Pulling the Plug: The Concept, Process, and Outcomes of Organizational Information System Discontinuance

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### Abstract

**Information systems (IS) and information technology (IT) are increasingly permeating today's organizations. However, the rapid emergence of new technologies along with organizations' changing strategic needs make retiring of incumbent systems a phenomenon with growing relevance. As old systems deteriorate or become obsolete, they need to be replaced with new ones. Then again, sometimes even current systems end up getting abandoned, due various reasons that can relate to strategy or operations, for instance. Despite the prevalence of such discontinuance decisions in many organizations, previous research has given scant attention to the topic. Whereas a handful of existing studies have shed some light on the antecedents of organizational IS discontinuance, the underlying mechanics of those decisions and the resulting outcomes remain poorly understood.**

The objective of this dissertation is to improve the understanding of organizational IS use discontinuance, specifically investigating the conceptual dimensions of the phenomenon, analyzing the processes of IS discontinuance, and probing its consequences. To this end, I focus on three research questions: 1) What does IS discontinuance mean?; 2) How do organizational IS discontinuance processes unfold?; and 3) What are the outcomes of organizational IS discontinuance decisions? I address these questions in four standalone research papers. Paper I synthesizes the prior literature on IS discontinuance and investigates the different meanings it has given to the term. Paper II reports on a case study of an organization where discontinuing an incumbent legacy system proved insurmountable, representing an IS change outcome of being caught in between old and new IS architectures. Paper III is a case study of an IT service provider where discontinuing an accounting automation software resulted in an organizational disruption. Finally, Paper IV discusses the outcomes of retail self-service technology discontinuance from the consumer perspective.

My empirical studies are among the first attempts to untangle organizational IS discontinuance processes and to probe the consequences of discontinuance decisions. I contribute to the IS literature by conceptualizing IS discontinuance and providing an analytic framework for studying the phenomenon. Moreover, my findings shed light on several phenomena connected to IS discontinuance decisions, including the challenges with modernizing legacy environments and the effects of automation on workers' skills.

**Keywords** IS discontinuance, IS replacement, organizational IS change, change process, process model, legacy system, automation, self-service technology

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I started my research career when I was around five years old by examining the behavior of ants and beetles. Little did I know that one day I would write a doctoral dissertation in the field of information systems science – even though an ant hive could arguably be considered as a certain kind of information system. In any case, while I did not expect to take this road, the journey turned out extremely rewarding. This book embodies some of the fruits of my labor from the past four years. However, it goes without saying that I cannot take the full credit of this accomplishment. I have enjoyed the privilege of working with some incredibly great minds, and I have had a wonderful network of friends and family as my support. Thus, it’s about time I dedicated a few words for thanking these people.

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Finally, I want to thank my family for always encouraging me to pursue my passion, whatever it may be, and for all the love and support you have given me along the way. I am grateful to my parents for doing a commendable job raising me, to my grandparents for providing me with enormous support and wisdom, and to my siblings for bringing joy into my days. Words cannot properly express how thankful I am for having such role models in my life.

When starting this degree, wrapping up a dissertation appeared to me as an end of the line in the world of science. However, my scientific inquiries have informed me that discontinuance is not the endpoint, but related processes are bound to follow it. Consequently, I have updated my perception: to me this dissertation marks merely the first step toward new discoveries and accomplishments in investigating the relationship between humans and technology, whether within the academic sphere or beyond it. Reportedly, Albert Einstein compared life to riding a bicycle: “only when moving can one comfortably maintain one’s balance.”

Thus, the journey continues.

Helsinki, October 2018
Tapani Rinta-Kahila
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List of Original Research Papers

This doctoral dissertation consists of a summary and of the following research papers which are referred to in the text by their numerals


Author’s Contribution

**Paper I:** Toward a Refined Conceptualization of IS Discontinuance: Reflection on the Past and a Way Forward

Soliman was the lead author of this paper. The research idea was developed by him, and he conducted the initial literature search and developed the theoretical framework. He also designed the research and was responsible for the initial data collection. Rinta-Kahila revised the theoretical framing, conducted additional data collection, and analyzed the data. Together, Soliman and Rinta-Kahila authored the discussion of results in light of data and wrote the overall research narrative.

**Paper II:** Caught in between: How an Organization Became a Prisoner of Its Legacy System after IS Change

Rinta-Kahila was the sole author of this paper.

**Paper III:** When the Black Box Disappears: The Surfacing of Latent Deskilling after IS Automation

Rinta-Kahila was the lead author of this paper. Penttinen discovered the research context and proposed the research topic. Rinta-Kahila developed the data-collection instrument and theoretical framing, with the assistance of Penttinen and Salovaara, and Rinta-Kahila and Penttinen collected the data together. Rinta-Kahila performed the analysis and wrote the paper under Penttinen’s guidance. Soliman, