixterity” that provides full back-office automation to professional photographers via a cloud-based service. A full list of all 90 start-ups considered for the derivation of process redesign heuristics can be found in the appendix.

III.1.3.4 *Phase 3: Deriving Process Redesign Heuristics*

In the third phase, process redesign heuristics were derived from the final dataset of start-ups presented in the preceding section. As such, (re-)design heuristics provide stimuli for designers “to take a known solution and transform it to a new solution” (Yilmaz *et al.*, 2011, 115). Derived from real-life examples, heuristics represent ‘cognitive shortcuts’ that facilitate the exploration of the solution space by an intentional variation in designs (Daly *et al.*, 2012). In line with the thought of exploration in ambidextrous BPM, the goal of our heuristics is to be a practical instrument for the opportunity-driven redesign of existing business processes and the development of not yet existing business processes in a forward-looking manner

based on digital technologies. Our heuristics do not completely eliminate creative and cognitive efforts or represent fully specified blueprints for processes. They rather stimulate ways of thinking to enrich business process redesign. Comparable to the concept of stylized facts, we derived and abstracted heuristics from observations of start-up innovations.

Stylized facts describe empirically observable phenomena in form of generalized and simplified statements and are successfully used for years in various research fields, particularly in economics, where they originate from (Kaldor, 1961). Houy *et al.* (2015) note five constituting characteristics of stylized facts: (1) they generalize a finding that is empirically supported by different sources, (2) stylized and hence not valid in every case, (3) observed at real-life sources independent from a specific theory, (4) with no intention to represent causal relationships, and (5) a certain interestingness of the phenomena. As Loos *et al.* (2011) suggest stylized facts as a reasonable approach for research in the field of Information Systems (IS), we base the derivation of process redesign heuristics on this concept and generalize innovations observed at real-life start-ups.

Guiding questions to identify innovations of a start-up were: What makes the start-up innovative and differentiates it from traditional service providers? Which practice within the service delivery of the start-up creates special value to the customer? How are digital technologies employed within a process to satisfy (new) customer expectations? We then analyzed each spotted innovation through the following analytical lens: How can we decouple the innovation of the start-up from its specific context and use the underlying thought to guide opportunity-driven business process redesign? Answers to the guiding questions represent generic heuristics that can be used to redesign business processes in a forward-looking manner. If a heuristic was observed at another start-up from the dataset, then the respective process heuristic was iteratively modified with new insights from the additional start-up example. To the end of our sample we reached conceptual saturation as no additional heuristics could be derived. For reasons of clarity and comprehensibility, heuristics with a comparable aim such as a smarter use of existing data sources within a process to create additional value for the customer were grouped together. Within this iterative and qualitative group process, the authors discussed all process redesign heuristics and used distinct start-up examples for the refinement and grouping of all heuristics.

III.1.3.5 *Phase 4: Validating Heuristics in a Focus Group*

To validate the comprehensibility of all process redesign heuristics, we conducted a focus group with around 15 active participants and a total duration of approximately 1.5 hours. Focus groups were originally described by Merton and Kendall (1946), developed over time, and became a widely used research tool in social sciences that was also adopted by marketers (Stewart and Shamdasani, 1990). Stewart and Shamdasani (1990) describe a focus group as a moderated group discussion in which the organizer tries to elicit information, opinions, and feelings about a topic from all participants. Thereby, the moderator may vary how intensively he directs the discussion depending on the research intent. Focus groups are not only applicable to exploratory research, but are also a thorough confirmative technique (Stewart and Shamdasani, 1990). Gibson and Arnott (2007) suggest focus groups as evaluation tool for IS research. They not only present a case study for the successful application of a focus group within the evaluation phase of a design science research project, but they also propose specific guidelines on, for instance, the choice of a suitable moderator or a pragmatic approach to analysis. For the organization of our focus group, we considered the guidelines of Gibson and Arnott (2007) and invited a group of participants to discuss the comprehensibility and applicability of our process redesign heuristics as well as their grouping. The participants, consisting of IS researchers with different levels of experience and familiarity with our research topic, first got an introduction into the process redesign heuristics. Every heuristic was presented with its name, the category it was grouped into, and its description. To start the discussion, the moderator, which was one of this paper's authors, asked for general impressions on the heuristics, their applicability, and comprehensibility. Within the discussion, he became more directive to maintain focus, get feedback on every heuristic, and include every participant in the discussion. Though the general sentiment towards the process redesign heuristics was positive, the authors modified the name and description of those heuristics, where the focus group participants noted a lack of clarity or where the authors observed a different understanding of a heuristic compared to its originally intended meaning. As another result, the grouping of the heuristics was revised where participants could not easily comprehend existing contextual relationships between heuristics within one group or explicitly saw relationships though heuristics were not grouped together.

III.1.3.6 *Phase 5: Conducting Workshops with Heuristics*

To test for the practicality and impact of our validated process redesign heuristics, we conducted an experiment consisting of two innovation workshops. The first workshop group, hereinafter referred to as "brainstorming group", generated process redesign ideas solely

based on traditional brainstorming, whereas the second workshop group, hereinafter referred to as "heuristics group", was introduced into our process redesign heuristics.

Existing research suggests that people tend to explore only a fraction of the solution space if they face a creative challenge where no structured procedure for the solution development is available (Dennis *et al.*, 1996; Rietzschel *et al.*, 2007). Participants of an experiment that were asked to generate solutions for a problem missed on average more than half of the solution categories (Gettys *et al.*, 1987). We expect a similar result for the participants of our brainstorming group as they might choose the "path-of-least-resistance" (Rietzschel *et al.*, 2007, p. 936) that leads to blind spots in the solution space. As summarized by Vanwersch *et al.* (2015), studies of Nijstad *et al.* (2002) or Coskun *et al.* (2000) indicate that participants receiving stimulating guidance outperform unaided participants in the number of generated ideas and the extent to which their ideas explore the solution space. As our process redesign heuristics provide structured guidance for the generation of process redesign ideas based on digital technologies, we expect the heuristics group to outperform the brainstorming group. We used an experiment to test this assumption, as it provides a suitable alternative for a thorough evaluation of our heuristics (Hevner *et al.*, 2004).

In our experiment, all participants received a case description consisting of a short company profile and exemplary business processes. To ensure correctness, all information provided to the participants was aligned with representatives of this case's company. Real-life case descriptions, as the one given in our workshops, are an often used input type for the generation of process improvement ideas (Vanwersch *et al.*, 2015). While the brainstorming group was asked to immediately start with the generation of redesign ideas solely based on the company profile, the heuristics group first got an additional introduction into the process redesign heuristics presented in this paper. Each heuristic was described and explained with a notional example not directly linked to the company of the workshop. Prior research noted that examples in a creative generation task can have constraining effects as participants might feel the need to generate ideas that conform to the given examples (Smith *et al.*, 1993). This may also reduce the number of generated ideas in our workshop based on our process redesign heuristics. However, more recent research indicates that examples do not necessarily have constraining effects. In one study, engineers were introduced into design heuristics which they subsequently applied in the design of outdoor products (Yilmaz *et al.*, 2011). Though one or more examples were provided for every heuristic, the results did not indicate that the heuristics lead to prescribed designs. Yilmaz *et al.* (2011) concluded that the

examples even supported the generation of design ideas. Due to the conceptual similarity of our heuristics to the heuristics of Yilmaz *et al.* (2011), we expect the provided examples not to limit the number or prescribe the nature of the generated process redesign ideas.

After the generation of ideas, both groups completed a questionnaire about personal characteristics and how they experienced the workshop. With questions about their self-assessment regarding creativity and innovation capabilities, we wanted to measure if both groups consist of participants with a comparable mind-set and be able to quantify the influence of the participants' creativity on the outcome of the workshops. Questions about the workshop were asked to evaluate if the brainstorming group would have appreciated practical support in the idea generation and if our process redesign heuristics were helpful to the heuristics group. In other studies such as those of Vanwersch *et al.* (2015) or Shahzad and Giannoulis (2011), participants indicated that they were satisfied with the proposed process improvement principles and they intended to use the approach in future projects. Engineers applying heuristics in the design of outdoor products reported comparable satisfaction with the technique (Yilmaz *et al.*, 2011). Due to the conceptual similarity of our heuristics to the principles and heuristics of Vanwersch *et al.* (2015), Shahzad and Giannoulis (2011), and Yilmaz *et al.* (2011), we expect a high satisfaction of the workshop participants with our process redesign heuristics.

III.1.3.7 *Phase 6: Evaluating Workshop Results with Practitioners*

To assess the outcome of both workshop groups not only regarding the quantity of ideas, but also regarding their content, two practitioners of the company presented in the workshops independently evaluated each workshop idea.

After the workshops and before the ideas were forwarded to the practitioners, the authors digitalized and filtered all generated ideas removing those with no direct link to digital technologies. The authors further corrected orthography and grammar of the ideas that were jotted down by the participants during the workshops. In cases where context from the workshop discussions was missing, the authors added context based on their notes of the workshops. The authors did not add context that was not discussed in the workshops, but focused on describing the idea as discussed by the workshop participants. To make sure that all ideas still represent the original meaning discussed in the workshops, the digitalized and revised list of ideas was presented to all participants, who were asked to provide feedback if the list matches their original ideas and discussions.

As the authors did not receive any change requests, but confirmations, the list of ideas was forwarded to practitioners from the company presented in the workshops. As the job roles of both practitioners comprise the evaluation of emerging technologies regarding their potential to transform the business operations of their company, they were capable of assessing the outcome of our workshops. The company representatives rated all ideas within four categories as shown in table III.1.3-4.

Criterion	Description	Scale
Excitement potential	Potential that idea implementation creates excitement among (internal and external) customers.	1 (low) to 5 (high)
Economic potential	Positive contribution of the idea to the company's brand by a long-term cash flow preservation or even increase.	1 (low) to 5 (high)
Ease of implementation	Technical feasibility and effort of idea implementation.	1 (low/difficult) to 5 (high/easy)
Connection to business	Proximity of the idea to the product portfolio and service offering of the company.	1 (low) to 5 (high)

Table III.1.3-4 *Criteria used by practitioners to assess all process redesign ideas*

Some studies assume the quantity of ideas highly correlated with the number of high-quality ideas and therefore do not explicitly assess the quality of each idea, but solely refer to the number of ideas as measure for productivity (Vanwersch *et al.*, 2015). Though this assumption is backed by studies such as those of Parnes and Meadow (1959), Diehl and Stroebe (1987), and Stroebe *et al.* (2010), we nevertheless wanted to make sure that our heuristics do not only lead to a higher quantity of process redesign ideas, but also to a higher quantity of easy implementable ideas with a high potential for excitement, a high economic potential, and a close connection to the existing business.

III.1.4 **Process Redesign Heuristics Derived from Start-ups**

After collecting and filtering start-ups in the first and second phase of our research method, the third phase was related to the derivation of process redesign heuristics. Based on our dataset of 90 innovative start-ups, we derived 17 process redesign heuristics that serve as stimuli for innovating business processes based on digital technologies. To improve comprehensibility, we grouped the derived heuristics into six groups. The heuristics of each group are presented in a table that includes an ID, name, and description per heuristic. We further provide justificatory references for every heuristic that represent the IDs of the underlying start-up examples. The last column lists digital technologies that are employed with respect to the specific heuristic by the underlying start-up examples. Though these lists are not necessarily complete as there might emerge future technologies, they provide orientation among existing digital technologies that can be employed to implement a process redesign heuristic. After each table, we provide examples how every single heuristic could be applied to redesign business processes.

III.1.4.1 *Group A - Make Smart Use of Your Data*

The first group of heuristics stimulates ideas for a smart use of different types of data in business processes.

ID	Redesign Heuristic	Description	Justificatory References	Digital technologies
A1	Integrate various data sources	Gain a holistic view on your customer or an object used in your process by collecting, combining, and exploring diverse data from various data sources within your process.	2, 3, 7, 10, 11, 13, 14, 20, 22, 23, 24, 25, 29, 37, 46, 54, 55, 61, 62, 63, 69, 76	Data analysis, GPS, Internet, mobile computing, sensor technology, social media
A2	Add a digital identity	Add a digital identity to a physical object used in your process to digitally rebuild and extend its attributes, values, and functionalities.	5, 7, 8, 9, 10, 16, 23, 24, 28, 30, 36, 42, 45, 56, 59, 61, 63, 68, 70, 71, 72, 78, 79, 83, 87	Artificial Intelligence, data analysis, GPS, Internet, mobile computing, sensor technology
A3	Provide an API access	Allow public or limited access to data used, generated, and/or sanitized by your process and functionality of your service through a standardized interface.	7, 9, 23, 37, 38, 58, 61	Internet
A4	Use algorithms for pattern recognition	Discover patterns from structured and unstructured data used in your process and find irregularities.	2, 3, 11, 13, 14, 15, 19, 21, 23, 25, 29, 32, 38, 45, 62, 66, 71, 75, 76, 78, 89	Artificial Intelligence, computer linguistics, computer vision, data analysis, Internet
A5	Predict future scenarios	Support decisions within your process by predicting future scenarios based on current and historic data.	3, 10, 11, 14, 22, 23, 25, 28, 39, 45, 58, 61, 62, 71	Artificial intelligence, data analysis, Internet, predictive analytics
A6	Analyze location data	Ensure the availability of location data about people and objects involved in your process, and analyze these location data.	7, 9, 10, 18, 21, 23, 42, 47, 50, 61, 68, 70, 71, 77, 78, 83, 85, 86	Artificial Intelligence, data analysis, GPS, Internet, mobile computing, predictive analytics, sensor technology

Table III.1.4-1 *Group A - Make Smart Use of Your Data*

For its customer advisory process, an insurance broker could *integrate all existing databases* inside and outside the company to compile a comprehensive view on one customer that consists of purchased insurance products and past insurance claims as well as customer's age, income, and risk profile. This holistic view would inform the advisor about the customer in detail and enable insurance advisory that fits the customer's life situation in a more personalized way.

An enterprise owning vending machines could *add a digital identity* to all its vending machines and connect them to the Internet. The replenishment process of each vending machine could then be triggered based on location, current stocks, dates of expiry, and expected customer demand provided by the digital identity of the vending machine. Additional functionality would allow for dynamic pricing of all products in stock.

A retail bank could allow its partners to initiate the request for a loan process through an *API* in addition to the traditional paper-based application. Based on the information transmitted through the API, the bank would automatically decide on the loan requested through the bank's partner and instantly provide terms for the loan to the customer.

In their process for reimbursement in case of a damage, an insurance company could implement algorithms that analyze insurance claims in order to *identify patterns* that are similar to those of fraudulent claims. In case of similarity to a fraudulent claim, the respective insurance claim would be either not accepted or examined in detail.

A call center could improve its capacity planning process by *predicting* the number and types of incoming calls based on historic and current data. The predicted information about inbound calls would serve as a basis to plan the required capacity of call center agents and their expertise.

A taxi company could *track the location* of all its taxis to use this information in their process of handling incoming transportation requests. The process would then forward a new transportation request to the next free taxi that is located closest to the requester.

III.1.4.2 *Group B – Offer a Platform*

The second group of heuristics stimulates two different ways of including a platform concept in business processes.

ID	Redesign Heuristic	Description	Justificatory References	Digital technologies
B1	Serve as a broker	Design your process comparable to a broker that brings together your customers with other customers or third party providers. For instance, intermediate between buyers and sellers of a product or service among your customers.	1, 4, 6, 17, 20, 27, 33, 34, 35, 36, 41, 42, 43, 54, 58, 59, 60, 67, 77, 84, 86	Internet, mobile computing, data analysis, social media
B2	Be a matchmaker	Connect buyers and sellers of a product or service among your customers and third parties, and actively engage in the matchmaking between an individual buyer and an individual seller. As alternative to the sale of a product or service, bring together individuals with matching interest or intentions.	15, 16, 32, 48, 81, 88	Artificial Intelligence, data analysis, Internet, mobile computing

Table III.1.4-2 *Group B - Offer a Pltaform*

A retail bank could redesign its request for a loan process. In case the bank cannot or does not want to issue the loan to its customer, the bank would *serve as a broker* and suggest loans of third party banks to the customer. In addition, the bank could suggest other customers that are willing to crowd-finance the loan.

In addition to the traditional car rental process, a car rental company could *be a matchmake*r and offer a platform on which individuals can share their private cars in times of non-utilization. In the booking process, the car rental company would allocate a suitable free private car that fits to the preferences of the customer. The company would further handle all related communication and payments between customers, car owners, and insurers.

III.1.4.3 *Group C – Profile Your Customer*

The third group of heuristics suggests a better understanding of customers by profiling their preferences and behavior.

ID	Redesign Heuristic	Description	Justificatory References	Digital technologies
C1	Create a preference profile of your customer	Understand your customer by creating and analyzing a profile based on the preferences your customer explicitly expresses within your processes.	15, 16, 47, 53, 59, 64, 77, 81, 82, 88	Computer linguistics, data analysis, Internet, mobile computing
C2	Create a usage profile of your customer	Understand your customer by creating and analyzing a profile based on the behavior your customer shows in your processes.	31, 32, 45, 57, 78, 79, 80, 89	Artificial Intelligence, computer linguistics, computer vision, data analysis, Internet, sensor technology

Table III.1.4-3 *Group C - Profile Your Customer*

An online wine store delivers bottles of wine to its customers in frequent intervals. After delivery, the store could ask its customer for assessment of the wine. The wine store would collect this information over time and use it for upcoming orders of the same customer to select wine that fits to the taste of this particular customer by comparing his preferences with those of other customers.

An online finance manager sorts expenses of its user's bank account into specified categories and could *create a usage profile of its customers*. With usage over time and manual reallocations of expenses to categories by the user, the finance manager would better understand the spending behavior of its user and learn to correctly allocate a category to an expense.

III.1.4.4 *Group D – Design Digital Processes*

The fourth group of heuristics comprises two types of process digitalization.

ID	Redesign Heuristic	Description	Justificatory References	Digital technologies
D1	Replicate digitally	Digitize your whole process or individual process steps in a way that either no human interaction is required anymore or that this interaction is then carried out through digital technologies such as the Internet or mobile computing.	17, 19, 32, 33, 35, 40, 41,44, 48, 49, 51, 53, 54, 59, 64, 68, 70, 73, 77, 80, 81, 82, 86, 87, 90	Artificial Intelligence, computer linguistics, computer vision, data analysis, GPS, Internet, mobile computing, sensor technology, social media
D2	Enhance digitally	Digitize your process and lever the opportunities of the digitalization to enhance your process in a way that it creates higher value for either your company, your customer, or both of you.	8, 18, 20, 22, 23, 24, 25, 26, 36, 37, 39, 46, 55, 56, 61, 62, 65, 84, 85	Artificial Intelligence, computer linguistics, computer vision, data analysis, GPS, Internet, mobile computing, predictive analytics, social media

Table III.1.4-4 *Group D - Design Digital Processes*

A trading company could *digitize* its travel expense process to accept soft copies of invoices within reimbursement claims instead of mainly paper-based claims for reimbursement.

Public authorities could *digitally enhance* their tax declaration process to allow filling, signing, and submitting tax forms online. In addition, the online system would automatically transfer relevant inputs from uploaded documents into the tax declaration form and recommend inputs for individual fields of the form to reduce the time that is required to fill a tax declaration.

III.1.4.5 *Group E – Become Proactive*

The fifth group of heuristics suggests a transformation of business processes from a reactive into a proactive mode.

ID	Redesign Heuristic	Description	Justificatory References	Digital technologies
E1	Be a recommender	Within your process, recommend a certain product, service, decision, or action to your customer.	16, 23, 25, 31, 35, 40, 42, 62, 66, 80	Artificial Intelligence, computer linguistics, data analysis, GPS, Internet, mobile computing, predictive analytics, sensor technology
E2	Be an assistant	Use your process to assist your customer with the purchase of a certain product or service, to make a decision, or to execute an action.	8, 18, 20, 22, 29, 32, 37, 39, 41, 50, 56, 57, 64, 65, 69, 85, 89	Artificial Intelligence, computer linguistics, data analysis, GPS, Internet, mobile computing, predictive analytics
E3	Be an autopilot	Purchase a certain product or service for your customer within your process, fell a decision for your customer, or execute an action on your customer's behalf.	10, 12, 13, 21, 26, 28, 36, 45, 46, 55, 74, 76, 83	Artificial intelligence, computer linguistics, computer vision, data analysis, GPS, Internet, mobile computing, predictive analytics, sensor technology, social media

Table III.1.4-5 *Group E - Become Proactive*

An online retail shop for clothes could *recommend* individual products to its customers that independent bloggers currently describe as trendy and that are bought by a major share of the customer base.

Within their bank account opening process, a retail bank could *offer an assistant* to its new customers in order to smooth the change of their bank account by informing contractual partners of the customers about the new bank account details. The bank would assist with the creation of letters based on recent debit transactions on a former but still active bank account

of the customer. After the migration, the close of the old bank account would be prepared by the new bank.

An online pharmacy could *be an autopilot* and offer a subscription model for drugs with and without prescription. Within the frequent delivery process, the pharmacy would check if a required prescription has to be renewed. The pharmacy would automatically initiate the renewal of expiring prescriptions by contacting the doctor of the customer. The customer itself would not have to think about prescription renewal and the upload of prescription documents.

III.1.4.6 *Group F – Innovate Your Customer Relationships*

The sixth group stimulates two ways of innovating customer relationships.

ID	Redesign Heuristic	Description	Justificatory References	Digital technologies
F1	Enable natural interaction for customers	Enable your customer to interact naturally within your process instead of requiring formal communication routines.	13, 20, 31, 39, 40, 52, 64, 68, 75, 78, 79, 80	Artificial Intelligence, computer linguistics, computer vision, data analysis, Internet, mobile computing, sensor technology
F2	Transform customers into digital subscribers	Transform your process to serve your customers not on a transactional purchase level, but to provide your products and services on a long-term subscription model. Instead of buying individual products, your customer gets instant access to the whole product portfolio.	1, 5, 43, 48, 74	Internet, mobile computing

Table III.1.4-6 *Group F - Innovate Your Customer Relationships*

A publisher of premium cooking recipes wants to provide natural interaction to its customers whilst cooking. The publisher could therefore redesign its online search process and allow natural language voice inputs to navigate through the recipes.

A software company, so far selling software applications on physical CDs, could transform its customers into digital subscribers. All software products would be accessible via an online software store. Customers could download and use all offered software products at once. The products would be monetized by a usage-based subscription model, where customers only pay for the time they actively use the software.

III.1.5 **Evaluation**

After the validation of our process redesign heuristics in phase 4 of our research method, we conducted two innovation workshops in the fifth phase to test the practicality and applicability of our process redesign heuristics. We invited ten participants and split them randomly into two separate workshop groups as described in the Research Method section. All participants were researchers in the fields of customer relationship management, business process management, and digitalization and are therefore considered as being familiar with recent trends in their research fields. Both the brainstorming and the heuristics group first read through the real-life case description. In this document, a leading European mid-sized business was introduced that offers premium products and services to the construction industry. The company has more than 25,000 employees in over 100 countries, possesses many years of industry experience and stands for innovation and quality. Its products are directly sold to business customers, to which the company also offers services such as computer-aided construction planning, but also repair, instruction and training for the sold products. The case description further included a high-level summary of exemplary business processes such as the order process, maintenance and repair processes, and the handling of complaints. The participants had 15 minutes to make themselves familiar with the company and its exemplary processes. Before both groups were asked to generate ideas, the heuristics group received an additional introduction into our process redesign heuristics. To read through the descriptions and examples of all 17 heuristics, the participants needed no more than 30 minutes. Though the heuristics group had access to the list of redesign heuristics during the workshop, we did not define a structured process for their idea generation, but gave them the same freedom as provided to the brainstorming group. Both workshop groups had 45 minutes to generate and write down business process redesign ideas for the presented company, even beyond the exemplary processes that were included in the case description.

III.1.5.1 *Results of Innovation Workshops*

Both groups generated a variety of ideas for the redesign of business processes. For instance, one group suggested to allow sales representatives dictate their comments after a customer visit while driving to the next customer. This would potentially increase the efficiency of customer visit documentations. The mobile application that is already in use on the mobile devices of the sales representatives could then transform the notes into formal CRM system entries via speech recognition. The other group generated an idea that improves maintenance and repair processes for both customers and the company. By adding sensors and a digital identity, sold products monitor their condition and proactively trigger maintenance and repair processes. By anticipating repairs, the company could not only better plan its repair capacity, but also increase customer satisfaction by preventing outages.

Number of ideas	**Brainstorming group**	**Heuristics group**	**Increase**
Ideas generated in workshop	22	35	+59%
Thereof with link to digital technologies	18	35	+94%

Table III.1.5-1 *Number of ideas generated in workshops*

Table III.1.5-5 shows the number of ideas that were generated by each workshop group. The brainstorming group generated 22 process redesign ideas of which 4 ideas had to be removed as a direct link to digital technologies was missing. The heuristics group generated a total of 35 ideas, all of which contained a link to digital technologies. In the workshop setting of this study, the use of our process redesign heuristics led to a nearly doubled number of generated ideas by the participants.

Feedback of workshop groups	**Brainstorming group**				**Heuristics group**			
	μ	**σ**	**min**	**max**	**μ**	**σ**	**min**	**max**
Q1. I knew what was expected from me in the workshop.	4.6	0.49	4	5	4.8	0.40	4	5
Q2. The company profile was clear and comprehensible.	4.8	0.40	4	5	4.8	0.40	4	5
Q3. I know the presented company well.	4.6	0.80	3	5	4.4	0.80	3	5
Q4. The generation of ideas was easy.	4.2	0.40	4	5	4.0	0.63	3	5
Q5. The generation of ideas was difficult.	2.2	0.40	2	3	2.2	0.40	2	3
Q6. I am a creative person.	3.2	0.40	3	4	3.8	0.75	3	5
Q7. It is easy for me to generate ideas.	3.4	0.49	3	4	3.8	0.40	3	4

Table III.1.5-2 *Mean (μ) and standard deviation (σ) of feedback by all workshop participants*

Beside the fact that the participants were randomly mapped to one of the two workshop groups, all of the participants were researchers with diverse experience in the fields of business process management, customer relationship management, and digitalization. During

the observation of the workshops, no individual participant stood out in the process of generating ideas as all participants actively engaged in the creative process. Table III.1.5-2 shows the aggregated responses of all participants which were asked to provide feedback after the process of idea generation. The answer options comprised a 5-point Likert scale for all questions where 5 represents full agreement with the statement and 1 represents full disagreement. All participants reported that they knew what was expected from them in the workshop (Q1) and the introductory material about the company and exemplary processes was clear and comprehensible (Q2). The knowledge about the company they were generating ideas for was comparable for the participants of both workshops (Q3). Both groups had a positive impression of the idea generation (Q4-Q5). A slight difference can be observed for Q6-Q7 where participants' self-assessment regarding their innovative and creative capabilities was slightly higher for the heuristics group. This self-assessment however can be biased, as the feedback was collected at the end of the idea generation were participants already knew their generated ideas. The heuristics group may be positively influenced in their self-assessment as they knew that they were supported by the set of process redesign heuristics. We therefore believe that the participants of the heuristics group are not more creative or innovative by nature, but rather were more confident regarding their creative and innovative capabilities. However, in total, the participants' feedback in table III.1.5-2 supports two findings. First, both workshop groups comprehended the instructions and knew what is expected from them in the workshops. Second, the additional support by our process redesign heuristics did not further complicate the process of idea generation, but led to a comparably high level of joy and ease during the workshops.

Specific feedback of the heuristics group	**μ**	**σ**	**min**	**max**
Q8. The presented process redesign heuristics are clear and comprehensible.	4.8	0.40	4	5
Q14. The process redesign heuristics contributed to the idea generation.	4.8	0.40	4	5
Q15. The process redesign heuristics are a useful tool for generating ideas.	4.8	0.40	4	5
Q16. I generated ideas based on the process redesign heuristics which otherwise would not have come to my mind.	4.4	0.49	4	5

Table III.1.5-3 *Specific feedback of workshop group with heuristics*

We asked specific feedback questions to the heuristics group. As shown by table III.1.5-3, participants confirmed our heuristics to be clearly described and comprehensible (Q8). The participants reported that our process redesign heuristics supported them in the generation of process redesign ideas for the company introduced in the workshop (Q14-Q15). It helped them to cover potential blind spots, as the participants responded that the process redesign

heuristics let them come up with ideas they wouldn't have had without them (Q16). Based on the participants' feedback, we believe our process redesign heuristics to be understandable and a useful tool in the generation of process redesign ideas.

III.1.5.2 *Results of Practitioner Evaluation*

As seen in the previous section, the heuristics group generated nearly twice as many process redesign ideas as the group that only used traditional brainstorming with no further source of inspiration. To assess the generated ideas content-related, we asked practitioners of the company introduced in the workshops to evaluate all of the participants' ideas in four dimensions.

Evaluation criteria	Ideas of brainstorming group					Ideas of heuristics group					p-value (Mann-Whitney)
	μ	σ	range	n	4-5	μ	σ	range	n	4-5	
Practitioner #1											
Excitement potential	3.06	1.26	1-5	17	7 ideas	3.03	1.16	1-5	35	15 ideas	0.9436
Economic potential	2.47	1.19	1-5	17	3 ideas	2.89	1.19	1-5	35	11 ideas	0.2832
Connection to business	2.53	1.24	1-5	17	4 ideas	3.49	1.23	1-5	35	18 ideas	0.0137
Ease of implementation	2.82	1.29	1-5	17	5 ideas	2.21	0.76	1-4	34	1 idea	0,0787
Practitioner #2											
Excitement potential	2.94	1.16	1-5	17	7 ideas	3.45	1.13	1-5	31	19 ideas	0.1435
Economic potential	2.35	0.97	1-4	17	3 ideas	2.94	1.19	1-5	31	9 ideas	0.0993
Connection to business	2.65	1.45	1-5	17	6 ideas	3.61	1.18	1-5	31	18 ideas	0.0289
Ease of implementation	2.65	1.28	1-5	17	6 ideas	2.26	1.05	1-5	31	3 ideas	0.3382

Table III.1.5-4 *Evaluation of workshop ideas by practitioners*

Table III.1.5-4 summarizes the practitioner's independent evaluation of all ideas by four criteria. We performed statistical Mann-Whitney U tests (Mann and Whitney, 1947; Wilcoxon, 1945) for each criterion to check if the practitioners' average rating is significantly different between the brainstorming group and the heuristics group. A low p-value of the Mann-Whitney U test indicates that a practitioner rates ideas of the heuristics group significantly different from brainstorming group ideas. We suggest a significance level of 10% as threshold for the interpretation of the p-values.

The first practitioner sees a comparable medium excitement potential of ideas from both groups, whereas the second practitioner even sees a higher excitement potential for ideas of the heuristics group. Though the difference in the average ratings of the second practitioner is not statistically significant (p-value: 0.1435), we can observe a larger absolute quantity of high-quality ideas with an excitement potential of 4 or 5. Both practitioners rate 7 ideas of the

brainstorming group, but even 15 and 19 ideas, respectively, of the heuristics group with a high excitement potential. This leads to the finding that, on an absolute level, the heuristics group generated more high-quality ideas regarding the excitement potential.

Regarding the economic potential, both practitioners assign a higher average rating to ideas of the heuristics group than to brainstorming ideas. For the second practitioner, this finding is even statistically significant with a p-value of 0.0993 (p-value of 0.2832 for the average rating of the first practitioner). Besides the average rating, the heuristics group generated three times as many high-quality ideas (3 high-quality ideas of the brainstorming group vs. 9 to 11 high-quality ideas of the heuristics group).

According to practitioners' average rating, ideas of the heuristics group showed closer proximity to the existing core business of the company. This statistically significant finding is backed by p-values of 0.0137 (practitioner 1) and 0.0289 (practitioner 2). Also on an absolute level, the heuristics group generated three to four times as many ideas with a close proximity to the existing business (rating 4 or 5) as the brainstorming group.

Both practitioners rated ideas of the heuristics group on average as harder to implement as the ideas of the brainstorming group. This finding is statistically significant for practitioner 1 (p-value of 0.787), but not for practitioner 2 (p-value of 0.3382). We however believe that the non-standard ideas of the heuristics group were rated harder to implement as they especially leverage emerging digital technologies with a higher disruptive potential for which practitioners do not yet see clear solutions for implementation. In case of a high excitement and economic potential, it could nevertheless be worthwhile to consider these ideas for an opportunity-driven redesign of business processes as a forward-looking perspective can be a critical success factor to retain and strengthen a company's competitive position in the long run.

Summarizing the findings of the practitioners' idea evaluation, statistical tests did not always support an excitement and economic potential that is on average higher for ideas developed with our process redesign heuristics. On an absolute level, however, the heuristics group generated two to three times as many high-quality ideas (rated 4 or 5 by practitioners) compared to the brainstorming group. In this specific scenario, our heuristics further led participants to develop ideas that have a closer connection to the existing core business of the company (up to four times as many ideas rated with a connection to the existing business of 4 or 5) than ideas of the brainstorming group. Yet the implementation of ideas from the

heuristics group was on average rated more difficult as a clear path for their implementation was not foreseeable for the practitioners, potentially because of the emergence of novel digital technologies.

III.1.6 **Discussion & Limitations**

Our study contributes to the body of knowledge about the explorative part of ambidextrous BPM as it enriches current BPM research with an opportunity-driven perspective. Whereas the majority of traditional BPM focuses on the improvement of processes or activities within a process that is based on the analysis of the as-is and the identification of problem areas to improve, our study proposes 17 heuristics that lead to an opportunity-driven redesign of business processes. Potentially, the application of our redesign heuristics may even create new value propositions for customers. This way, we extend the well-established BPM toolset with a future-looking set of heuristics for business process redesign that follows an outside-in approach and specifically takes into account the possibilities created through digital technologies. As stimulation for unstructured creativity techniques such as traditional brainstorming, our heuristics contribute to a more exhaustive exploration of the business process redesign solution space, which continuously gets further expanded by digitalization. Furthermore, we contribute to a better understanding of the specific implications that digital technologies have on business operations. By proposing heuristics derived from real-life start-up examples, we illustrate concrete opportunities how digital technologies can be employed to redesign business processes in forward-looking manner that potentially even creates new value for customers and the company. In addition, the application of the heuristics in innovation workshops and the subsequent assessment of the workshop outcomes by practitioners are among the first attempts to provide case study alternatives for the evaluation of business process redesign ideas. We've shown a structured procedure to evaluate methods for process redesign in a controlled experiment.

As with every research project, our study is beset with limitations. First, the considered sample of start-ups, we derived our heuristics from, is not exhaustive. More start-ups exist that built on digital technologies to excite their customers. Though we tried to address this issue by selecting a subset of start-ups that are founded by graduates and supported by innovation programs of leading top universities, it is possible that other start-ups would lead to other heuristics for process redesign. It is however far more likely that the consideration of additional start-up samples lead to additional heuristics instead of disqualifying the already elaborated ones of this study. Due to the modular design of our heuristics, they are easily

extendable if researchers investigate other start-up samples. For the considered sample, however, we reached conceptual saturation as towards the end new start-up examples did not lead to new heuristics, but instead backed the existing ones. Second, only a small group of participants generated ideas in our innovation workshops. To gain statistically reliable data, it might be beneficial to conduct workshops with a larger group of participants and more diverse backgrounds. Our findings however indicate that the application of our heuristics in a creative idea generation process leads to a larger number of redesign ideas and even a larger number of high-quality ideas. Third, the derivation of process redesign heuristics from innovations of start-ups itself is a creative process. No matter how structured the research method is set up, there will always be subjectivity in the process of actually transforming specific practices or innovations of start-ups into generic process redesign heuristics. We tried to address this issue by intensive discussions of all heuristics among the authors and a subsequent validation in a focus group. As we state justificatory references for each heuristic in a transparent way, readers are able to replicate the derivation of individual heuristics from specific start-up examples. Despite the described efforts, we cannot fully exclude that other researchers would abstract heuristics with a different focus.

Despite these limitations, our study entails a range of managerial implications. Our research fuels the adoption of digital technologies within organizations as we highlight specific opportunities how digital technologies can be employed to redesign business processes in a forward-looking manner. As companies might feel overwhelmed by the sheer amount and adoption speed of digital technologies, our research provides particular starting points to innovate their business operations. The heuristics proposed in this study stimulate creative thinking on business process redesign. As most of the opportunity-driven process redesign is still triggered by traditional brainstorming sessions, our heuristics augment the rich set of problem-driven approaches with an explorative tool. Our research might therefore help businesses to retain and strengthen their competitive position and transform themselves into revenue-resilient organizations.

III.1.7 **Conclusion & Further Research**

This study answered the research question what can be learnt about opportunity-driven business process redesign from innovative start-ups based on digital technologies. The major finding was a set of 17 process redesign heuristics that were empirically derived from real-life start-ups and evaluated subsequently. The proved to impose no additional effort when applied in a creative idea generation process. They instead stimulate the idea generation and result in more high-quality ideas compared to traditional brainstorming. Highlighting specific design alternatives, the process redesign heuristics proposed in this paper fuel the adoption of digital technologies.

Our results also motivate future research. First, we recommend an evaluation in broader context. Experiments with more participants of diverse backgrounds that apply the process redesign heuristics on different company scenarios could improve their general validity. Researchers could even investigate the effects of different usage styles. As the sheer amount of heuristics may feel overwhelming to participants and cognitively less assessable, it may be worthwhile to evaluate if a step-wise provision of the heuristics may even increase the quantity of high-quality process redesign ideas. Second, researchers may want to verify the proposed heuristics by examining other samples of start-ups based on digital technologies. As we reached saturation of new heuristics towards the end of our sample, we expect additional samples of start-ups to strengthen the justificatory references of the proposed heuristics. Third, researchers may even set out to extend the list of process redesign heuristics. We explicitly encourage a reassessment after some time as new digital technologies rapidly emerge and potentially create new possibilities for the creation of value to customers and hence provide new stimuli for the redesign of business processes. Fourth, studying the relationship between the heuristics and companies' success may be beneficial for the decision which heuristics should be applied in a forward-looking design of business processes. As no longitudinal data is available about the adoption and impact of digital technologies it could be rational to appraise the benefits and risks of single digital technologies in the long run.

III.1.8 **References**

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III.1.9 **Appendix**

Filtered list of start-ups

ID	Start-up	URL	Source
1	CycleLand	http://www.cycle.land/	Start-up Incubator, University of Oxford
2	Gyana	http://www.gyana.space/	Start-up Incubator, University of Oxford
3	Singular Intelligence	http://www.singularintelligence.com/	Start-up Incubator, University of Oxford
4	Prolific Academic	https://prolificacademic.co.uk/	Start-up Incubator, University of Oxford
5	Bibliotech	http://www.bibliotech.education/	Start-up Incubator, University of Oxford
6	LittleBig Money	http://www.littlebigmoney.org/en/	Skoll Centre for Social Entrepreneurship, University of Oxford
7	Institute of Public and Environmental Affairs	http://www.ipe.org.cn/	Skoll Centre for Social Entrepreneurship, University of Oxford
8	Medic Mobile	http://medicmobile.org/	Skoll Centre for Social Entrepreneurship, University of Oxford
9	Shack/Slum Dwellers International	http://www.sdinet.org/	Skoll Centre for Social Entrepreneurship, University of Oxford
10	OnFleet (formerly addy.co)	https://onfleet.com/	StartX, Stanford University
11	Aerial Intelligence	https://www.aerialintel.com/	StartX, Stanford University
12	AmperVue	https://ampervue.com/	StartX, Stanford University
13	Cleargraph (formerly Argo.IO)	https://cleargraph.io (formerly argo.io)	StartX, Stanford University
14	Arundo	https://www.arundo.com/	StartX, Stanford University
15	Blendoor	http://www.blendoor.com/	StartX, Stanford University
16	BlueCrew	https://bluecrewjobs.com/	StartX, Stanford University
17	Boom Fantasy	https://boom4d1.boomfantasy.com/signup/introduction	StartX, Stanford University
18	Booster	https://www.boosterfuels.com/	StartX, Stanford University
19	Branch Metrics	https://branch.io/	StartX, Stanford University
20	Bright.md	http://bright.md/	StartX, Stanford University
21	Civil Maps	https://www.civilmaps.com/	StartX, Stanford University
22	Clarify	http://www.clarifyhealth.com/	StartX, Stanford University
23	clearmetal	http://www.clearmetal.com/home	StartX, Stanford University
24	Confident Cannabis	http://www.confidentcannabis.com/	StartX, Stanford University
25	datatron	https://www.datatron.com/	StartX, Stanford University
26	AestheticLink (formerly DermLink)	https://www.aestheticlink.com/	StartX, Stanford University
27	Disctinc.tt	http://distinc.tt/	StartX, Stanford University
28	SpryHealth (formerly echolabs)	spryhealth.com (formerly http://echolabs.co/)	StartX, Stanford University
29	EdCast	https://www.edcast.com/	StartX, Stanford University
30	Eko	https://ekodevices.com/	StartX, Stanford University

ID	Start-up	URL	Source
31	Elsa	https://www.elsanow.io/home	StartX, Stanford University
32	Embroker	https://www.embroker.com/	StartX, Stanford University
33	Finvoice	https://app.finvoice.co/	StartX, Stanford University
34	gfycat	https://gfycat.com/	StartX, Stanford University
35	Open Sky (formerly Heart this)	https://www.opensky.com	StartX, Stanford University
36	Hemlane	https://www.hemlane.com/	StartX, Stanford University
37	Hint Health	https://www.hint.com/	StartX, Stanford University
38	Human Diagnosis Project	https://www.humandx.org/	StartX, Stanford University
39	Joined App	https://www.joinedapp.com/	StartX, Stanford University
40	Lark	http://www.web.lark.com/	StartX, Stanford University
41	Legal IO	https://www.legal.io/	StartX, Stanford University
42	Let's Maybe	https://letsmaybe.com/	StartX, Stanford University
43	LittleLane	https://www.littlelane.com/	StartX, Stanford University
44	Lomotif	http://www.lomotif.com/	StartX, Stanford University
45	Lully	http://www.lullysleep.com/	StartX, Stanford University
46	luma health	https://www.lumahealth.io/	StartX, Stanford University
47	LumosTech	http://lumostech.co/	StartX, Stanford University
48	Yup (formerly MathCrunch)	https://www.yup.com/ (formerly mathcrunch.com)	StartX, Stanford University
49	MathPapa	https://www.mathpapa.com/	StartX, Stanford University
50	Memery	http://memery.com/	StartX, Stanford University
51	Crossdeck	http://crossdeck.us/	StartX, Stanford University
52	OhmniLabs	https://ohmnilabs.com/	StartX, Stanford University
53	Original Stitch	https://www.originalstitch.com/	StartX, Stanford University
54	Orthobullets	http://www.orthobullets.com/	StartX, Stanford University
55	PicnicHealth	https://picnichealth.com/	StartX, Stanford University
56	PhotoByte	http://pixterity.com/	StartX, Stanford University
57	Polarr	https://www.polarr.co/	StartX, Stanford University
58	Quantiacs	https://www.quantiacs.com/Home.aspx	StartX, Stanford University
59	realstax	https://realstax.com/	StartX, Stanford University
60	Reveal	https://angel.co/reveal-4	StartX, Stanford University
61	Rhumbix	https://www.rhumbix.com/	StartX, Stanford University
62	Roam Insights	https://roamanalytics.com/	StartX, Stanford University
63	roc connect	http://roc-connect.com/	StartX, Stanford University
64	Ropazi	http://www.ropazi.com/	StartX, Stanford University
65	SameGoal	samegoal.com	StartX, Stanford University
66	SimPolaris	https://www.simpolaris.com/	StartX, Stanford University
67	Sizzle	https://onsizzle.com/	StartX, Stanford University

ID	Start-up	URL	Source
68	skip	http://www.skip.it/	StartX, Stanford University
69	Slyce	https://www.slyce.io	StartX, Stanford University
70	PastureMap (formerly Summer Technologies)	http://pasturemap.com/	StartX, Stanford University
71	Swiftly	https://goswift.ly/	StartX, Stanford University
72	switchmate	http://www.myswitchmate.com/	StartX, Stanford University
73	TankWallet	https://www.tankwallet.com/	StartX, Stanford University
74	The Pill Club	https://thepillclub.com	StartX, Stanford University
75	Threadloom	http://www.threadloom.com/	StartX, Stanford University
76	Toneden	https://www.toneden.io/	StartX, Stanford University
77	Tripcipe	https://www.tripcipe.com/	StartX, Stanford University
78	UnifyID	https://unify.id/	StartX, Stanford University
79	Starling by VersaMe	https://www.versame.com/	StartX, Stanford University
80	Vida	https://www.vida.com/	StartX, Stanford University
81	vocate	https://www.vocate.me/	StartX, Stanford University
82	Vynca	https://www.vynca.org/	StartX, Stanford University
83	Chronos Mobile Technologies (formerly Waldo)	www.trywaldo.com	StartX, Stanford University
84	WeFinance	https://www.wefinance.co/	StartX, Stanford University
85	WeFuel	http://www.wefuel.com/	StartX, Stanford University
86	workhood	http://www.workhood.com/	StartX, Stanford University
87	Worklife	https://www.worklife.com/	StartX, Stanford University
88	ZendyHealth	https://zendyhealth.com/	StartX, Stanford University
89	ZingBox	http://www.zingbox.com/	StartX, Stanford University
90	Zinier	https://www.zinier.com/	StartX, Stanford University

Table III.1.9-1 Filtered list of start-ups

III.2 Research Paper 4: Frank L, Fridgen G, Heger S, Hosseini S (2017) Do Not Forget About Smart Towns – How to Bring Customized Digital Innovation to Rural Areas

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In:	Resubmitted after 1st revision to Business & Information Systems Engineering (BISE)

Abstract

To date, research on smart cities has primarily focused on urban congested areas. As this paper points out, it is becoming ever more important to look at intermediate and thinly populated regions like towns and rural areas as arenas for digital innovation. By following a multi-phase research process inspired by design science, we examine towns with highly individual needs, derive key aspects from recent literature that can serve to mitigate or solve their problems, and present an open innovation process by way of integrating local context factors, local stakeholders, and suitable information and communication technology solutions. Our objective is to develop a digital innovation approach that allows for stimulating digital innovation and to arrive at a comprising solution, rather than multiple isolated smart solutions, which satisfies the challenges and needs typically faced by towns and rural areas. Specifically, we conduct a case study which demonstrates the applicability and effectiveness of our innovation approach in a small town in southern Germany. Thereby, the concept of an innovation ecosystem reveals a promising solution to face the challenges of the investigated town and can be transferred to other towns.

Keywords: *Digitalization, Open Innovation, Open Innovation Framework, Innovation Ecosystem, Rural Areas, Smart City, Smart Town*

III.2.1 **Motivation**

In a world of ever-changing (corporate) environments, disruptive digital technologies, and highly diverse citizen needs, the concept of smart cities has become a broadly discussed subject (Hollands 2008). In general, smart cities are deemed to be a promising answer to urban challenges of the 21st century, such as air pollution, immigration, and socio-demographic problems (Klein et al. 2017). The penetration of smart cities by digital technologies affords this generation the unprecedented chance to fundamentally reorganize urban infrastructures, be it transportation or food and water supply, in much smarter ways (Ramaswami et al. 2016). Accordingly, the use of modern information and communication technologies (ICTs) fosters the exchange and connectedness of people, which can provide manifold opportunities for innovative business models (Schaffers et al. 2011).

According to the statistical office of the European Union, urban areas can be depicted by the so-called degree of urbanization (DEGURBA) characterizing urban areas into cities (densely populated areas), towns and suburbs (intermediate density areas), and rural areas (thinly populated areas) (Eurostat 2017). So far, research on smart cities and smart solutions has predominantly focused on densely populated areas, leaving towns, suburbs, and rural areas behind. Roberts et al. (2017, p. 372) point out that "digital technology remains a niche topics in rural studies". Furthermore, research on rural areas and development takes a strong agricultural focus and hardly considers digital technologies from an overall community and business perspective (Roberts et al. 2017). Low research and development levels in predominantly rural areas (Tödtling and Trippl 2005) aggravate this problem although digital technologies and smart solutions might provide promising solutions for future developments of towns (Roberts et al. 2017).

Nonetheless, recent literature highlights the paramount importance of smart strategies and innovation in rural areas yet (Provenzano et al. 2016). This new focus on the social periphery is becoming increasingly important, as the majority of our global population lives in rural areas, suburbs and towns (in the following referred to as towns), while only 10% of mankind lives in cities with more than one million residents (Hess et al. 2015). As Porter et al. (2004) state, these towns have enormous economic potential, though the gap between thinly and densely populated areas is widening. Further studies have revealed that the recent success of populist candidates in democratic elections can at least in part be accorded to determinants such as economic distress (Rothwell and Diego-Rosell 2016; Monnat 2016), which in turn

may be most keenly felt where the personal economic situation is at odds with election results (Glasgow and Weber 2005).

Of course, towns require innovation to make use of the potential of digitalization. Yet much like cities, towns are also facing a complex range of locally specific challenges predicated on their diverse characteristics like geographic, economic, social, and ecological conditions. Neirotti et al. (2014) summarize such variables as local context factors that are crucial for the development of all kinds of urban areas. Yet solutions based on innovative digital technologies are discussed in the broad context of smart cities, which is to say they do not necessarily fit the requirements of towns as well. Similar to activity- and context-based design (Gay and Hembrooke), it is important for towns to understand in which way a certain digital technology should be applied in order to act "smart". Analogous to designers who should not start with a preconceived idea of what users should do (Gay and Hembrooke), but rather have to first get a precise understanding about what users actually do, smart town "designers" have to grasp how relevant stakeholders and context matter, and how technology could manifest and be used rather than pushing and enforcing the "smart" dimension on it (Bélissent 2010).

A further challenge is that, especially, in towns and rural development it is common practice to follow and operate a "one-size-fits-all" solution approach - although local-specific requirements are highly required - wherefore such solutions often fail when they are applied to rural areas with different properties (Roberts et al. 2017, Stratigea 2011, Tödtling and Trippl 2005). As rural development and regions are at disadvantage when it comes to competitive positioning in the new era and digital age (Stratigea 2011), more "integrated approach that helps them find the usefulness of such technologies for their individual purposes" are required (Roberts et al. 2017, p. 381). In this regard, there is a need for improvements and extensions in the way information systems operate in order to yield more successful and predictable innovation outcomes in towns, which is why this paper addresses the following research questions:

RQ 1: How should an innovation process be designed for smart towns to better leverage the potential of digitalization?

RQ 2: To adhere to the individual needs of smart towns, can information systems themselves enable town-specific innovations?

The extant literature provides a host of ideas on how to design innovation processes in general, and recent research has indicated that open innovation is an effective and efficient way to meet demands of smart cities (Paskaleva 2011). On this understanding, we draw on

open innovation as a promising strategy, not only for cities, but also for towns. Yet since towns often do not have sufficient resources to apply green-field approaches, we develop a generic innovation process that allows towns with diverse local characteristics to develop smart digital answers to challenges of the 21st century.

Throughout this paper, we adopt a problem solving perspective (Nickerson and Zenger 2004) to answer the above questions. More specifically, we follow a multi-phase research process inspired by design science research (Hevner 2007; Hevner et al. 2004) that consists of four phases. We identify the relevant problem by analyzing the state of the art in Section 2 and introduce our research method in Section 3. In Section 4.1, we identify justificatory knowledge of "problem-adjusting factors" in previous scientific work on the subject. In Section 4.2, we develop an innovation process and derive an appropriate solution that can stimulate digital innovation in smart towns. Finally, in Section 5, we apply the process to a small town in southern Germany and conclude the study in Section 6 by summarizing key results and limitations, which indicate implications for future research.

III.2.2 **Smart Cities and Smart Rural Areas**

Smart city research can be regarded as an umbrella term that covers divergent trends with respect to (information-related) city research (Barth et al. 2017). There is a plethora of various definitions of the term "smart city" and there is no collective understanding of what a smart city actually is. Barth et al. (2017) argue that by focusing on specific facets of smart city research, prior research led to important, but isolated and scattered pockets of understanding the whole (interdisciplinary) story. To better understand and integrate these pockets of understanding, we draw on recent studies such as Neirotti et al. (2014) and Albino et al. (2015) that provide literature reviews on smart cities as a starting point to gain a resilient knowledge base on smart cities.

The label smart city first occurred back in the 1990s, when it came with strong technical connotations, as it denoted the application of new ICT to cities. Yet over the years, personal and communal needs have come to the fore, so ICT were applied with the objective to improve urban systems and thus quality of life (O'Grady and O'Hare 2012; Batty et al. 2012; Albino et al. 2015). The term "smart city" has since been synonymous with "intelligent city" or "digital city", but as a result of such loose wording, Albino et al. (2015) find that ideas relating to smart cities are applied not only to "hard" domains (e.g., mobility, energy grids) but also to "soft" domains (e.g., education, policy innovations). Here, we use the term as defined by Giffinger et al. (2007, p. 11), who states that a smart city is "a city well performing

in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens. Smart city generally refers to the search and identification of intelligent solutions, which allow modern cities to enhance the quality of the services provided to citizens." In accordance with this definition, a socio-technical view on smart cities is required (Nam and Pardo 2011) to solve various challenges and problems encountered in modern cities. The extant literature on this issue therefore focuses on such well-known problems as air and water pollution, energy efficiency, public transportation and mobility, and unemployment (Nam and Pardo 2011). Going forward, however, there is a need for "initiatives and strategies that create the physical-digital environment of smart cities, actualizing useful applications and e-services, and assuring the long-term sustainability of smart cities through viable business models" (Schaffers et al. 2011).

Importantly, politics and research must not only consider the challenges and problems of smart cities on the large scale. Following Hess et al. (2015), only 10% of mankind lives in cities with more than 1 million residents. In Germany, for instance, 70% of the national population lives in rather rural areas with less than 100,000 people. A broad range of public (research) projects has illustrated the importance of digital innovations in regions where residents are spatially more dispersed. Exemplary research projects include "Smart Rural Areas" (Trapp, 2016) or the Living Lab initiatives (Schaffers et al. 2011). It is worth noting, though, that rural areas differ from cities with regard to their specific characteristics, challenges, and problems. These comprise (but are not limited to) significantly reduced amounts of research and development, as well as the consequent grievances of little to no innovation, poorly developed industries, missing knowledge carriers, and hardly any assistance for innovation by administrations (Tödtling and Trippl 2005). Furthermore, when having a look at digital policy agenda, rural areas tend to be more "passive and static, set in contrast to the mobility of urban, technological and globalization processes" (Roberts et al. 2017, p.372). Such issues bedevil various "domains like telecommuting, health-services, logistics, mobility, farming, commerce, or education" (Hess et al. 2015, p. 164). Thus, our definition of a smart town refers to Giffinger et al. (2007) as a town or rural area that is intermediate or thinly populated, but nonetheless provides appropriate and future-oriented ICT solutions to improve various domains regarding economy, people, governance, mobility, environment, or living.

There is, then, a manifest need for innovation in the interest of social as well as commercial benefit. Yet the range of solutions presented in recent discussion on smart cities is rather

generic. Most of the contributions are limited to a high level of abstraction (cf. Khan et al. 2012) or offer mutually exclusive solutions (Zanella et al. 2014; D'Asaro et al. 2017), due to the great diversity of local characteristics. Nevertheless, towns tend to follow "one-size-fits-all" solution approaches which fail when they are applied to towns with different properties (Roberts et al. 2017, Stratigea 2011, Tödtling and Trippl 2005). Too individual are the characteristics of cities and, even more so, those of towns. This means that local administrations and governments have to activate "cities and urban areas as well as rural and regional environments as agents for change and as environments of 'democratic innovation'" (Schaffers et al. 2011, p. 432; Hippel 2005).

To summarize, smart towns must offer intelligent solutions to the challenges of contemporary urban and rural life, solutions that improve the quality of their citizens' life as well as the town's economic viability. Thus, it is not enough to apply modern ICT to towns to make them smart. Efforts must be extended to the improvement of a given town's capability to attract and advance its own innovation potential.

III.2.3 **Research Method**

To tackle the above issues, we adopt a problem solving perspective (Nickerson and Zenger 2004). We take the problems and challenges of smart towns as the basic unit of our analysis. In line with Nickerson and Zenger (2004), as well as Felin and Zenger (2014), we argue that the optimal method of solution can be determined by understanding and scrutinizing a problem's complexity. We therefore follow a multi-phase research process inspired by design science research (Hevner 2007; Hevner et al. 2004). It consists of four phases: (I) we identify a relevant problem by analyzing the state of the art and define the term "smart town", (II) we consider justificatory knowledge "problem-adjusting factors" within the current scientific work on the subject, (III) we develop an innovation process to derive a suitable solution, and (IV) we evaluate the process by applying it to a small town. By doing so, we gain an understanding and first promising insights for digital solutions in smart towns.

In the first phase (Section 2), we demonstrate the relevance of our work. Following Hevner (2007), valuable research "often begins by identifying and representing opportunities and problems in an actual application environment". By analyzing the situation in a small town in southern Germany, we discover initial indications for our hypothesis that there is a need for digital solutions which stimulate innovation in smart towns. However, so far the literature on this subject has not provided an appropriate process to derive highly individual challenges in

smart towns due to local context factors (Neirotti et al. 2014). Thus, we consult literature to identify among its valuable insights the most promising entry points.

In a second phase (Section 4.1), we gain justificatory knowledge from scientific literature that provides foundation for our research (Hevner 2007). For identifying problem-adjusting factors, we draw on literature reviews of smart cities and rural areas and their current challenges to derive three core items that have to be well accounted for in order to ensure sustainable smart solutions.

In the third phase (Section 4.2), we follow (Hevner et al. 2004) who recommend design as a search process. We identify and invigorate a suitable innovation process. By way of reviewing literature, the innovation process is carved out and enhanced so that it is applicable by local administration and institutions. To this end, however, the process must be pragmatic and prevent these administrations from repeating common, well known mistakes. On the basis of this justificatory knowledge, we develop and refine our open innovation process. In doing so, we further discuss how to design an appropriate solution that enables digital innovation and contributes in transforming towns toward smart towns.

In the last research phase (Section 5), we demonstrate the applicability and effectiveness of our innovation process. Referring to Hevner et al. (2004, p.75), we argue that "knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact". Since "the goal of design science research is utility" (Hevner et al. 2004, p.80) our focus lies in demonstrating the applicability and utility of our artifact, i.e., the innovation process. Therefore, we evaluate our artifact in accordance with Venable et al. (2012) by use of a case study. What makes this evaluation especially suitable is the fact that the major risk is user-oriented. After all, it is a vital goal that our process is beneficial in real situations (Venable et al. 2016). Since we have access to real users, a real problem and a real system (Venable et al. 2012), we apply our approach prototypically to a small town and demonstrate its effectiveness in real situations and for the benefit of heterogeneous groups of stakeholders.

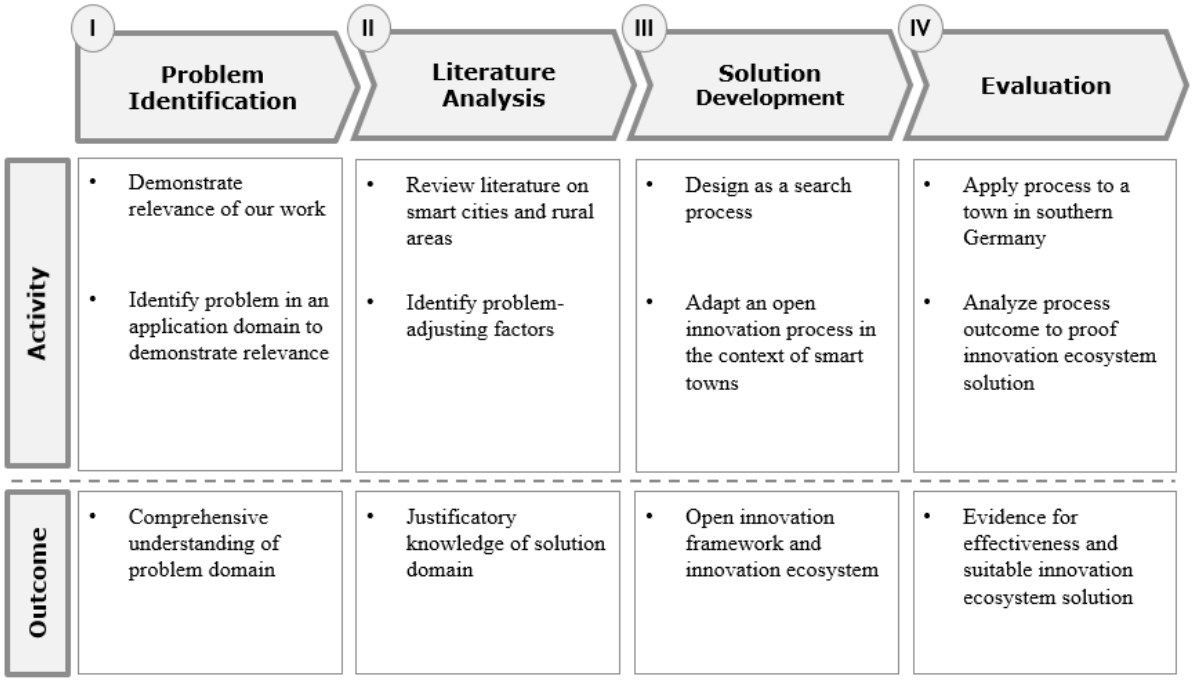

Figure III.2.3-1 *Multi-phase research process with four phases*

III.2.4 **Solution Development**

III.2.4.1 *Problem-adjusting factors*

In the following, we elaborate on the main problems and challenges that need to be considered when implementing smart solutions in towns, chief among them the importance of considering local context factors, ensuring local stakeholders' involvement as well as gathering solution information and identifying and aligning suitable ICT solutions. Research regarding (smart) towns in the digital age is yet on an early stage and rather immature as "digital technology remains a niche topics in rural studies" (Roberts et al. 2017, p.372). Therefore we primarily infer from literature on smart cities which challenges occur when ensuring sustainable smart solutions, and why they become all the more relevant with respect to towns. This does not imply that these factors are therefore of no importance in smart cities but rather they may require higher attention in smart town settings.

1. **An accurate understanding of the challenges and needs of towns by understanding their context**

Smart solutions must begin with the town itself, not with the "smart", as they must be grounded in the real context of a town (Bélissent 2010). Cities and towns come in different shapes and sizes and thus reveal different innovation characteristics.

Research on smart cities posits that generic smart city concepts are so far not sensitive to the local context of a city (Zygiaris 2013). Within an empirical analysis of 70 cities, Neirotti et al. (2014) investigate the role of various context variables (e.g., economic, urban, demographic, and geographical variables) and their impact on the development of a smart city. They reveal that evolution of smart cities largely depends on its local context factors. Similarly, Barca et al. (2012) highlight the importance of more place-based approaches for regional development, rather than place-neutral approaches, meaning that context – in terms of social, cultural, and institutional characteristics – really matters. Therefore, smart cities should be analyzed from a contextualized interplay perspective (Nam and Pardo 2011). Cities require better guidance on how to best grasp relevant context factors, determine the most appropriate domains of actions, and subsequently define a suitable smart city strategy (Neirotti et al. 2014). Other empirical studies have likewise shown that different types of cities and regions reveal different preconditions for innovation activities and processes. The specific strengths and weaknesses in terms of their economy and innovation potential, however, are all too often not taken into account sufficiently. There is no "one-size-fits-all" approach without consideration of the context (Tödtling and Trippl 2005). Certainly, gaining the right context knowledge and identifying the relevant needs are important first steps, but this alone is not sufficient. Smart cities have to be able to set smart priorities in terms of domains of actions, priorities that are in line with the city's overall development plan and innovative outlook (Zygiaris 2013; Schaffers et al. 2011).

Hence, we argue that, while understanding the context of smart cities already constitutes a major challenge when implementing smart solutions, this becomes even more relevant and difficult when addressing smart towns. The digital development of smart towns by means of applied innovation depends, to a large extent, on its local context factors, e.g., economy, geographical variables, or density of population and other specific impact factors (Neirotti et al. 2014). Towns therefore require stronger guidance in grasping relevant context factors and defining appropriate smart strategies.

2. Ensuring stakeholders' involvement and establishing an innovation community

Cities and towns are entities that can be regarded as an overarching system of stakeholders (Bélissent 2010), while the "citizens and communities are the human engine" (Zygiaris 2013, p. 221). Such entities must ensure the ability to engage constructively with relevant local stakeholders, while also ensuring community participation (Zygiaris 2013). Within an innovation process it is important to understand roles and the dependencies of involved

stakeholders as they constitute a critical factor in smart projects and smart city development (Pierce and Anderson 2017, Stahlbröst et al. 2015). Furthermore, there is a clear need for leadership in terms of orchestrating and monitoring the entire innovation and smart city solution process (Zygiaris 2013). The existence of various stakeholders with competing interests can lead to cancellation of smart projects (Bélissent 2010). Cities, as well as towns, must therefore facilitate a smart vision in holistic terms – specific operations and processes within a city must be synchronized and aligned to its smart vision so as to meet the identified challenges in its given context (Zygiaris 2013). Here, different aspects of collaboration need to be considered (Schaffers et al. 2011). On the one hand, an innovation process for coming up with smart solutions should allow an "ongoing interaction between research, technology and applications development and validation and utilization in practice" (Schaffers et al. 2011, p. 441). On the other hand, it is important to nurture a collaborative approach to foster an innovation ecosystem that is "based on sustainable partnerships among the main stakeholders from business, research, policy and citizen groups" (Schaffers et al. 2011, p. 443). Thus, an integrated approach that connects various facets of a given community becomes even more important (Nam and Pardo 2011). In order to prevent poor innovation results, it is of key importance to identify the relevant stakeholders and the right extent of their incorporation as well as how to establish meaningful collaborations between decision-makers and other actors in smart initiatives (Pierce and Anderson 2017, Tödtling and Trippl 2005). Similarly, Barca et al. (2012) point out that policies should not only be place-based but also people-based, if it is the intention to foster innovative ideas through the interaction of endogenous and exogenous actors and thus the improvement of regional development efforts.

In conclusion, neither a smart city nor a smart town should be considered solely as an object of innovation, but rather as an "innovation ecosystem empowering the collective intelligence and co-creation capabilities of user/citizen communities" (Schaffers et al. 2011, p. 432). Active Involvement from various domains is essential and should be ensured so as to achieve synergy effects (Nam and Pardo 2011). Since towns, as compared to cities, are characterized by smaller sizes, sparser population, and more interlinked relations between citizens and communities, the involvement and incorporation of relevant stakeholders becomes even more vital when implementing smart solutions.

3. Gathering solution information and identifying smart solutions

In general, any smart city concept depends on the correct and meaningful application of ICT and digital technologies to city life (Bélissent 2010; Nam and Pardo 2011). The same applies

for smart towns. Each technological innovation is an important mean to such a smart entity, but not an end in itself (Nam and Pardo 2011). Once the context of the city or town with its individual characteristics, strengths, and weaknesses has been scrutinized and understood, the "smart" dimension becomes key to problem-solving and smart solutions. In this regard, digital technologies and IT infrastructures can be seen as important prerequisites, but, without acute engagement and collaboration of relevant stakeholders, there is no smartness (Nam and Pardo 2011). The common gap and mismatch between technology orientation and actual needs of cities constitutes a major challenge of smart cities (Schaffers et al. 2011). Despite the diverse and individual challenges of cities, smart city solutions emerge rather from a vendor push than a city pull perspective (Bélissent 2010). Tech vendors are pushing their technologies into cities and the public sector, although "for smart city initiatives to be sustainable opportunities, tech vendors must ground their strategies and solutions in the context of the cities and the systems within them" (Bélissent 2010, p. 20). The challenge, then, is to recognize the needs and underlying service provisions. Based on these opportunities, smart solutions of tech vendors have to be aligned with the overall goals and initiatives of smart cities (Bélissent 2010). Nam and Pardo (2011) point out that smart cities can be regarded as a large organic system, which is to say that smart systems and solutions should not operate in isolation but rather as an "organic whole – as a network, as a linked system" in order to make the emerging systems smarter (Nam and Pardo 2011, p. 284). Sustainable smart initiatives call for smart ecosystems that illustrate a smart town as a large organic system. IT should thus facilitate the establishment of new types of innovative environments.

Hence, we argue that with a view to cities and towns, the pure application of scattered digital technologies and partially considered smart solutions does not suffice. Smart towns have to be able to evaluate and monitor the potential benefits of such partial solutions with regard to the bigger picture. The challenge is to assess smart ideas and technologies and to understand which ideas may prove to be most effective in terms of fulfilling the needs of citizens, users or other stakeholders. A smart policy, then, must be designed to provide decision support and reduce uncertainties (Anttiroiko et al. 2014). As rural literature so far takes a strong agricultural focus with respect to digital technologies - although there is promising potential from an overall community and business perspective in towns - this constitutes a major challenge to overcome (Roberts et al. 2017).

III.2.4.2 *Innovation Process*

In the following, we will elaborate on how an innovation process can be designed in order to better leverage the potential of digitalization in smart towns. We thereby include literature on smart cities and transfer findings to towns where reasonable. We draw on the three aforementioned problem-adjusting factors: considering local context factors, ensuring local stakeholders' involvement as well as gathering solution information, and identifying smart solutions. We show how elements from the open innovation paradigm can bring these factors together and provide a suitable solution for smart towns.

Open Innovation in the context of smart towns

Open innovation is an innovation approach that has its origins in industrial innovation management yet has become an essential paradigm of innovation management at large. The term "open innovation" was coined by Chesbrough (2006, p. 2) and defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the market for external use of innovation, respectively". As opposed to traditional innovation management, which has a strong in-house focus, companies that favor open innovation can tap into external sources of ideas to develop new innovative products and services (King and Lakhani 2013). To gain a better understanding of how multifaceted open innovation truly is, Enkel et al. (2009) has deconstructed open innovation into three categories: the outside-in, inside-out, and coupled process.

The outside-in process refers to the use of external knowledge to obtain new sources for innovative ideas. Different innovation practices – such as the integration of customers, customer communities, research institutions, or suppliers – can be applied here in order to increase a company's innovativeness (Chesbrough et al. 2006). In contrast, the inside-out process of open innovation denotes the external exploitation of a company's unused or underused technologies and ideas, e.g., by leveraging these in new markets (cross-industry innovation) (Enkel et al. 2009; Enkel and Heil 2014). The third process, known as the coupled process, comprises collaborative and co-creative activities among different stakeholders and innovation parties in order to jointly leverage innovation, e.g., by the means of collaborative networks or innovation communities (Enkel et al. 2009; West and Bogers 2014). The core processes represent different elements of an open innovation strategy that can vary depending on the concerns of each company.

We argue that, similar to organizations which have to pursue a more open strategy to utilize innovation communities and ecosystems for achieving competitive advantage (Chesbrough

and Appleyard 2007; Rohrbeck et al. 2009), smart towns should likewise follow a new and more open ecosystem approach to increase innovativeness and bring digital innovation to their stakeholders. In the following, we focus on how the different types of open innovation – namely the coupled, outside-in, and the inside-out process – can be understood and used as a means of increasing innovativeness in the context of smart towns.

Coupled Process

When it comes to industrial innovation management, it is crucial that a company is able to select suitable innovation partners with the maximum potential to (co-) create value (Emden et al. 2006). The same applies for smart towns. Whereas companies must be able to develop a specific partner relationship in which they can carefully select external innovation partners in possession of the relevant knowledge (Hosseini et al. 2017), towns have to be able to constructively engage with relevant local stakeholders and ensure community participation (Zygiaris 2013). To jointly leverage innovation, it is essential that towns develop a collaborative approach towards an innovation ecosystem based on sustainable partnerships among relevant stakeholders (Schaffers et al. 2011). Here, the coupled process of open innovation can help to provide an integrated approach and facilitate connectedness as well as knowledge exchange within communities (Nam and Pardo 2011). Smart towns should involve citizens and other local stakeholders as valuable input sources and innovation actors in order to understand the town's unique context and needs, and to subsequently evaluate and derive smart solutions and strategies. As elaborated in Section 4.1, it is of vital importance that smart towns ensure the stakeholders' involvement and the establishment of an innovation community. By ensuring active involvement from various domains of the town, the coupled process can allow the town to act as an overarching system of stakeholders and achieve essential synergy effects among these (Nam and Pardo 2011; Bélissent 2010). By integrating relevant stakeholders into the innovation process, this generally allows them to consider people's (tacit) knowledge regarding need information (Haller et al. 2011; Hippel 2005). In this context, such need information may refer to all types of information regarding preferences, wishes or satisfaction factors of a town's stakeholders.

Outside-In Process

The outside-in process of open innovation generally creates an opportunity to generate and identify external ideas and technologies that might lead to increased innovativeness. Just as companies require open innovation decision-making capabilities and clearly defined roles and responsibilities in order to ensure well-defined procedures in the compilation of open

innovation teams (Hosseini et al. 2017), smart towns require similar capabilities. Such measures can prevent the so called ‘absorptive capacity problem’ (the notion that there are so many ideas that one struggles to manage and select between them) and ‘attention allocation problem’ (the problem that ideas are not seriously taken into account or considered for implementation due to a surfeit of ideas) (Laursen and Salter 2006; Hosseini et al. 2017). In smart towns, there is an equivalent requirement for leadership in terms of orchestrating and monitoring the open innovation and smart solution process (Zygiaris 2013). King and Lakhani (2013) demonstrate how open innovation can be used for both generating and identifying well-suited ideas. By doing so, a smart town can seize valuable solution information which describes (technological) possibilities of how to best address the respective ‘customer’ needs in an effective and efficient manner and thus reduce failure rates and uncertainties (Haller et al. 2011; Hippel 2005). Therefore, the outside-in process of open innovation can serve a smart town in identifying smart solutions and indicating how these solutions need to be aligned with the special requirements of a given town as established by way of the coupled process. By then combining these two elements, smart towns can prevent the common gap between the applied technologies on the one side and the actual needs of towns on the other side. After all, sustainable smart solutions should not emerge from a pure vendor push but rather from a pull perspective driven by the actual needs and requirements of the given city or town (Bélissent 2010).

Inside-Out Process

The inside-out process of open innovation stems from – and has primarily been applied to – more basic research-driven companies such as IBM that try to transfer ideas to the market or sell and license knowledge and technology to the external environment (Enkel et al. 2009). In this sense, open innovation can be used to extend the market for external use of innovation (Chesbrough 2006). More and more companies are trying to improve their innovation performance and enter into new business fields by engaging in open innovation ecosystems. From a company perspective, an innovation ecosystem should be enlarged by including decentralized business units and other external stakeholders from various fields to increase overall innovativeness (Rohrbeck et al. 2009). When this rationale is applied to smart towns, the question arises how they can ensure market expansion and make better use of it for innovation. Efforts must be extended to the improvement of a given town’s capability to attract and advance its own innovation potential. It is substantial for local stakeholders who want to bring digital innovation to towns, such as local administrations, to have profound

knowledge about ICT solutions. Still, it is a matter of common knowledge that at the same time there is a lack of clear understanding on the potential of digital technologies and solution information in towns and rural areas.

Smart (IS-enabled) innovation ecosystems provide assistance as they can ensure basic digital infrastructure and allow for new types of innovative environments. They can empower co-creation capabilities of user, citizen communities and encourage other business entities to develop complements (Ceccagnoli et al. 2012, Schaffers et al. 2011). That is, in the context of the inside-out process, a smart town should create a fertile ecosystem, so that third party producers (e.g., companies, local stakeholders) can develop complements. Towns should open the boundaries of their interaction with different stakeholders, as this will increase the town's overall innovativeness. The best context in which to do so is an open innovation ecosystem that allows ideas to emerge. The shaping and operating of an ecosystem for better co-creation capabilities can be facilitated by appropriate innovation ecosystems (Ceccagnoli et al. 2012). An innovation ecosystem can foster synergy effects, support the alignment of different stakeholders and expand the market for external innovation. That means the town itself does not necessarily have to be the initiator of the innovation, but can provide a general set-up that serves as the basis for further external innovation – a notion which is in line with Schaffers et al. (2011) calling on local administrations and governments of rural and regional environments to provide environments for more democratic innovation. In this sense, innovation ecosystems can be a suitable environment in which to stimulate further innovations by way of smart solutions (Nam and Pardo 2011, Schaffers et al. 2011). Acting and participating in digital innovation ecosystems can benefit in terms of increasing knowledge spillover effects and therefore result in better (co-creation) innovation capabilities as well as overall innovativeness (Ceccagnoli et al. 2014, Schaffers et al. 2011).

Innovation Process Artifact

Referring to Hevner et al. (2004), the innovation process depicted in Figure III.2-2 constitutes our overall artifact. By drawing on primarily two research streams, namely smart city/town and open innovation, challenges and needs are identified from the first (Section 4.1), solutions how to address them from the latter (Section 4.2). In correspondence to Hevner et al. (2004), the problem-adjusting factors are means to identify the "towns' needs" (equivalent to "business needs" in a corporate context). The problem-adjusting factors are derived from literature and serve as input elements that need to be specified when applying the innovation process in order to identify relevant smart solutions for towns. We also draw on open

innovation as our knowledge base to apply and transfer within the context of smart towns. In particular, the outside-in, coupled, and inside-out process of open innovation can be leveraged to address and "operationalize" the problem-adjusting factors.

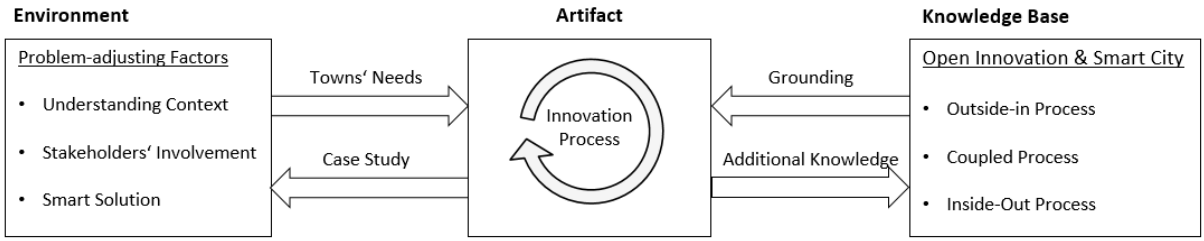

Figure III.2.4-1 *Innovation Process Artifact*

III.2.5 **Evaluation**

To evaluate the proposed open innovation process, while demonstrating its applicability and effectiveness in a real world context, we conduct an exemplary case study (Venable et al. 2012). A case study methodology fits our declared goal of creating a process that is beneficial in real situations and is especially suitable as the major risk is user-oriented (Venable et al. 2016). Furthermore, we have access to real users, a real problem, and a real system (Venable et al. 2012), which is to say we have a valuable opportunity to assess our process under real world conditions.

Case Setting

We apply the innovation process to a small town in southern Germany, a town mainly characterized by its strong dependency on tourism. The case study was conducted in the context of a research project within the scope of a national funded research initiative regarding future/smart cities and towns. The case study lasted for nine months. Afterwards the results of the research project and innovation process were evaluated by an independent expert committee on behalf of the federal ministry of education and research to decide whether the research project will be funded in a second phase to support the town at hand in its transformation towards "smartness" in the digital age.

While the number of inhabitants only amounts to about 5,000 people, the town can record up to a million accommodations per year. Tourism is accountable for about 80 % of the town's full value creation and the sector offers about 1,500 jobs. According to the DEGURBA used by the statistical office of the European Union, the town can be characterized as a rural area with thinly populated areas (Eurostat 2017) having a strong focus on agriculture and tourism. As for the town's demographic structure, about 45 % of the population is older than 50 years,

about 15 % is younger than 18 years, and about 40 % is between 18 and 49 years of age (Bayerisches Landesamt für Statistik 2015).

Role of the Researchers

During the case study, we as the authors of this article, guide and moderate the process scientifically to guarantee a course of action compliant with the proposed innovation process in Section 4. That is, as depicted in Figure III.2-2, to help identifying the town's need with the help of the problem-adjusting factors by drawing on the different open innovation elements. Along the coupled, outside-in, and inside-out process several workshops have been conducted. Within the workshops both individual and (cross-functional) group interviews were conducted to discuss the town's (interim) results and problem-adjusting factors. The group interviews were attended by at least one researcher and allowed to consult with different domain experts, citizens, and tourists. These group interviews provided opportunities for interaction and the development of ideas based on the domain experts' expertise and the other respondents' comments. The researches role was not to operate or dominate the workshops content-wise but rather to moderate and ensure that the open innovation elements and innovation process were conducted correctly and all stakeholders participated in the process.

Coupled Process

As proposed by the innovation process, the first step for successful innovation in smart towns is to understand the specific context of the town in question. It is elementary to engage with relevant stakeholders and ensure communities' participation. In order to achieve connectedness and foster knowledge exchange within the community, we set up an expert panel containing representatives of the community's different sectors. Overall, the expert panel consisted of 12 persons. We aimed to cover diverse roles and responsibilities that are central to the town at hand. When considering the composition of the expert panel we took two aspects into consideration: On the one side, we consulted literature regarding challenges and action fields that are unique to the context of towns (with a touristic focus) (Bundesministerium für Wirtschaft und Energie 2013), and on the other side, we discussed the respective results and the composition of an expert panel with the town's second mayor and tourism director - under the assumption that they can best pre-assess which roles and responsibilities to cover and staff to cater for the pre-identified challenges and action fields. Supplementary, the authors are also part of the expert panel to ensure scientific rigor throughout the innovation process. In particular, the expert panel consisted of the second

mayor of the town, councilman, head of IT administration, tourism director, digital online manager and representatives of the food, retail, and electricity industry, hotel business as well as consultants having long-term project experience with the town and two researches.

In doing so, we enable the town to act as an overarching system of stakeholders and to achieve essential synergy effects attributed to the heterogeneous knowledge. This allows to consider people's tacit knowledge regarding need information. By following the lead user approach (Hippel 1986) and involving lead users in an early phase of innovation projects, better results in cross-functional (innovation) teams can be achieved (Lüthje and Herstatt 2004). As lead users are highly characterized by expertise in their subject area and motivated to provide substantial contributions to the development of an innovation (Lüthje and Herstatt 2004), two decisive factors are taken into account for the selection of the expert panel's members. First, they have to be well accepted and valued for their expertise within their own occupational group. Second, they must have a high affinity to digital technologies, creativity, or at least openness for new solutions. The right selection of panel members plays a crucial role for successful innovations, as creative innovators are of key importance to smart towns (Nam and Pardo 2011).

To guarantee that intended innovations are in line with the overall plan for the town, the second mayor of the town is also part of the expert panel (Schaffers et al. 2011; Zygiaris 2013). This way, the expert panel can ensure that priorities within the innovation process fit the need information regarding preferences, wishes or satisfaction factors of the exemplary town. The strong integration of and exchanges with the expert panel guarantee a better fit of the results according to its advantageousness and feasibility within the town's context.

To obtain need information and to move from assumption to analysis and a better understanding of the town's individual demand, a citizen survey is developed. Subsequently, the members are responsible to ensure participation of respective members of sectors and residents in order to receive representative results. In order to correctly classify the town's challenges, several context variables have been incorporated into the survey. The researches designed the survey as a questionnaire which contains questions regarding the satisfaction with the town's status quo in different domains of life and retrieves some socio-demographic information (Neirotti et al. 2014). To ensure the coverage of relevant domains of life, insights from different studies on the individual demands and characteristics of rural areas are combined (Schlechtriem et al. 2013; Bundesministerium für Wirtschaft und Energie 2013). The questionnaire was discussed within the expert panel. Feedback was incorporated that

helped to further refine the questionnaire to suffice the town's specific context. Here, again, the expert panel provides inside knowledge to further specify the town's individual demands.

As a result, the questionnaire draws on a list of 18 different domains (e.g., mobility, energy supply, quality and quantity of available goods in town, educational offering). Further questions relate to the domains in most urgent need of change and the potential of digital technologies to support such change. This is done to pre-evaluate potential fields of action. The questionnaire also records the participants' expertise in using digital technologies, so as to evaluate their capabilities to predict starting points for digital solutions. A 5-point Likert-Scale (with 5 denoting the best and 1 the worst degree of agreement with the respective question) is applied to enable a quantitative overall estimation of the status quo and the opportunities for improvement for each domain of life. Additional open questions allow for a deeper understanding and explanation of the individual demand.

More than 200 participants replied to this survey, a sample chosen to reflect the town's demographic breakdown. Accordingly, 41 % of participants are older than 50 years, 56 % are between 18 and 49, and 2 % are younger than 18. Wide-spread participation among all walks of local life – from citizens, butchers, bakers, and business people to visitors and tourists – means that the results are representative of the town's population at large and helps to prioritize the most urgent domains for change.

When it comes to the satisfaction of the participants with the status quo within the different domains of life, it is highest with regard to inner-town security (mean 4.59), the safety precautions in the nearby mountains (mean 4.45) and the tourist information offerings (mean 4.12). Lowest satisfaction is stated with a view to educational offerings (mean 3.13), entertainment offers (mean 3.23) and the available variety of goods in town (mean 3.30). The biggest potential – from a quantitative perspective – for change using digital technology is seen within the domains of leisure time (mean 3.49), educational offerings (mean 3.47), and mobility (mean 3.45).

Complementary to the survey, several citizen workshops were conducted to discuss and understand the key issues raised in the questionnaire. Within the expert panel we realized that it was quite difficult for the participants to understand the impact digital technologies might bring along different domains of life. Subsequently, we decided to conduct additional workshops to gain a common understanding and to elaborate on the potential of digitalization. Those workshops were open for all stakeholders, and again the incorporation of the expert panel ensured the participation of at least one person from every stakeholder group. Within

our workshops we conducted both individual and (cross-functional) group interviews to discuss our (interim) results. The group interviews allowed to consult with different domain experts, citizens, and tourists. These group interviews provided opportunities for interaction and the development of ideas based on the results of the citizen survey. All group interviews consisted basically of two parts: The first part addressed the results from the citizen survey that have been prepared and presented by the researchers; in the second part the interviewees discussed the as-is status of the town in order to discuss and derive reasonable implications based on their expertise, research, and expectation about future developments. As a result, strengthening the local retailers was stressed as the domain of upmost importance, as the situation for local shops downtown is getting worse and worse.

Outside-In Process

Within the outside-in process of open innovation, we generate and identify external ideas and technologies to increase innovativeness and identify smart solutions for the town. With the specific needs and challenges as well as the regional and economical background of the town in mind, an innovation contest is set up subsequently. The aim of the innovation contest is to gather solution information on how digital technologies can contribute to improve the situation and overcome the town's specific problems. This contest, too, is open to all groups of the community, which ensures that innovative ideas are applicable to the town and improve its ways of dealing with specific challenges. To this end, we provide a form to be filled out with any innovative ideas and handed in either online or offline. The form consists of two main sections. The first section provides the opportunity to write down the innovative idea, including an extensive description. In the second section, participants are asked to classify their idea according to the domains of life – analogue to the ones from the citizen survey – it supposedly affects. The expert panel orchestrates and monitors the outside-in process, trying to prevent the "absorptive capacity problem" and "attention allocation problem". On completion of the innovation contest, the expert panel examines the submitted ideas and condenses similar ones. Then, the expert panel classifies and prioritizes the ideas in accordance with which domain of life are affected by each idea. The evaluation from the citizen survey serves as basis for evaluating each single idea regarding its relevance. As a result of this consolidation and classification, 27 ideas are identified as the basis for another workshop with citizens and tourists of the town. In order to produce a consensual and broadly accepted innovation plan, together we form a synthesis of need information and solution information. Results of all – citizen survey, workshops, and innovation contest – are

extensively discussed with citizens, tourists, and the expert panel. After all, the communication and collaboration between the different sectors of the community is of utmost importance to guarantee customized solutions and thus avoid "poor innovation results". By drawing on the local knowledge of the expert panel including the town's second mayor, we produce an innovation roadmap that fits the town's overall plan.

Specifically, this final workshop considers four domains for improvement of particular importance: first, "improvement of educational and entertainment offers", second, "improvement of mobility offers and barrier liberty", third, "strengthening of tourism", and fourth, "support of local agricultural products and retail stores". In this regard, we match these action fields with the innovative ideas of the innovation contest. It turns out that many participants emit their ideas of the contest with hope of making a positive impact on these four fields of action. An online marketplace for regional agricultural products, for instance, could expand and ensure a more solid customer base to increase sales volume. Furthermore, a breakfast delivery service for bread and sausages that offers the option to order online would enhance the offer of butchers and bakers. Digital terminals built in the town allow for better advertisement of cultural events and thus improve perception of entertainment offers. Another idea raised in the competition was a smartphone app that guides tourists to available accommodations in line with their individual preferences. Several further ideas promise improvement in one or another action field.

Regarding those results, there are admittedly no ground-breaking innovation ideas. However, it is important to take into account the initial situation within the small town. The introduction of yet well-known digital solutions are a considerable improvement regarding the starting point and local background of the town. The main challenge is rather how to holistically approach and enable the ideas, as the effort required to implement all of those ideas separately would be massive. In this regard, the expert panel agreed that a fundamental ecosystem is missing to enable the identified smart solutions.

Inside-Out Process

The inside-out process of open innovation can help to extend the market for external use of innovation. The results from the coupled and outside-in process have revealed several solutions to meet the specific challenges of the town. However, the realization of each idea in an isolated manner would not be a sustainable approach. Scale effects of an ecosystem would remain unused and tourists and citizens would have to use a bunch of different applications which is not customer-oriented and does not satisfy the users. Hence, efforts must be extended

to the improvement of the town's capability to attract and advance its own innovation potential. A solution is required that can address the most promising ideas in an integrated fashion and at the same time extend the town's environment for further innovation. With respect to Section 4.2, an IS-enabled innovation ecosystem approach was discussed as a well-suited solution. The approach of a scalable innovation ecosystem with an open interface allows for further innovative applications and encourages local stakeholders to develop innovative components. As a result, the concept of an IS-enabled innovation ecosystem includes digital infrastructure, well-established standards, guaranteed data interoperability, open interfaces for ecosystem participants, and privacy by design concepts. Furthermore, it provides a multi-channel user interface (e.g., terminals, website, mobile app), which is highly customizable and enables various use-cases for tourists, citizens, administrations, and local companies. New business models can arise through the interplay between different ecosystem actors such as local hotels, citizens, tourists, and agriculture peasants. Within the expert panel as well as in further citizen workshops, the innovation ecosystem was evaluated positively by all participants and deemed to have been a great help in developing a concept for the town's customized digital solution to its specific demands. As the research project was conducted within the scope of a national funded research initiative regarding smart cities and towns, the innovation process and results were likewise evaluated by an independent committee (experts with respect to the topic at hand) on behalf of the federal ministry of education and research to decide whether the research project will be funded in a second phase to further conceptualize and operationalize the presented results. Within the evaluation process, the federal ministry of education and research puts not only high emphasis on the achieved results from the town's perspective but also on the generalizability, transferability, and relevance of the results with respect to other towns in Germany. As the research project has received further funding to further operationalize the results (six digit € amount), we are confident that the innovation process provides promising first steps towards digital solutions in towns. First steps towards this holistic concept have already been implemented. Besides, the innovation ecosystem constitutes both a highly customizable and generic solution at the same time. Due to its generic characteristics it can be transferred to and applied by other towns. This way, towns can draw on the IS-enabled innovation ecosystem and tailor it by their own applications that fit their specific needs and context.

To conclude, the prototypical application of our innovation process at a small town in southern Germany demonstrates its applicability as well as its effectiveness. We demonstrate how the coupled, outside-in, and inside-out process of open innovation can be used to bring

digital innovation to towns. Furthermore, the concept of an IS-enabled innovation ecosystem illustrates the overall performance of our innovation process.

III.2.6 **Discussion and Conclusion**

It is not sufficient to simply consider the impact of digitalization regarding smart cities, as recent literature has done. Rather, it is crucial to bring intelligent solutions to smart towns, solutions that improve the quality of their citizens' lives. However, it is not enough to apply modern ICT to towns to make them smart. It is a major challenge to bring innovation capabilities to towns in order to make use of their digital potential. As illustrated, known solutions for smart cities will not necessarily suit towns, since they have highly individual characteristics and require a specific innovation process to handle various challenges and specific needs. Hence, an innovation process must take local context, local stakeholders, and smart solutions as problem-adjusting factors into account. Smart towns can use an open innovation approach to identify suitable solutions. Furthermore, innovation ecosystems can support the proposed open innovation process, as they enable digital innovation in smart towns. To demonstrate this, we applied our process to a small town in southern Germany. Results indicate its applicability and effectiveness, and further reveal IS-enabled innovation ecosystems as an enabler of digital innovation.

Our study entails several theoretical and managerial contributions. From a theoretical perspective, our research contributes to the body of knowledge regarding smart towns, specifically how to manage innovation processes and bring digital innovation to rural areas. There are, to the best of our knowledge, no frameworks or guidelines that deal with this issue from an innovation and information systems perspective. We provide a definition of smart towns, three key problem-adjusting factors, and a blueprint of an innovation process. We illustrate how different elements from open innovation, namely the coupled, outside-in, and inside-out process can be used to bring these factors together and provide better guidance for innovation. In this context, we demonstrate how IS-enabled innovation ecosystems can bring innovative capability to towns. Our results supports the call of current research that digital technologies are becoming more and more vital to rural areas and therefore the focus should not merely lie on traditional agricultural perspectives but rather on broader business and community perspectives (Roberts et al. 2017).

From a managerial perspective, our study provides towns with an innovation framework they should have in mind when engaging smart solution initiatives. The research project was conducted within the scope of a national funded research initiative regarding smart cities and towns, and received funding to further conceptualize and operationalize the innovation process and IS-enabled innovation ecosystem since its nature provides generalizability and

transferability to other towns. Practitioners may use the process as a basis for structuring their smart town approaches and the use of information systems to foster specific innovation required in individual towns. This can help to address the urgent need to bring digital innovation to sparsely populated areas by providing a best practice approach that guides local administrations.

Just as all research, our study comes with certain limitations that stimulate further research. Although the proposed innovation process has produced promising results, the innovation process has only been applied in one town so far wherefore the generalizable results are limited. There are no time varying observation or control groups that could allow for a town-specific comparison of innovation outcomes. Additional case studies in future research can provide a better understanding and further insights of our innovation process in towns allowing for benchmarking and more generalizable results. Furthermore, the digital innovation ecosystem has not yet been implemented in its entirety wherefore measurable results in terms of economic potential of innovation outcomes is not possible. Future research to validate the results of our study and evaluate the transferability to other towns is highly recommended. To do so, we plan to expand our study to further towns. We also plan to derive universal design principles as basis for IS-enabled ecosystems in smart towns.

Despite these limitations, we believe that the results of our study constitute an important first step on the journey of bringing digital innovation to towns, and we thus hope to encourage fellow researchers to further explore the digital potential in towns in their own research.

III.2.7 References

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III.3 Research Paper 5: Frank L, Moser F, Mette P (2017) Selecting the Right Open Innovation Approach for Enterprise Mobile Service Innovations – A Descriptive Case Study

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In:	Working Paper

Abstract

Driven by the success of consumer-oriented mobile services, companies increasingly recognize the potential of enterprise mobile services for internal processes as well as to advance B2B and B2C activities. For being able to develop and launch successful mobile enterprise applications, the integration of the mobile service's end-user (e.g., internal staff like mobile sales representatives) or other stakeholders (e.g., students, start-ups) in the sense of an open innovation approach is highly promising. As the original approach of open innovation exclusively focuses on integrating external idea suppliers, the massive potential of internal open innovation stakeholders (e.g., employees outside the innovation department) becomes increasingly relevant especially regarding mobile enterprise applications. To provide preliminary knowledge in the rather new domain of internal open innovation for enterprise mobile services, we applied a single descriptive case study approach in an international company with a strong mobile-driven sales model from the construction industry. We aim at examining whether internal or external open innovation activities are more suitable in the case study's context. The results can serve as a starting point for future methodological papers regarding internal open innovation and to support the successful development and application of enterprise mobile services in sales-oriented business models.

Keywords: *Mobile Life, Enterprise Mobile Services, Open Innovation, Mobile technology use in organizational sales processes, Descriptive case study*

III.3.1 **Introduction**

Since the introduction of the first smartphones the market for mobile services has experienced an ongoing success within the last five years. Accompanied with the tremendous success of smartphone sales, market analysts estimate more than 300 billion mobile app downloads worldwide in 2016 (Gartner, 2012). This development results in an economic potential of more than €115 billion globally and €32 billion in the European Union by 2020 (Oliver, 2009). Whereas the first wave of this enormous success majorly was based on consumer-oriented mobile services, the market for enterprise mobile services still is in its infancy. However, the role of enterprise mobile services like mobile services in internal business processes, business-to-business (B2B) or business-to-customer (B2C) scenarios gains growing attention in the strategic IT-planning of companies (Unhelkar and Murugesan, 2010; Sybase, 2011) due to the nearly unlimited potential of mobile collaboration, mobile-information or mobile-operations (Oliver, 2009). The study's results make clear that innovative mobile services bear the potential for sustainable and valuable economic impact due to new or advanced business models. However, as competition is expected to grow dramatically, some companies are likely to fall behind as they are not able to adequately integrate mobile services in their business processes or cannot develop auspicious enterprise mobile services for the company's internal staff or business partners. The reason for this is oftentimes that companies lack a systematic and long-term oriented strategy regarding the development and utilization of innovative mobile services that fit the needs of a company's internal and external mobile service customers adequately (Sybase, 2011). In order to be able to develop and launch successful mobile services inside the company and for B2B and B2C relationships, the integration of the mobile service's end-user (e.g., internal staff, business partners) or other stakeholders (e.g., students, start-ups) in the idea generation process bears high potential.

One possibility for integrating the mobile service's end-user in the development process is Open Innovation (OI), a management paradigm according to which companies use the purposive inflow of knowledge to accelerate innovation (Chesbrough, 2003). Such an approach allows for quality, speed and market proximity of services which likely are going to generate bottom-line financial impact for the company (Monse and Weyer, 1999). Various literature has shown that integrating external stakeholders like customers, students, or start-ups in the open innovation process leads to products and services that better fit the users' needs (Kleinschmidt and Cooper, 1991; Gruner and Homburg, 2000; Lengnick-Hall, 1996; Patrakosol and Olson, 2007). However, literature also emphasizes possible obstacles or risks

that are associated with OI approaches as external innovation partners might not come up with adequate ideas, do not understand the specifics of the innovation project or, due to opportunistic behavior, even impinge on intellectual property rights by selling their knowledge to competitors (Enkel et al., 2005; Laursen and Salter, 2006). Consequently, as the concept of OI is more and more threatened to become a short-term fashion (Gassmann et al., 2010), research recently puts more emphasis on analyzing both, associated costs, risks and also on expanding the concept by potential new innovation partners (Mette et al., 2013; Reinhardt et al., 2010; Laursen and Salter, 2006; Enkel et al., 2005). One promising approach to avoid a wide range of obstacles associated with the integration of external OI partners is the idea of transferring the classic concept to an internal OI setting as emphasized by Reinhardt et al. (2010). In contrast to external innovation partners, internal innovators (i.e., innovators outside the company's innovation management department but within the company boundaries) share common goals and visions, are highly motivated, know processes, business partners or products and also are less likely to sell company knowledge due to opportunism (Reinhardt et al., 2010).

As the impact or advantageousness of internal OI activities in contrast to classic OI approaches still lacks a well-founded analysis, we apply a descriptive single case study approach for a setting of an international company from the construction industry with a strong sales force-driven business model. Our aim is to examine whether internal or external OI approaches are more suitable to generate innovative ideas for mobile services and which of the two approaches is more beneficial from a cost/benefit perspective. Thus, we can state our two research questions:

Research Question 1: Which open innovation approach (external open innovation vs. internal open innovation) is more suitable to find innovative ideas for enterprise mobile services in a sales force-driven business model?

Research Question 2: Which open innovation activity is the most promising considering its cost/benefit ratio?

The paper is structured as follows: In section 2, we state the problem setting and provide an overview on relevant open innovation and mobile service literature. Subsequently, section 3 analyzes a suitable methodology to measure the effectiveness of internal and external open innovation approaches before we explain our methodology and case study approach in the sense of Yin (2008) in section 4. In section 5, we analyze our results on the basis of an economic scoring model. Section 6 discusses the paper's results, its contribution for research

and practice, methodological and contextual limitations and gives an outlook on future research opportunities in this field.

III.3.2 **Literature review and problem setting**

The integration of customers in the creation and design of new services is part of research discourses since the early 1980s. Von Hippel (1986) quite early presented the concept of integrating lead users as they can provide accurate data on future needs. Other authors emphasize the customers' contribution to the concepts, design, performance testing or validation in the development of new products and services (Silpakit and Fisk, 1985; Kleinschmidt and Cooper, 1991; Lengnick-Hall, 1996; Ulwick, 2002; Gruner and Homburg, 2000). The effectiveness and benefits in form of more customer-oriented products that meet expectations more precisely is stressed by various past and recent research papers and studies (Leonard-Barton and Sinha, 1993; Atuahene-Gima, 1995; Fuchs and Schreier, 2011; Bogers et al., 2010). Next to the benefits, also risks associated with customer integration in innovation processes are examined (Enkel et al., 2005). Turning away from internal and isolated idea creation in the beginning was called "Open Innovation" by Chesbrough (2003). "New information and communication technologies (ICT) have reduced the perceived distances between the actors of the innovation process […]" (Gassmann, 2006) and so allowed for a broader integration of customers. Literature is rich of qualitative case-study research that describes best practices in implementing OI activities within different industries or different kinds of users or integration in different stages of the innovation process. However, authors mostly neglect a company`s employees as a highly attractive group of internal innovators. In line with Reinhardt et al. (2010), we define internal innovators as all employees of the company outside the innovation department. Integrating this group is very auspicious for several reasons. First of all, they are familiar with internal processes which may help identifying room for improvement. Second, some of the employees to be integrated in the innovation process are likely to be part of the eventual target group a mobile service will be developed for. Hence, a mobile service may experience higher acceptance, thus more frequent usage increasing efficiency and empathy within the target group.

Regarding mobile service innovation, discourse on OI virtually is missing at all. As one of the few papers, Platzer (2011) extended the classic Technology Acceptance Model (TAM) and developed a systematic that enables user integration in terms of an OI approach for automated classification of user reviews. This enables a learning environment within mobile service development during the innovation process to increase the probability to develop mobile

services that meet the customers' needs. In the very early stage of mobile services, Aalto et al. (2004) described the prototypical implementation of an OI approach for the development and testing of mobile applications.

Even though prior work has stressed the importance of internal open innovation and incorporation of employees in the sense of an open innovation approach (Reinhardt et al., 2010), so far only few studies analyzed the economic impact of OI. Another aspect that lacks a well-founded analysis in OI literature is the economic ex ante as well as ex post valuation of OI activities. Van de Vrande et al. (van de Vrande et al., 2010) examined a broad range of OI publications within the last decade and found most OI literature to be theoretical and qualitative. Bouwman et al. (2008) stressed the importance and relevance of OI approaches for mobile service models but find that, in opposite to other service models, companies lack experience and best practices regarding the development of innovative mobile services. Though Mette et al. (2013) as one of the few addressed this aspect by determining the optimal investment amount in OI activities for mobile services, they do not analyze a suitable allocation to single OI possibilities. They assume the economic attributes of different OI activities to be equal which in terms of selecting the right OI approach is a major limitation. However, the huge amount of different internal and external OI activities with highly heterogeneous economic attributes and possible results does not allow for an unambiguous judgment and universally applicable recommendations for action. To receive some first indications on this, we set up a case study including *internal as well as external OI activities* that allows for i) a first comparison regarding the OI activities' suitability for idea generation and ii) a cost/benefit evaluation of these approaches. Although the generalization on the basis of these findings is limited due to the nature of the research approach, it builds a first base for further research. As the high number of different OI activities as well as their wide area of application bears complexity that could not be grasped in a single study, in our approach, we limited ourselves to the area of mobile service development considering three different OI activities. Thus in the following, mobile services are considered exclusively, but the findings might be transferable to other applications.

III.3.3 **Research Method**

As stated above, we found that in contrast to external OI, only a small amount of research articles focusses on the benefits of *internal OI activities*. Benbasat et al. (1987) stated that in areas where no or only little research has been conducted before, case studies are an appropriate research methodology to build the basis for further research. A case study is

defined as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2008). Particularly in the context of IS research, the case study is a popular research method for many different subject-matters (Fischbach et al., 2009; Sarker et al., 2012; Williams and Karahanna, 2013). Yin (2008) in this vein states that the case study method fits best i) to determine "how" or "why" questions, ii) in a setting where "the investigator has little control over events" and iii) the investigation of the phenomenon is to be made within a real-life context. *Internal OI* – in contrast to external OI – is a rather unexplored research area where we have "…to identify the appropriate causal links to be analyzed" (Yin, 2008). Furthermore, the development of mobile services which aims at supporting mobile sales representatives in the field has to be studied in its "real-world context" (Yin, 2011). Hence, a case study approach is justifiable and also suitable to answer the stated research questions. In the setup of the case study, we followed the guidelines of Yin (2008) including the following six steps: **i)** "plan", **ii)** "design", **iii)** "prepare", **iv)** "collect", **v)** "analyze", **vi)** "share". Also, we aimed at setting up the case study with respect to the rigor criteria (internal validity, construct validity, external validity, and reliability) which often appear in the field of case study research (e.g. Gibbert et al., 2008). Thereby, *internal validity*, i.e., causal relationship between variables and results without influence by other factors with a certain significance as a research framework is described in sections 4 and 5. However, as our case study is a first approach in the field of internal OI activities in the context of enterprise mobile services, strong internal validity (e.g., measured by significance tests) and generalizable results cannot be derived. *Construct validity*, which refers to the extent to which a study examines what it claims to examine, i.e., the suitability of the procedure to reach an accurate observation of reality is given by our extensive data collection in a real world setting as described in paragraph 3.1. Though our single case study approach does not fulfil all requirements to satisfy the criterion of *external validity*, the case study company's market position and its partly transferable direct-sales-business model can be a valid starting point as our case study also contains different investigations within one organization (i.e., in analogy to a nested approach) as claimed by Yin (2008). The last criterion, *reliability*, which demands for transparency and the possibility of replication is given through the fact that our case study was fully recorded (partly in audio, completely written protocols) and so allows for a retrieval for later investigators. In the following, we will go through the remaining steps in detail and explain how we conducted our research according to the aforementioned guidelines.

III.3.3.1 *Planning and designing the case*

In the planning phase of the case study, we had to choose a company that conducts different OI activities in an innovative environment. Therefore, we found a company of the construction industry aiming at identifying mobile service innovations to support mobile sales representatives. The company of our case study globally develops, produces, and markets tools for industries like building, construction or maintenance. It distributes its products via a direct sales model with a worldwide number of ~10,000 mobile sales representatives which account for ~70% of annual sales, an online shop (~20% of annual sales) and professional shops (~10% of annual sales). On a basis of more than nine million customer base entries, two of three employees have daily customer contact leading to more than 200,000 customer contacts, more than 50,000 sales orders and 150,000 order item entries per day across all channels. To increase productivity of the mobile sales representatives which each visiting about 10-15 customers daily by car, the company aims at putting emphasis on their support with mobile services. Today, the mobile sales representatives in their daily routine are supported by a smartphone and a laptop. The laptop's main functionality thereby is the web-based customer relationship management (CRM) software for order entries, schedule and customer visit planning and documentation as well as customer data update. In addition, the smartphone currently is mainly used for calling customers, colleagues, and the service management. However, the company has already developed and launched a mobile service for the smartphone which allows to synchronize the CRM day planner with the customer contact and schedule details with the smartphone calendar. Thus, the mobile sales representatives do not have to open the laptop to see appointment details but can use their smartphone and synchronize details like the address with the car's navigation system. Due to the enormous success of this mobile service which has decreased the time for daily schedule planning by about 40%, *the company now aims at developing more enterprise mobile services for the mobile sales representatives' smartphones* to leverage the functionalities of modern devices in the daily sales routine. To find new ideas for innovative mobile services which can support the mobile sales representatives within their daily routines, *the company has launched both internal and external OI activities*. In the following, we first go into detail how the data was collected before we analyze and evaluate the outcomes to answer the research questions.

III.3.3.2 *Preparing and collecting data*

The company used two internal OI activities and one external OI activity: The first internal OI activity were field rides with the mobile sales representatives (i.e., sales and advisory process

observation in the field accompanied with interviews). The second internal OI activity was an online survey along a representative set of mobile sales representatives of one business region (Southern Germany). The external OI activity was a worldwide innovation competition which addressed students worldwide.

III.3.3.2.1. *OI activity 1 – Mobile sales representatives field rides*

As the method of lead user interviews is a well-accepted open innovation activity (Zogaj and Bretschneider, 2012), the company initiated nine interviews with mobile sales representatives who were considered technology-affine lead users of the company's mobile services. To inspire creativity and allow additional observations, the interviews were not conducted in a one-on-one dialogue situation, but before, during, and after a typical day of a mobile sales representative in the headquarters, in the car, on construction sites, and in customer offices. Each lead user interview consisted of indirect observations as well as a semi-structured and questionnaire-based interview. The questions of the semi-structured interviews were developed by members of the company's innovation management section, market research as well as experts from the global sales force (which used to be mobile sales representatives before). As observers and interviewers, one of the company's innovation managers as well as one of the OI project team accompanied each field ride. The results of each lead user interview were transcribed, processed and exchanged between the project team members to improve future lead user interviews as well as to set the basis for the online survey across the mobile sales representatives.

III.3.3.2.2. *Description of OI activity 2 - Mobile sales representatives online survey*

The second OI activity was a structured online survey which aimed at collecting ideas for enterprise mobile services from a wider range of mobile sales representatives. The benefits of surveys with potential users of a service or product are well accepted within OI literature (Zogaj and Bretschneider, 2012). Besides general questions like "Which parts of a typical customer visit do you document and how could a mobile service support this documentation or lead to increased documentation?", technology-specific questions were part of the survey, e.g. "Imagine how augmented reality could support your activities regarding the advice as well as sales processes?". In order to ensure that mobile sales representatives were able to understand the benefits and identify possible application areas of the technologies, a text box with a brief description of the technologies was added to the survey. Additionally, open answers were used to collect further ideas. All in all, the online survey consisted of 34 questions and was sent to 97 mobile sales representatives lead users who covered the company's most important industries in a representative business region (Southern Germany).

67 completely filled out surveys could be analyzed (average time of completion: 42 minutes) which included various ideas as well as proposals for improvements regarding the existing sales process, the pilot mobile service and the study itself. Also a wide range of participants allowed the OI project team to contact them for a follow-up telephone interview to specify certain ideas.

III.3.3.2.3. *Description of OI activity 3 – Innovation competition*

In addition to the internal OI activities, the company conducted an external innovation competition. Students worldwide from all disciplines where called to participate in the competition and submit innovative ideas for mobile services which may help to improve the company's sales service, customer care, and other sales processes. Therefore, the company provided a comprehensive overview of its business model in general and certain sales processes on a website. On this basis, prospective participants of the innovation competition where asked to submit concept papers, movies, or prototypes of enterprise mobile service ideas to the company. Over the period of three months, extensive effort was taken to promote the innovation competition on websites, social networks, and by several e-mail campaigns. Moreover, participants had the opportunity to contact an expert team of the company in case of questions. Before the given submission deadline, 27 contributions from 70 participants of 14 different countries were submitted. The competition received fairly high attention in North America and Asia, whereas participation from Europe was rather weak. Out of the 27 submissions, the company selected the best 11 and invited the participants to an onsite workshop at the company headquarter to further develop their ideas.

III.3.4 Economic evaluation of Open Innovation approaches

In order to ensure internal validity in the form of a rigor research framework that measures the interrelation between input variables (e.g., number of ideas) and outcome variables (i.e., effectiveness of OI activity), an economic evaluation of the outcomes is important. Though OI activities aim at generating innovative and completely new mobile services, outcomes in terms of idea's quantity and quality may differ when applying different OI activities. Since the revenue generated by new ideas for mobile services is unknown at the time an OI activity is initiated, an ex-ante evaluation must be accomplished to estimate the quality of the ideas with regard to its impact on customer satisfaction and, consequently, revenue (Mittal et al., 2005; Faems et al., 2010). Since no reliable data is available, a structured and quantitative comparison of the quality of different OI activities can be accomplished with a scoring model. However, an estimation of revenue increases induced by mobile services requires a profound

understanding of the service market, a service's technical features and a successful prognosis of future, uncertain cash flows. As this had to be conducted for every enterprise mobile service idea, an ex-ante financial estimation in this case was not a promising opportunity to evaluate the suitability of internal and external OI activities. However, since OI can be a key success driver for increasing customer satisfaction (Peppers and Rogers, 2001) and thus is directly linked to revenue (Mittal et al., 2005; Faems et al., 2010; Mette et al., 2013), estimating the impact of OI activities on customer satisfaction is a reasonable approach to evaluate the quality of an OI activity on an economic basis. Following Kano et al. (1984), customer satisfaction is determined through the (over)-fulfillment of customer expectations in must-be attributes, one-dimensional attributes and attractive attributes. Thus, a proper valuation approach could be designed as a scoring model, which addresses the determinants of customer satisfaction to reach a realistic estimation of ideas' quality and, in the end, an OI activity's economic value. Besides the quality of ideas induced by an OI activity, the investment amount necessary to conduct the respective OI activity is decisive. Consequently, scoring values indicating the economic value of an OI activity must be compared to the respective costs.

III.3.5 **Analysis and sharing of results**

The last step of our study is the analysis of the collected data. Since the OI activities were completed quite recently and the subsequent decision process and development cycles are not finished by now, no service innovation results can be observed on the market yet. However, in order to enable a first evaluation of the ideas and to provide the opportunity to prioritize them, the company set up an expert team and developed an economic scoring model to evaluate idea quality. The judging team consisted of company managers from IT, Corporate Innovation Management, Global Market Reach and members from an external research institute. The economic scoring model analyzes the three conducted OI activities on the basis of the quality and quantity regarding ideas which originated from them on the one hand and the associated cost on the other.

III.3.5.1 *Evaluation of OI activities*

In a first step, mobile service innovation ideas which, according to the expert team's opinion, only had a very small probability of being realized, were removed from the idea selection. Also, the expert team removed ideas for which the market already offered mobile services at low-cost or even free. Moreover, all ideas with relevance for only a minority of the

company's employees, customers or processes were removed. In a second step, each idea has been evaluated with a scoring model on the basis of the following criteria:

- **Excitement factor** describing the potential to create excitement among the users (i.e. "wow-effect")
- **Connection to company products** depicting the idea's proximity to the company's core businesses
- **Ease of implementation** is an estimate of the technical feasibility and/or the implementation effort respectively

For the design of the scoring model, the company was inspired by the previously mentioned work of Kano et al. (1984). Especially Kano's *attractive attributes* are captured by the excitement factor, as customers do not expect them and are positively surprised if a product shows a "wow-effect". The expert team used a 5-scale Likert scheme to evaluate the ideas with 1 being the lowest possible value and 5 the best. The scoring values for each mobile service idea are results of the expert teams' discussions and experience from previous mobile service developments (e.g., download rates of previous mobile services from the company internal mobile service store). It is obvious that these values are subjective and also estimates which cannot be validated yet. However, the company uses the results of this scoring model as a basis to derive investment decisions for implementation projects. Thus, the scoring model results cannot be assumed to be ultimate truth but are serving as one of several important informational inputs for decision making.

The company conducted 9 mobile sales representatives (MSR) field rides (i.e., sales process observations with interviews) (OI.1) resulting in an overall amount of 9 generated mobile service ideas. The mobile sales representatives (MSR) online survey (OI.2) generated the double amount of ideas from 67 participants, whereas the innovation competition generated a total of 27 ideas from 70 participants. After the pre-selection process, 7 ideas of OI.1 (77.8%), 13 ideas of OI.2 (72.2%) remained in the selection and only 5 submissions from the innovation competition (18.5%). Consequently, the idea-per-participant-ratio dropped after evaluation step 1 to 0.78 (OI.1), 0.19 (OI.2), and 0.07 (OI.3). All remaining ideas were evaluated according to the four scoring model criteria mentioned above. Ideas obtained from the internal OI activities OI.1 and OI.2 received higher scoring values for the excitement potential on average. The connection to the company category is also lead by an internal OI activity (OI.2 with 4.46), followed by the external innovation competition (4.20) and, lagging

behind, the field rides (3.12). Ideas obtained from OI.3 are typically hardest to implement (2.4), whereas internally generated ideas can be implemented easier (2.67 and 3.08). To evaluate the idea quality of the OI activities, a company needs to weight the values of the three criteria in a way that depicts the company's goals with an enterprise mobile service (i.e., one company might emphasize the excitement potential whereas another stresses the importance of the ease of implementation). In the case study, the company weighted all three criteria equally and thus aggregated the weighted value of the three average scoring values of each OI activity to one average overall value. In this vein, the MSR online survey was found to be the OI activity with the best average overall rating (3.53), followed by the external innovation competition (3.20) and the sales process observations with interviews (3.04). The results are summarized in table III.3-1.

	Internal OI		**External** OI
	Personal	Impersonal	
	OI.1: MSR field rides	**OI.2:** MSR online survey	**OI.3:** Innovation competition
Number of participants	9	67	70
Number of created ideas	9	18	27
Ideas per participant	1	0.27	0.39
Evaluation step 1			
Number of ideas in final selection (%)	7 (77.8%)	13 (72.2%)	5 (18.5%)
Ideas in final selection per participant	0.78	0.19	0.07
Evaluation step 2			
Average excitement potential of ideas in final selection	3.33	3.08	3.00
Average connection to company (products) of ideas in final selection	3.12	4.46	4.20
Average ease of implementation of ideas in final selection	2.67	3.08	2.40
Average overall value of ideas in	3.04	3.53	3.20

final selection			

Table III.3.5-1 *Key figures and valuation results of conducted OI activities*

Based on the aggregate values of this case study, an unambiguous judgment regarding the suitability of external and internal OI activities cannot be made. However, the results of this valuation can serve as a starting point or contribution to develop hypothesis which can be tested empirically in subsequent research. Nevertheless, the internal OI activities of this case deliver ideas with higher excitement potential than the ideas from external sources. Moreover, these ideas are easier to implement on the average. One explanation for this observation might be that the employees of the innovating company are more familiar with the business processes and, by experience, possible and practicable improvement potentials. Another interesting observation is the fact that the MSR field rides (OI.1) as an internal OI activity resulted in ideas with lower average connection to company (products) (3.12) than the ideas from the external OI activity innovation competition (4.20). This result is counterintuitive in the first place as one might expect the mobile sales representatives to have more ideas which are closely connected to their daily business as the ideas from external students which do not know the company so well. This is closely linked to another conclusion that can be drawn when distinguishing between impersonal OI activities, where the company communicated with the innovators via an online survey site (OI.2) or mail (OI.3) and activities which were conducted in personal encounters (OI.1). Thus, it becomes visible that OI.1 basing on personal encounters creates the most exciting ideas, though these are not closely connected to the company's business. One explanation might be that participants in personal encounters are more likely to think beyond company barriers and bring up ideas which have a revolutionary character or are completely apart from the company's core business than when addressed through impersonal communication.

In order to reach a reasonable economic valuation, idea quality and quantity have to be compared to the costs associated with conducting the respective OI activity (estimated on the basis of internal accounting numbers, and transfer prices). The results are summarized in table III.3-2 and described in the following.

	Internal OI		**External** OI
	Personal	Impersonal	
	OI.1: MSR field rides	**OI.2:** MSR online survey	**OI.3:** Innovation competition

Cost in monetary units (mu)	12,500	16,250	121,000
Costs in mu per idea in final selection	1,786	1,250	24,200

Table III.3.5-2 *Cost-benefit comparison of conducted OI activities*

Sales process observation and interviews (OI.1) resulted in an overall amount of payouts of 12,500 mu, the online survey (OI.2) was at 16,250 mu and the innovation competition resulted in a disproportionately higher amount of 121,000 mu. With regard to idea quantity, one mobile service innovation idea was discovered at costs of 1,786 mu with sales process observation and interviews (OI.1), 1,250 mu when discovered through the online survey (OI.2) and 24,200 mu with the external innovation competition (OI.3). Based on a cost-benefit comparison, ideas with the highest overall quality ranking were created at lowest cost by the online surveys. The personal interviews resulted in a higher cost-per-idea-ratio, but revealed, as mentioned before, the ideas with the highest average excitement potential though without close connection to the company's core business. The innovation competition was extraordinarily expensive compared to the quality and quantity of identified ideas. Nevertheless, its positive impact with regard to company image or recruiting of student talents relativize the high payouts for the company.

III.3.5.2 *Evaluation of mobile service technologies*

As of our second research question, we want to focus on the technological rational underlying the identified mobile service ideas. For this reason, we analyzed which mobile device technologies build the technological basis for each idea. In doing so, we are able to derive information on which technological innovations are most likely to create over-fulfillment of customer expectations and, hence, customer satisfaction.

In this connection, we found mobile service ideas relying on the ability of mobile devices to process Global Positioning System (GPS) data as most often enabling technological rational (9 identified service ideas base on GPS). Close to GPS technology, Radio Frequency Identification (RFID) and Near Field Communication (NFC) were found to be important technological drivers enabling machine to machine communication of mobile devices (5 identified service ideas base on RFID or NFC). Camera-based mobile services build the basis for 6 identified mobile services ideas, and the technological capability to exchange information in social company networks within the company or with customers builds the basis for 4 identified service ideas. On the contrary, Augmented Reality or speech/text recognition are no technological enablers of identified ideas. Reasons for this might be that

these technologies are not common on today's service market yet and that these technologies are either not known or their benefit in mobile services cannot be identified, yet. Hence, a company's IT Innovation department within its innovation activities regarding internal OI activities is well-advised to consider the employee's lack of knowledge regarding very new technologies though providing a short description. Table III.3-3 summarizes the number of mentions for the technologies.

Technology	No. of Mentions
Global Positioning System (GPS)	9
Radio Frequency Identification (RFID)	5
Near Field Communication (NFC)	5
Camera-based mobile services	5
Connection to social networks (within or outside the company)	4

Table III.3.5-3 *Innovative technologies which underlie the mobile service innovation ideas*

The qualitative feedback of the performed OI activities illustrate that information technology is not only seen as an enabler of over-fulfillment of expectations and customer satisfaction but also a possible threat in case of malfunctions. The participants of the OI activities complained several times that mobile service and data connectivity are not sufficiently stable for convenient usage of mobile services. This is especially valid for the case company's business model since its mobile sales representatives usually meet their customers on the jobsite, i.e. in basements, large factories or in very remote areas. Furthermore, it was remarked that mobile sales representatives use their mobile devices usually together with their hands-free car kit. When connected to the car kit, some devices then do not allow to use mobile services at all, which reduces the opportunity to realize the possible benefits that an innovative service may bring. In the end, some users still struggle with the stability of their mobile devices itself, which is quite surprising in a time where mobile devices are considered to be rather a commodity than a technological masterpiece. Thus, mobile services are no universal remedy, but bring risks and success obstacles itself. Table III.3-4 summarizes a small selection of qualitative feedback that reflects the case study participant's opinion.

No.	Qualitative Feedback of mobile sales representatives regarding the internal OI activities OI.1 and OI.2
1	'Very interesting. I like the intensity our company is considering this topic'
2	'I like the fact that we are being involved'
3	'You should not try to replace the personal relationship of customers and MSR with technique'
4	'It is important to ask for opinions in the field'

Table III.3.5-4 *Selection of mobile sales representative's qualitative feedback*

III.3.6 Discussion of results and limitations, conclusion and implications for research and practice

To develop and launch successful mobile enterprise applications, the integration of the mobile service's end-user or other stakeholders in the idea generation process bears high potential. One possibility for such an integration is Open Innovation (OI), a concept which experienced a tremendous attention in research and practice within the last decade (Gassmann et al., 2005). However, as the original approach of OI exclusively focused on the integration of external idea suppliers (Chesbrough, 2003), the massive potential of *internal OI stakeholders* becomes increasingly relevant especially in the context of using mobile enterprise applications. This is due to the fact that internal employees often know their processes better than typical external OI stakeholders like students or start-ups (Reinhardt et al., 2010). To broaden the knowledge about the benefits of *internal OI activities*, we applied a single descriptive case study approach to build the basis for further research. This paper aims at providing preliminary knowledge about the benefits of OI activities in a company and especially emphasizes the differentiation between *internal and external* OI activities. Thus, it aims at examining whether internal or external OI activities are more suitable to find innovative ideas for enterprise mobile services in the context of a sales-force-driven business model.

Within our case study, two different internal types of OI activities (field rides with mobile sales representatives, web survey across mobile sales representatives) have been compared with one external OI activity (idea competition). The results of all OI activities (number of idea, type of idea, cost of activity) which were performed to identify innovative mobile enterprise applications were evaluated by an expert team. Within this evaluation, the different OI activities have been evaluated with regard to the number of ideas, quality of ideas, and cost/idea ratio. Moreover, the identified ideas with regard to their technological drivers enabling the respective mobile service innovation have been analyzed. Technologies like GPS, RFID/NFC and video camera build the basis for a large group of identified mobile service innovations. On the contrary, technologies like Augmented Reality and speech/text recognition are not among the technological drivers of the identified service innovations.

Due to the descriptive nature of this single case study, direct managerial implications cannot be given. Instead, we provide a careful interpretation of the results to indicate steps for further action.

- *Internal and external OI activities differ in quality and quantity of resulting ideas*. One difference is that in this case study, the internal OI activities delivered ideas with a higher excitement potential than the ideas from external sources. Moreover, ideas from internal OI activities on average are easier to implement. One explanation for this observation might be that the employees of the innovating company are more familiar with the business processes and, by experience, possible and practicable improvement potentials.
- *Counterintuitively, the MSR field rides (OI.1) as an internal OI activity brought up ideas with lower average connection to company than the ideas from the external OI activity innovation competition*. Naturally, one would expect the mobile sales representatives to have more ideas which are closely connected to their daily business than students from outside the company.
- *When distinguishing between impersonal OI activities and activities which were conducted in personal encounters*, it becomes visible that personal encounters create the most exciting ideas which are not closely connected to the company's business. One explanation might be that participants are more likely to think beyond company barriers and bring up ideas which have a revolutionary character or are completely apart from the company's core business in personal encounters than through impersonal communication. Thus, a combination of personal and impersonal, technology-based and technology-supported OI activities seems meaningful to derive good results in terms of idea quality and quantity.
- Regarding the *cost-benefit comparison*, internal OI activities in this case study had a better cost-benefit ratio, i.e., ideas were created at lower costs compared to an external OI activity (like a student competition). Focusing on the internal OI activities, personal interviews resulted in a higher cost-per-idea-ratio but also came up with ideas that had the highest average excitement potential
- The current state of knowledge regarding modern technologies seems to be of major importance for the success of internal OI activities. Modern technologies like Augmented Reality or speech/text recognition were not identified as technological enabler of innovative mobile services even though they might be the basis of radical ideas within nearer future. These technologies are not common on today's service market yet and the interviewed employees either do not know these technologies or cannot identify ideas how to use them in mobile services. Thus, participants should be

informed about new technologies, e.g. in the course of the OI activity itself. Since this can be achieved in personal encounter easier than through standardized surveys, innovative service ideas on the basis of newest technologies can be identified better with OI activities based on personal encounter.

Though leading to first valuable findings and first propositions for deriving hypothesis in subsequent research regarding the application of OI in the development of innovative enterprise mobile services, this case study has some limitations which might open up promising research opportunities for future work in this area.

- Limited generalizability of results: The findings of single case studies are not universally valid and can only be conferred to similar companies with similar micro- and macrostructure.
- Also, our single case study approach and the lack of previous results form case studies or empirical work regarding causal relationships in the application of internal OI does not allow for testing the significance of our results yet.
- The selection of OI participants is limited to one geographical area (Southern Germany) and this might hinder a generalization to other business regions.
- As it is the case for a wide range of case study or interview-based research, the behavior of the mobile sales representatives might have been influenced by the presence of the interviewers.
- Though the evaluation of the enterprise mobile service ideas was conducted by an expert team with in-depth knowledge, the valuation results are still subjective estimations without empirical validation.

Despite the paper's limitations, the results from this work deliver first insights in the areas of internal OI as well as the development of innovative mobile enterprise applications. Thus, it can serve as a starting point for future methodological papers regarding internal OI as well as studies which aim at supporting successful development and application of enterprise mobile services which very likely are experiencing an enormous success within the next decade. As the application of internal as well as external OI as studied in this single case study yet is a relatively unstructured phenomenon where only very little quantitative analysis exist, our paper is an appropriate tool to contribute to research *"[…] in the critical, early phases of a new management theory, when key variables and their relationships are being explored"* (Gibbert et al., 2008; Eisenhardt, 1989; Yin, 2008).

III.3.7 **References**

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III.4 Research Paper 6: Frank L, Gimpel H, Schmidt M, Schoch M (2017) Emergent User Roles of a Digital Workplace: A Network Analysis Based on Trace Data

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Abstract

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

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

III.4.1 **Introduction**

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

Therefore, the aim of this paper is to derive a user typology from the informal social structure of a digital communication and collaboration environment in an organization, in order to understand the heterogeneous user behavior as well as the emergent roles that knowledge workers take on, and to investigate why they do so. The latter is necessary to draw specific

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

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

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

III.4.2 **Problem Context and Literature Review**

III.4.2.1 *Knowledge Creation and Social Structures*

According to the knowledge-based theory of the firm, knowledge is the primary resource of an organization (Grant 1996) and a superior knowledge base increases the value of an organization and its performance (Kogut 2000). Yet, despite the importance of knowledge, organizations often do not know what they know, because their body of knowledge is

comprised of the knowledge of individual employees as well as shared knowledge resulting from social interactions within the organization (Alavi and Leidner 2001). The fact that knowledge is mostly owned by employees places great emphasis on knowledge application and the role of the individual (Grant 1996). For knowledge workers, it is critical to know how and from whom to obtain the valuable information required to do their jobs (Cross et al. 2002). Congruent with that, a trend towards networked organizations and an emphasis on social networks of employees is noticeable. The social interactions inherent in such networks are a manifestation of the structural dimension of social capital and are related to the extent of resource exchange within an organization (Tsai and Ghoshal 1998). It is well studied that social contacts help the members of intrafirm networks to maintain and extend their social capital within the organization (Steinfield et al. 2008). Communication and collaboration tools of the digital workplace can foster interactions, in particular between employees who are on different hierarchical levels (Behrendt et al. 2015), or who have no formal social relations between one another (Faraj et al. 2011; Kane et al. 2014). This in turn helps employees to increase their access to the network and to gain social capital. Therefore, and to study organizational networks, an investigation of the implicit social structure that emerges from those interactions between the users of the digital workplace seems promising. While this is an important step towards understanding an organization's knowledge capability, little empirical research exists in that area (Richter et al. 2010). In relation to the implicit social structure, the existence of emergent roles is a particularly interesting topic in order to improve the understanding of user behavior. Emergent roles are roles that users take on implicitly and as a result of their interactions with others. In self-organizing collaboration communities such as Wikipedia, emergent roles are a cornerstone of the knowledge-creation process (Arazy et al. 2016). However, it remains unclear whether these emergent roles can also be observed for organizational settings.

III.4.2.2 *The Digital Workplace for Knowledge Workers*

Many jobs in modern organizations require extensive amounts of knowledge work (Kane et al. 2012). Thus, we are particularly interested in the digital workplace of the so-called knowledge workers. Knowledge workers are characterized as employees who "think for a living" (Davenport 2005, p. 3) and turn "complex information […] into knowledge" (Davenport 2005, p. 3). Davenport further sharpens the definition of knowledge workers, as people that "have high degrees of expertise, education or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge" (Davenport 2005, p.10). Köffer (2015, p. 2) introduced the digital workplace based on C. Tubb as "the

collection of all digital tools provided by an organization to allow employees to do their jobs". As a first step to investigating the digital workplace for knowledge workers, it is important to understand and define the different software tools available to them. Generally speaking, there are software tools which are driven by structured and reproducible business processes rather than human interactions (van der Aalst et al. 2011), and those which foster open digital interactions between employees (Wang and Noe 2010). Examples for process-driven tools are enterprise resource planning or workflow management systems. These systems are not well-suited for the identification of an implicit social structure between employees because they follow pre-defined processes and often do not leave room for spontaneous personal interactions. Without the set perimeters of pre-defined business processes, however, an implicit social structure can emerge freely. We classify such software tools congruently with McAfee (2006) as communication channels and collaboration platforms. Communication channels include peer to peer communication tools, such as email or instant messaging, and cannot be accessed or searched by others (McAfee 2006). Collaboration platforms, such as content management systems, wikis, and blogs, by comparison, are accessible to many or all employees within the organization and the knowledge stored in them is persistent (McAfee 2006). Both of those systems foster digital interactions between employees, and therefore represent how people go about their daily business and who they interact with digitally.

III.4.2.3 *Related Work on User Roles*

Recently, the existence and formation of emergent roles of knowledge workers has caught the interest of researchers. Multiple current studies have identified communication and collaboration use cases including *Broadcasting, Dialog, Collaboration, Knowledge Management,* and *Sociability* (Schlagwein and Hu 2016; Schubert and Glitsch 2016). While these use cases provide a detailed outline of the functionality and capabilities of such a software environment, the authors do not attribute the use cases to specific user roles. Regarding email communication, there are a number of studies that have looked into network structures (e.g. Bird et al. 2006; Kane et al. 2012; van Alstyne and Zhang 2003), but surprisingly little research has addressed user roles. Among the notable exceptions are Alavi and Leidner (2001), who defined that in a digital environment, knowledge flows from a *Provider* to a *Seeker*, and that balancing the two is desirable. Muller et al. (2010) used real-world data to investigate the consuming behaviors of *Uploaders, Contributors*, and *Lurkers* within an enterprise file-sharing system. Reinhardt et al. (2011) created a general typology of knowledge worker roles based on a literature review. Subsequently, they verified the

existence of *Controllers, Helpers, Learners, Linkers, Networkers, Organizers, Retrievers, Sharers, Solvers,* and *Trackers* through a laboratory task execution study. Their paper provides a comprehensive overview of knowledge worker roles and their behaviors, but lacks a validation based on real-world data. In contrast to that, other authors have looked at real-world data of ESN to investigate the influence of formal hierarchy on user behavior (Behrendt et al. 2015; Riemer et al. 2015). Behrendt et al. (2015) found that in ESN, the hierarchy seems to have an influence on user behavior. Riemer et al. (2015), on the other hand, found that while hierarchy has a low influence on the likelihood of responses from the network, the users' own contributions are far more important. Those findings further substantiate the relevance of informal social structures in the context of ESN. However, it remains unclear how significant the influence of formal hierarchy on emergent roles is. A study by Arazy et al. (2016) employed a SNA to identify seven emergent roles within the self-organizing collaboration platform Wikipedia. In their study, they found *All-round Contributors, Quick-and-Dirty Editors, Copy Editors, Content Shapers, Layout Shapers, Watchdogs,* and *Vandals.* A similar exploratory study by Füller et al. (2014) investigates the heterogeneous user behavior and the social structure of a collaborative open-innovation-contest community based on real-world data. In their study, they found six distinct user roles*: Socializers, (active and passive) Idea-Generators, Masters, Efficient Contributors*, and *Passive Commentators.* While their research approach is conducive to our goal of identifying user roles in a digital workplace, it is questionable whether their results can be directly transferred to the organizational context.

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

III.4.3 **Empirical Study**

To address the identified research gap, we use a mixed method approach (Venkatesh et al. 2013), which combines aspects of previous studies by identifying user roles in an exploratory

fashion, analyzing potential influencing factors quantitatively, and interviewing users qualitatively to better understand the reasons for why employees act the way they do.

III.4.3.1 *Research Setting and Data Set*

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

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

For our study, the digital trace data was pseudonymized by the organization's system administrator to address privacy concerns (e.g. Herzog et al. 2015; Köffer 2015; Pawlowski et al. 2014; Wang and Noe 2010). This ensures the identification of communication and

collaboration patterns but prevents the researchers from knowing about the content, or from identifying individual employees (van Alstyne and Zhang 2003). Both the Exchange and SharePoint logs contain only internal communication and collaboration, but do not include recipients or users outside of the organization. To identify characteristics of users, who perform a certain role, we were provided with the user-specific binary attributes *gender*, *site* (differentiating between the company's two sites), and *length of employment* (split into "long" and "short" according to the median), as well as the *position in the organizational hierarchy* (distinguishing between five hierarchical levels). The selection of the attributes and their granularity was chosen in such a way, that each combination of attributes matched multiple (or no) employees of the organization, but never a single one.

III.4.3.2 *Social Network Analysis and Interaction Patterns*

We use the tools of SNA as a basis to study the heterogeneous user behaviors and derive different user roles from the resulting social structure. SNA is ideally suited to study the actors of a given social system (Wasserman and Faust 1994) and has been used in social sciences for many decades (Borgatti et al. 2009). With metrics drawn from the social structure, actors can be distinguished, potentially resulting in new insights into user roles (Arazy et al. 2016; Füller et al. 2014). The foundation of many SNA concepts, such as *centrality* and other actor-related measures, is graph theory (e.g. Füller et al. 2014; Wasserman and Faust 1994). The relational structure of a social system consists of patterns of relationships among the actors of the system. Network data is fundamentally dyadic, meaning that ties are observed for a set of two actors at a time (Borgatti and Foster 2003). The sum of those actors and the ties amongst them form a social network (Wasserman and Faust 1994). Such an approach focuses on the patterns of interconnection but tends to neglect the content of the network ties between the actors (Borgatti et al. 2009). It is based on the idea that an actor's position in a network influences their opportunities and constraints (Kane et al. 2014). This approach is conducive to our pseudonymized data set which contains communication and collaboration patterns but not their contents.

SNA typically considers one or more of the following basic tie types: proximity (co-membership in groups, such as departments), relations (social relationships, such as friendship), interactions (discrete exchanges between nodes, such as a conversation), and flows (tangible or intangible material that moves from one node to another, such as information) (Borgatti et al. 2009; Kane et al. 2014). While flows are important, because "information flows drive knowledge transfer in organizations" (Alavi and Leidner 2001, p. 119), they are often difficult to measure. Consequently, and congruent with previous IS

research regarding IT platforms and channels, we focus primarily on interactions (Kane et al. 2014). To understand the differences between our two IT systems, it is important to differentiate between the channel, which "pushes" information, and the platform, which requires users to "pull" information. For the push-medium email communication (i.e. Exchange), the sender initiates an interaction by sending an email. For the pull-medium content collaboration (i.e. SharePoint), however, the sender provides content to the IT system and the retriever accesses this content, resulting in an interaction.

The application of SNA in IS has long focused on single links, which contrasts multiplex approaches common in the social sciences (Howison et al. 2011). In our case, interactions can cover several distinct forms of communication or collaboration between two users. We define the following four possible dyadic interaction patterns that can be observed within the given data set, as presented in Figure III.4-1:

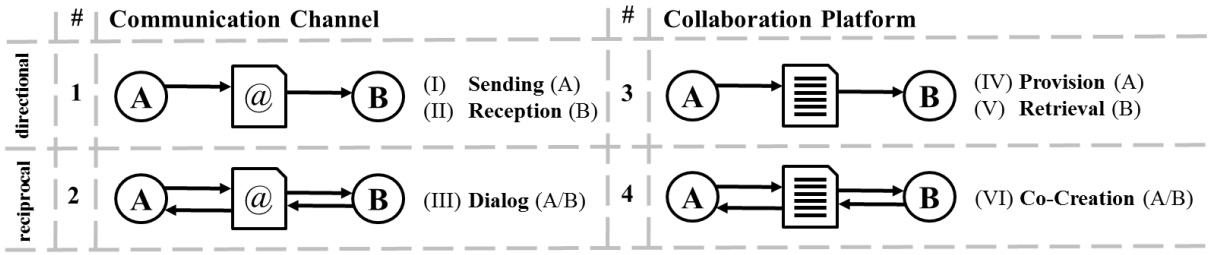

Figure III.4.3-1 *Interaction Patterns*

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

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

III.4.4 **Analysis and Results**

III.4.4.1 *User Typology*

To construct a social network from the log files, the defined interaction patterns were first mined from our digital trace data set. We find that the average number of colleagues a user is connected to through content collaboration is substantially lower than via email communication (10.6 and 8.9 for collaboration vs. 55.7 and 78.3 for communication). A deeper examination of the ties' intensity, which refers to the number of files or email subjects they have interacted on, reveals that users, who are connected, have on average approximately four bilateral and five unilateral communication ties (i.e. communicate on four email subjects in a discussion and on five subjects one-sidedly), but only three collaboration ties (i.e. collaborate on three files). In the social network, the overall number of interactions (weighted with their intensity) for the two directions of unilateral network ties (email sending/reception and content provision/retrieval, respectively) is identical, and therefore, the means are too. Median and standard deviation can differ depending on the directionality. For example, a single user can send emails to multiple recipients, which results in a more even distribution for email reception than for email sending. The mean number of sending and reception ties, however, stays the same. The descriptive statistics on the frequency of interactions (table III.4-1) show that more users are connected through communication ties (means of 271 and 297.4) than through collaboration ties (means of 33.2 and 23.2). The heterogeneous standard deviations substantiate the assumption that users behave differently from one another. A large standard deviation for the email sending measure (327.5 compared to 185.2 for email reception), for example, suggests that a limited number of users are responsible for the majority of the unilateral communication. However, due to the skewness of some of the data, the standard deviation has to be taken with a grain of salt.

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

Observations: n = 146 , SD = standard deviation

Table III.4.4-1 *Descriptive Statistics on the Frequency of Interactions*

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

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

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

From our cluster analysis, we conclude the following typology: of the eight distinct user types, there are three that use both the communication channel and the collaboration platform roughly to the same extent. These clusters are labeled *All-rounders* with *low*, *mid*, and *high activity*. Four of the clusters are labeled according to a peak in one or more of six clustering dimensions. Two user types with peaks in communication interactions (Email heavy-users and broadcasters) were observed and two user types with peaks in collaboration interactions

(Content co-creators and providers). Lastly, a user group that remains largely passive on both systems was identified. An overview of all clusters is provided in table III.4-2.

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

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

Table III.4.4-2 *User Typology with Corresponding Means and Standard Deviations (SD) of the Different Interaction Types*

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

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

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

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

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

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

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

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

III.4.4.2 *Covariates of Role Membership*

To investigate the association between our categorical explanatory variables and the eight user types, we first examine the contingency tables illustrating the relative frequency distributions (Agresti 2007). We then apply a chi-squared-test for independence to determine whether there is a significant difference between the expected and observed frequencies. To deal with small cell values for rare user types, we simulate the associated p-values through a Monte Carlo Simulation (Adery 1968). First, we study the relationship of the identified user roles and the organizational hierarchy. Organizational hierarchy is a factor that has been mentioned frequently in literature regarding user behavior in the context of digital communication (Behrendt et al. 2015; Riemer et al. 2015). We observe a strong relation between the identified user roles and the position in the organizational hierarchy (table III.4-3). The association between the two variables is highly significant ($p<0.01$) with a chi-squared test statistic of $X^2 = 184.81$. We find that Heads of Departments and Heads of Support Functions tend to be heavy email-users, as observed in 50% of the cases. These users

communicate heavily via email, but tend to use the collaboration platform to a substantially lesser extent. Assistants to a Head of the Department, conversely, mainly belong to the *All-rounder High-Activity* category. This user type is similarly involved in email communication than heavy email-users, but also engages heavily in collaborative activity, resulting in a more balanced usage of the collaboration platform and the communication channel. The full-time employees who don't hold a leadership role, are widely spread across the different user types, with a peak at *Content Co-Creators* and A*ll-rounders of Low- and Mid-Activity.* This shows that in our study regular full-time employees are generally less involved in email communication than their superiors. However, about one third of the full-time employees are heavily involved in collaborative activities, in particular content co-creation with other colleagues. This is an observation that will be subject to further qualitative investigation in the following section. Part-time employees are mostly *Passive Users*. This user type receives more emails than it sends and has a very low engagement on the collaboration platform. The rest of the part-time employees are mainly *All-rounders of Low-Activity.*

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

Table III.4.4-3 *Contingency Table for User Role and Organizational Hierarchy*

In general, the organizational hierarchy does not fully explain all user types, but the different hierarchical levels show (more or less) clear tendencies towards a specific user type. To get a better picture of the factors related to the cluster membership, we proceed to analyze three additional potential covariates. First, regarding the organization's two different *sites,* we find a significant difference to the expected frequencies across all roles ($p<0.10$). According to a column-wise chi-squared test for goodness-of-fit, this is mainly due to the clusters All-rounder High and Mid-Activity, as well as due to the Email Broadcaster and Content Provider. For All-rounders High-Activity, the cause may be a higher number of Assistants to

Head of Departments that are located at site A - the organization's oldest branch. Broadcasting and Content Provision activities might possibly be related to a high number of shared services, which are located at site A. Second, we examine the association between *gender* and emergent roles and do not find significant differences across our clusters ($p=0.58$). Previous studies regarding knowledge management have found significant influence of gender diversity on knowledge sharing (Wang and Noe 2010). Third, regarding the *length of employment* we find a highly significant association ($p<0.01$). We observe that Email Heavy-Users and All-rounders of High and Mid-Activity are more likely to have been with the company for a long time, while passive users have been with the company for only a short time significantly more often. However, both of those observations are correlated with the organizational hierarchy, as superiors tend to have been a part of the organization for a longer period of time than part-time employees in this organization.

III.4.5 **User Interviews**

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

III.4.5.1 *Intended Behavior and Use Cases*

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

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

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

III.4.5.2 *Addressing the Quantitative Findings*

In the second stage, we asked the interviewees to address our quantitative findings and to provide explanations as to why the observed patterns may exist. For that, they were shown versions of figure III.4-1, and table III.4-2 and III.4-3 before being asked questions such as: "We observed that Assistants to a Head of Department are more heavily involved in content collaboration than other employees. Judging from your experience and interaction with them, is this a plausible observation and if so, why do you think they are?"

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

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

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

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

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

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

III.4.5.3 *Meta-findings*

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

We found that part-time employees use the communication channel and the collaboration platform less frequently than full-time employees. However, task-specific exceptions, such as Content Providers, or Email Broadcasters are possible. In the user role Content Provider, part-time employees do not necessarily create new knowledge, but document existing tacit

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

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

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

Table III.4.5-1 *Meta-Findings - User Roles with Quantitative and Qualitative Factors*

III.4.6 **Discussion**

III.4.6.1 *Theoretical Implications*

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

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

A large part of the users in our study are all-rounders, which is congruent with a study by Arazy et al. (2016), who investigated emergent user roles in the open collaboration platform Wikipedia. For example, in our study, the majority of Assistants to the Heads of Departments – who are middle managers – are High-Activity All-rounders characterized by high levels of communication and collaboration activities. The organizational knowledge creation theory (Nonaka et al. 2006) can provide an explanation for this observation. It has, amongst other things, dealt with the role of leadership in knowledge management. According to Nonaka et

al. (2006), top level managers communicate and coordinate visions about knowledge throughout the organization. Congruent with that, we find that Heads of Departments and Support Functions – who are top managers – are heavily involved in email communication and not so much in collaborative activities such as content provision or co-creation. For reasons of cost and time, not all knowledge can be shared (Nonaka et al. 2006). This is particularly the case for people high up in the hierarchy whose time is particularly precious. According to our interviews, this might be a reason for why Heads of Departments and Support Functions tend to create less tangible content through the collaboration platform and use asynchronous and verbal communication more frequently. Middle managers, on the other hand, bring the visions of top managers into concepts and facilitate organizational knowledge creation by synthesizing knowledge of front line employees as well as of their top managers and help make it explicit (Nonaka et al. 2006). These users are described in our user interviews as employees who gather information and reshape it to suit the needs of their superiors. In that sense, their behavior also resembles that of Linkers who "mash up information from different sources to generate new information", as found in a study by Reinhardt et al. (2011).

Contrary to previous studies which hypothesized and found Retrievers, Learners or Seekers (Alavi and Leidner 2001; Reinhardt et al. 2011), we do not find a user group that has peaks in content retrieval in our real-world data set. While many of the identified user types rely heavily on content retrieval, they also convert that information into tangible content to a similar extent. Because our study is based on social network data, we only consider content that was modified within the six-week observation period. It remains unclear whether the absence of Retrievers might be influenced by that restriction. However, it seems reasonable that employees do not look for information simply for the sake of knowing it, but that they do something with the obtained information. This then results in more balanced user types, which according to Alavi and Leidner (2001) is desirable, at least on an aggregated organizational level.

Several previous studies regarding digital social structures report about a dense network core and a large periphery of rather passive users (e.g. Füller et al. 2014; Muller et al. 2010). We, too found a passive user type, however, we are uncertain whether this is due to the uncommon organizational structure with many part-time employees or if it is a phenomenon that can generally be observed for employees with operative tasks. Congruent with our observation, and within a different organization, Behrendt et al. (2015) found that lower hierarchical levels

are less active in ESN. In their study, the lowest hierarchical levels barely participate in ESN at all, average hierarchical levels have the most social relationships, middle managers communicate actively, and top managers reach many users at once. In our study, some part-time employees pointed out, that their lack of digital communication and collaboration might be due to a higher level of personal interactions in their open-plan offices. However, the effect of such personal interactions on digital interactions are not considered in our quantitative analysis.

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

III.4.6.2 *Managerial Implications*

Our contributions, can be used to help practitioners with addressing *six* of the practical challenges for collaborative work in the digital workplace, which Köffer (2015) extracted through a literature review. First and most generally, we show a way to *monitor general work behaviors (1)* through digital trace data with our study. While privacy issues might limit the usefulness of such an analysis in an organizational context, our approach does provide a way to investigate how communication and collaboration systems are being used on an organizational level. This might help organizations to assess the overall adoption rates and identify areas for improvement. It could also be interesting for platform owners, who can study which features – if defined as interaction types – are being used by which user groups. Second, Maruping and Magni (2015) report that with the diversity of work practices, no *one size fits all* strategy regarding the incorporation of collaboration technology can be pursued. With our typology of user roles, we provide guidance for practitioners to *segment employees (2)*, not only regarding their collaboration behavior, but also regarding their communication requirements (Cameron and Webster 2013). Third, through identifying different user types in our study, we also help organizations to better understand user needs based on which they can *provide support and training (3)*, tailored to the individual needs of their employees. As

mentioned in Section 3, for data privacy reasons it would be challenging for organizations to recreate this analysis in order to identify individual employees, however, in our analysis of covariates of cluster membership, as well as our qualitative interviews, we described the user types and their characteristics in depth. This might help organizations to target entire homogeneous groups of knowledge workers with their support or training efforts, rather than individual users. Fourth, and connected to the previous point, through the identification of Passive Users, employees with a small number of ties can be encouraged to interact with others (Zhang and Venkatesh 2013), which in turn helps to *enable social interactions (4)*. Fifth, by getting a better idea of the communication and collaboration requirements of each hierarchical level, practitioners are also supported to more adequately *consider individual characteristics (5)*, such as digital skills and experience in their hiring or promotion decisions. For example, the 9% of full-time employees that reside in the High-activity All-rounder cluster and the Email Heavy-Users cluster might be candidates for a more communication-heavy job in management. Last, top management support is often cited as a critical success factor for the adoption of new software tools and for a positive knowledge sharing culture (e.g. Wang and Noe 2010). We found that middle managers are particularly engaged in communication and collaboration as per their job requirements, which might make them better advocates to *demonstrate leadership* (6) on novel (social) collaboration platforms or ESN.

III.4.7 Limitations and Future Research

Our study has a number of limitations and leaves room for further research. While our data set is taken from an organization that is well-suited to study knowledge workers in the digital workplace, it only represents a small sample of knowledge workers. Additionally, we only capture white-collar knowledge workers with our study, therefore our results cannot necessarily be generalized to other knowledge workers, such as healthcare practitioners or engineers. Also, while many of the user types found in this study overlap with those identified in previous studies in other settings, we cannot say with certainty that these user types are also inherent in the social structure of other organizations. Therefore, further research based on different data sets is necessary to validate the generalizability of our findings. Likewise, we follow an “eye of the beholder” clustering approach, which leans heavily on the interpretation of the identified clusters. While we provided extensive qualitative details to support our selected clustering solution, this remains an explorative approach which, again, needs to be validated in future research contributions. The maturity of the software usage within the

organizations and personal IT skills could be considered to draw comparisons between organizations. A problem that is frequently mentioned in the context of SNA based on digital trace data is that by definition it only considers social interactions within the software environment. For example, it neglects undocumented face-to-face interactions and interactions through other software tools (Wang and Noe 2010). Howison et al. (2011) caution not to over-interpret the number of digital events between employees, because the intensity and content of the interactions is unknown. Yet, researchers could define more distinct interaction patterns for future work, to distinguish further between user types. For example, Gleave et al. (2009) present different ego-networks and hypothesize that their shapes can give hints about the roles of actors. Additionally, for privacy reasons our analysis neglects the content of the interactions and the actual information flows transmitted through them. *Hashing* and *speech acts* have been used in the past to allow for an automatic analysis while maintaining the anonymity of the data (Carvalho and Cohen 2005; van Alstyne and Zhang 2003) and could be applied to this context as well. Another interesting question for further research is whether the employees keep or change their user roles over time. And if they change, what external factors cause those role changes. Researchers in the context of Wikipedia have found a turbulent stability of emergent roles, which describes the phenomenon that individual user roles may change, but the overall composition remains the same (Arazy et al. 2016).

III.4.8 **Conclusion**

In this study, we addressed the need to gain a better understanding of the heterogeneous behaviors of knowledge workers within their digital workplace in an organization. The importance of this question is rooted in the understanding that one size fits all solutions regarding the incorporation of such software into the diverse work practices are not adequate. Therefore, and to improve our knowledge of how these work practices differ, we set out to identify emergent user roles of a communication and collaboration environment. This endeavor is rooted in the knowledge-based theory of the firm and social capital theory, as well as in a fragmented body of research on the digital workplace and user roles in digital communication and collaboration environments. As a result of a cluster analysis, we found eight distinct user roles. In contrast to other studies in different contexts, we found that the presence of organizational roles can help explain many behavioral differences through factors such as the organizational hierarchy and the individual job requirements of the users. Those findings are routed in a quantitative analysis of influencing factors and qualitative user interviews. We observe that, congruent with the organizational knowledge creation theory,

top managers are heavily involved in communication, while middle managers bridge the gap between top managers and employees by turning visions into tangible content. For user types that distribute information and provide content, we observed usage patterns that can be explained through an in-role understanding of knowledge sharing. Similarly, for employees who are heavily involved in tasks that require team work, a tendency towards co-creation of content with colleagues was observed. Lastly, and congruent with the positive effects of social connections on social capital, we argue that outliers can potentially be hidden leaders and candidates for promotions. With our approach, we contribute to the scientific progress in the field and support practical implications of communication and collaboration in the digital workplace. Future research should refine our interaction types and validate our findings with different data sets, particularly through but not limited to longitudinal designs.

III.4.9 **References**

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IV Results and Future Research

This chapter summarizes the key findings of the doctoral thesis (Section IV.1) and presents an outlook on future research areas (Section IV.2).

IV.1 Results

The main objective of this doctoral thesis was to contribute to the fields of BPM and innovation management by particularly focusing on vital aspects for successful innovations in the digital age trough a BPM lens. After emphasizing the importance of an efficient and effective innovation management against the backdrop of rapid changing customer expectations and rising competitive pressure on prices, the dependencies between an organization's profitability, customer satisfaction and business process design were analyzed in detail and guidelines for decision makers were presented (Chapter II). Building on these insights, the focus of the doctoral thesis was set on the examination of innovation management from a BPM point of view. In this, the opportunities for process innovations enabled by technological innovations were considered on the one hand. On the other hand, several leverage points for an improvement of the innovation process were identified and analyzed. For that reason, the doctoral thesis deals with the innovation process itself, as well as the applied methods and the deployed human resources during the innovation process (Chapter III).

Subsequently, the key results of the research papers being contained in this doctoral thesis are presented. Finally, Section IV.2 carves out opportunities for further research.

IV.1.1 Results of Chapter II: Customer-centric process design – Setting the prerequisites for profitable processes and innovations

The focus of chapter II was on the challenge of how to profitably design customer facing business processes against the backdrop of rapidly changing customer expectations and increasing market transparency coming along with and increased competitive pressure on the prices of products and services. Therefore, an analytical framework was developed, that helps to understand the dependencies and effects of different process design alternatives on customer satisfaction and business value. On the basis of this framework, concrete strategic guidance for business process design decisions of customer facing business processes was given (Section II.1). With the ongoing digitalization, customers do not only expect organizations to provide services offline, but additionally to provide them online. Yet an online provision of services is not reasonable in any case, as often the contribution of the service to the overall customer experience is inferior compared with the risks that come along with an online provision. Therefore section II.2 provides a four-step decision framework that helps to decide on which channels services should be provided.

- In Section II.1, a quantitative framework was developed in P1 to shed light on the coherences of an organization's profit, customer satisfaction and the decision on business process designs. Within the analysis we found an experience-efficiency trade-off on the one hand, as process designs aiming at high customer satisfaction are not necessarily efficient and vice versa. On the other hand, a risk trade-off according to the output quality of the process exists. Ensuring high quality of the process output causes costly process control and therefore increases the price of products and services, which contradicts the desire for low prices by the customer. At the same time, missing quality control leads to high variance in process outputs and therefore to customer dissatisfaction. Thus, the risk trade-off occurs. To approach these trade-offs, we combined knowledge from CRM and BPM within the framework. The transfer of the customer satisfaction model by Kano (1984) to business processes suggested a classification of processes into the three types basic, performance and excitement processes. Within the framework, from the customer perspective sensitivity towards fulfillment of their expectations as well as the customer's classification of the process within the three process types were determining variables. From a BPM point of view, the variance of the current process efficiency and current fulfillment are decisive. Based on that, we worked out the following strategic guidelines for process design :

a) *Basic processes* should be designed in a way that ensures little variance in process output, in any case. Depending on the actual state of fulfillments, explorative design is preferable until a basic level of fulfillment is reached to avoid customer dissatisfaction. Once this basic level of fulfillment is reached, basic processes should be designed exploitative.

b) *Excitement processes* should always be designed in a way that accepts higher variance of the process output, as there exists only upside- and no downside-risk due to the fact that excitement processes cannot dissatisfy customers. Regarding the experience-efficiency trade-off, exploitative design is favorable as long as there is no chance to reach moderate or high fulfillments. As soon as moderate or high fulfillments can be reached, explorative process designs are proposed to profit from a disproportionate increase of customer satisfaction.

c) *Performance processes* as the last type of processes should be designed with focus on little variance of the process output. In contrast to excitement and basic processes, in addition the decision on the design of performance processes is dependent on the customers' sensitivity towards fulfillment. For "easy" customers that do not react heavily on fulfillments, exploitative designs are favorable, whereas for "demanding" customers, explorative process designs should be preferred.

- In the subsequent Section II.2, in P2 the design of customer facing business processes was further investigated in a holistic manner. The developed four-step decision framework based on the findings of P1 enables practitioners to decide on the on- and offline provision of processes and how provided processes should be designed respectively. Therefore, the (digital) customer experience as an overarching construct comprising all direct and indirect, actual and historical experiences with an organization was established. The first finding, which is derived as a direct consequence of this holistic view, is the inseparability of the digital and the non-digital customer experience. Thus, organizations need to consider their online and offline offerings as a whole. Secondly, organizations should only offer services on a certain channel, if the provision either excites the customer, or if the provision is seen as indispensable by the customer. Lastly, the decision on process designs has to be done in a continuous process, to consider the rapid changes in customer demands and the

opportunities given by technological innovations. Thus, P2 provides a contribution for practitioners by guiding them in their decision on their on- and offline offerings.

IV.1.2 Results of Chapter III: Successfully managing innovations by considering innovation management through a BPM lens

Chapter III dealt with the efficient innovation of processes as well as with an effective innovation process. In this, several aspects that are crucial for successful innovations were investigated. Whereas Section III.1 came up with heuristics that enable process innovations driven by new technical opportunities, in Section III.2 special attention was drawn to the innovation process itself. Section III.3 scrutinized different OI approaches to provide guidance in the choice of the right approach, before Section III.4 further investigated ways to identify human resources that should be incorporated into the innovation process.

- In Section III.1, we provided 17 process redesign heuristics in P3 that help organizations to foster process innovation. In this context, we defined heuristics as an abstraction of thought patterns from real-world examples which foster new ways of thinking in a structured way and which thus can be seen as a kind of mental shortcut to further explore the solution space. The 17 process redesign heuristics were derived from 90 innovative start-ups within the digitalization context which we grouped into the following six meta-heuristics according to their basic idea: 1) Make Smart Use of Your Data, 2) Offer a Platform, 3) Profile Your Customer, 4) Design Digital Processes, 5) Become Proactive and, 6) Innovate Your Customer Relationship. Within the chosen sample of startups, saturation was reached with the derived 17 heuristics. The 17 heuristics contained in the six meta-heuristics help organizations to foster process innovation by guiding the idea generation without excessively restricting the individual creativity of the innovators. The benefit of those heuristics was tested within an experiment with two separated test groups that were asked to generate ideas for process innovations based on a real-world case description. One group was introduced to the heuristics, whereas the other group had to rely on traditional brainstorming. We found that the heuristics group generated 59% more ideas for process improvements than the brainstorming group. Furthermore an evaluation by practitioners who were asked to rate a) the excitement potential, b) the economic potential, c) the connection to existing business and, d) the ease of implementation indicates a benefit of the heuristics. According to the rating, ideas by the heuristics group were on average superior within the categories a), b) and c). Only in the

category ease of implementation the heuristics group was inferior to the brainstorming group. Although further investigation and empirical validation is needed to confirm those findings, the results of P3 indicate that practitioners can improve their process innovations by applying the provided redesign heuristics.

- In Section III.2, P4 provided a customized innovation process for smart towns which helps to reduce the likelihood of innovation failures and fosters the application of digital innovations to overcome town specific challenges. Based on an extensive literature analysis, we found that the use of digital technologies in the context of cities is frequently discussed under the umbrella term "smart city". However, literature lacks concepts for the application of digital technologies within towns and we found evidence that the developed concepts of smart cities do not necessarily fit to towns and rural areas. To address this shortcoming, we developed an innovation process that enables smart digital solutions for towns. To hold for specific challenges and characteristics of a town, we identified and incorporated three problem-adjusting factors within the process: a) considering local context, b) ensuring local stakeholder's involvement, and c) gathering solution information. We show how the combination of OI elements such as the outside-in, the inside-out and the coupled process can bring those problem adjusting factors together and provide customized solutions for smart towns. To show the applicability and effectivity of the proposed process, we conducted the innovation process within a town in southern Germany. We found the incorporation of stakeholders in the form of an expert panel suitable, as the incorporation of lead users in a coupled process helps to assess tacit knowledge regarding need information. Furthermore, the discussion of town specific challenges within the expert panel, with challenges being partly derived from literature, partly from citizen surveys, guaranteed a better fit of the results to the town's context. After the identification and discussion of the town's biggest challenges, a subsequent innovation contest, as part of the outside-in process, was conducted to increase innovativeness and identify smart digital solutions for the town. Again, the involvement of the expert panel ensured the fit of the solution to the town's needs. Finally, we showed that an inside-out process can enhance the innovation capabilities of a town, as the provision of a digital innovation ecosystem allowed for the use of scale effects and the developed digital solutions can complement each other to form higher value for the user. In the case of the exemplary town, an operating system that comprises several applications such as a digital local market place and a digital hiking

map was seen as a suitable solutions to address some of the most urging problems of the town like the "strengthening of tourism" and the "support of local agricultural products and retail stores". Accordingly, P4 contributes to smart town literature by providing an innovation process that enables a reasonable application of digital technologies to overcome major challenges of towns and rural areas.

- Narrowing the view from the whole innovation process to the "ideation" phase as the first phase of the generic innovation process by Dreiling and Recker (2013), P5 in Section III.3 addresses the choice of OI approaches for enterprise mobile service innovations. Therefore we conducted a comparison of three different OI approaches – namely "field rides", "online survey across mobile sales representatives" and "innovation competition" – within a descriptive single case study. Although, single case studies lack generalizability, they are suitable to get first insights into so far rather unexplored research in order to identify causal links and provide a base for further investigation. To cover a broad range of existing OI approaches, we considered internal OI approaches that purely address innovators within the own organization, but outside the R&D department, as well as approaches that additionally incorporate external innovators in our study. Focusing on quantitative measures, the external OI approach of an "innovation competition" generated the highest number of ideas, followed by the online survey and the field rides. Incorporating costs, the online survey emerges as the OI approach with the lowest costs per idea rate, followed by field rides and the innovation competition. To additionally take the quality of the generated ideas into account, we asked an expert team for a valuation of the ideas regarding the three criteria "excitement factor", "connection to company's products" and "ease of implementation". For this valuation an economic scoring model was applied to compare outcomes regarding quality and quantity of the ideas. According to this scoring model, in our case the internal OI approaches field rides and online survey lead to higher excitement potential of the ideas and their implementation is easier with simultaneously causing lower costs per idea. This economic advantage of internal OI in our case is even higher for OI activities with personal interaction (field rides) than the impersonal internal OI approach of an online survey. Even though generalizability of these results is not given due to a missing empirical validation of the results, P5 contributes to OI literature by giving first insights into the benefits of various OI approaches including an economic evaluation. These findings can form a starting point for the development of hypotheses that can be tested empirically in future research.

Furthermore, the case study can serve as a first indication for innovation managers to support them in their decision for an OI approach that fits to their aims.

- In Section III.4, P6 sheds light on the opportunity to analyze the collaboration and communication network of a digital workplace, to observe the communication and collaboration behavior of employees. This knowledge on the communication and collaboration behavior provides a valuable indication for the orchestration of powerful teams according to their capabilities. Thus, in P6 we conducted a SNA based on digital trace data, which built the base for an exploratory cluster analysis. As a result of this cluster analysis, eight distinct user roles were identified according to their communication and collaboration behavior. We found three types of all-rounders that use email communication and collaborate on content in an average proportion. These three all-rounder types can be distinguished according to the intensity of their activities into high-activity, mid-activity and low-activity. Furthermore, we found email heavy users, email broadcasters, content co-creators, content providers and passive users. The emergent user roles could partly be explained by several categorical explanatory variables such as the organizational hierarchy or length of employment. Accordingly, employees in leading positions are either email heavy users or high-activity all-rounders, whereas roles such as content co-creator or content provider are most commonly part-time or full-time employees. To enrich those quantitative insights, we conducted qualitative interviews with employees of the investigated organization on different hierarchical levels to get further explanations for the behavior of different employees. According to the interviews, roles such as the email broadcaster could have been explained as task-specific. Within the study, it was shown, that many user roles could have been explained by the organizational structure. Besides, some users were filtered that do not fit the role specific behavior. This way, e.g. hidden leaders can be identified. From a theoretical perspective, the study enriches literature by combining data from collaboration and communication systems in an integrated way. From a practical perspective, six of the challenges in the digital workplace emphasized by Köffer (2015) can be addressed with this study. The general work behavior of employees can be monitored (1) and a segmentation (2) can be conducted regarding their communication and collaboration behavior. Accordingly, individual support and training (3) can be provided and social interactions (4) of passive employees can be encouraged. Furthermore, the provided digital infrastructure can be better adjusted to individual characteristics and needs (5). Last, the challenge of

demonstrating leadership (6) within the use of innovative collaboration platforms and ESN, according to the study can be addressed best by the middle management. In connection to innovation management, these insights may help to identify and compose powerful and innovative teams.

IV.1.3 **Conclusion**

Summing up, the results of the research papers presented in Chapter II and III of this doctoral thesis contribute to literature in two ways. First, by providing a deep understanding on the strategic dimension of business process designs. Second, by investigating promising approaches within the area of innovation management by focusing on process improvement through technical innovations on the one side and vital aspects for an improvement of the innovation process on the other side.

IV.2 Future Research

Subsequently, potential aspects for future research are highlighted for the respective chapters of this doctoral thesis.

IV.2.1 Future Research in Chapter II: Customer-centric process design – Setting the prerequisites for profitable processes and innovations

P1, which provides strategic guidance for business process design activities to master the efficiency-experience trade-off and the risk trade-off has limitations that have to be addressed in future research:

- Up to now, the framework is restricted to customer-facing business processes, which are generally known as core processes (Dumas et al. 2013). Thus the framework is not applicable to a vast amount of processes within organizations such as management and support processes due to a missing quantification of the impact of those processes on customer satisfaction. However, support and management processes are an absolute precondition for an accurate procedure of core processes. Accordingly, future research should address this shortcoming by setting up a framework that allows a quantification of the impact of support and management processes on customer satisfaction.
- Based on the analysis of the framework, general guidelines were derived that suggest either the investment in process exploration until a saturation of fulfillment of customer expectations is achieved or the exploitation of the process as soon as a basic degree of fulfillment is reached. Due to a missing empirical investigation of those boundaries, validated values for those boundaries are missing. Although the presence of those boundaries was shown analytically, concrete values are indispensable for a real world application of the framework.
- The framework only supports decision on the strategic direction of business redesign activities, but does not guide organizations in their implementation and evaluation. Accordingly, research should investigate paths, to implement those strategic guidelines within an organization.

Although P2 constitutes a first attempt to provide a comprising operationalization for decisions on the digital and non-digital provision of products and services, further research has to address the following shortcomings:

- Within the operationalization, customers are treated as one homogenous group which does not correspond to the real-world. Distinguishing preferences within the customer base may lead to process designs that satisfy one customer group, but dissatisfy another group of customers. The developed decision framework does not sufficiently regard the impact caused by the group of dissatisfied customers. Accordingly, future research should integrate the negative effects of this dissatisfied group into the decision framework.

Taken together, these research opportunities provide important starting points for future contributions to more precisely grasp the effects and relations between an organization's value, customer satisfaction and the respective business process design decisions. However, a comprising comprehension of these relations is inevitable to identify the processes that should be innovated due to their promising positive effects on customer satisfaction and thus, business value.

IV.2.2 Future Research in Chapter III: Successfully managing innovations by considering innovation management through a BPM lens

Regarding the successful management of innovations in times of digitalization, the major limitations that provide room for future research are outlined in the following. In this, P3-P6 have all a limitation of generalizability to some extent in common, which is either conditioned by the chosen research approaches such as the single case-study approach or the application within a single data set. Details for every single research paper as well as further limitations and starting points for future research are provided below.

Although P3 constitutes a first step towards an exhaustive exploitation of technical opportunities for innovative process improvements by providing heuristics that guide the creativity process, several limitations have to be taken into account.

- The provided redesign heuristics were derived from a small subset of start-ups that build on digital technologies. Whereas in the chosen sample saturation was reached, other samples of start-ups may comprise further redesign heuristics. Thus, the investigation of further start-ups should be addressed in future research.
- Besides, the transformation from start-up practices and innovations to generic heuristics is beset with subjectivity, thus the results may vary, if other researchers perform the derivation process.

- With respect to the evaluation of the benefit of the heuristics, up to now general validity is not sufficiently tested, due to the evaluation within a small group and with only one real world scenario. The application of the heuristics within real world process improvement efforts in a broader context within several organizations would increase general validity.

Besides the innovation of processes, the doctoral thesis dealt with the innovation process itself in P4 leading to the following limitations:

- The proposed innovation process was only conducted within one singular town and thus lacks generalizability. Therefore, the innovation process should be conducted within several towns to test for transferability of the approach.
- Due to missing control groups, it is not proven that the outcomes of the innovation process are superior to other innovation processes. This shortcoming should be addressed in further case studies or similar research approaches to allow comparability and generalizability of the results.

P5 investigates the application of several OI approaches within the first phase of the innovation process "ideation". To further examine this area, future research should address the following points:

- The focus on a single case study only allows the transfer of the results to companies with similar micro- and macrostructures. Generalizability is moreover hindered by the restriction to one geographical area and thus, results are not necessarily transferrable to other business regions. Moreover, significance of the results cannot be tested due to a lack of previous results.
- Conducting the interviews with several sales representatives in a personal interview might have led to a bias due to the influence of the interviewers.
- As empirical evidence for the quality of every single idea created within the OI process is missing, there exists no objective estimation of the ideas' quality. Thus, an empirical valuation of the subjective evaluation results of the expert team has to be conducted.

The last aspect that was investigated within this doctoral thesis with P6 was the analysis of the digital workplace to support the choice of employees that match the requirements for an

incorporation into the innovation process. This investigation comes with the following limitations need to be addressed:

- Whereas the chosen approach for the analysis can be easily adapted to other data sets, the focus on a single data set within P6 leads to a limitation in generalizability. Especially the restriction to a specific part of knowledge workers – namely white-collar knowledge workers – restricts transferability of the results to organizations with similar setups.
- In addition, the chosen clustering approach is, as any clustering approaches, an eye of the beholder approach and thus, results are dependent on the interpretation of the clusters.
- The analysis of the social network is purely based on digital trace data. Accordingly undocumented personal contact or interaction by telephone is not captured within the analysis. To get a comprising picture of the social network within the workplace, all interactions need to be captured in future research.
- Finally, the analysis only captures the interactions per se, but does neglect the content of the interactions and thus limits the gain of knowledge out of the analysis.

IV.3 Conclusion

Summarizing, the research papers presented in this doctoral thesis contribute to the fields of BPM and innovation management against the background of changing market conditions driven by the ongoing digitalization. Therefore, in a first step, dependencies of business profitability, customer satisfaction and business process design were analyzed to provide a basis for the decision whether a process should be designed in an exploitative manner or if an innovation of the process is useful to explore the full potential of the process. Drawing on this knowledge (P1 & P2), the subsequent research papers (P3 – P6) investigated vital aspects of innovation management from a BPM view. In this, special attention was drawn on the interplay of process innovation and innovation processes. Although this doctoral thesis can certainly only provide insights into selected aspects of innovation management and BPM, it contributes to previous work in the respective research areas and the interplay of both. Accordingly, this doctoral thesis provides insights for research and practitioners on selected topics in the field of successfully managing innovations in the digital age.

IV.4 References

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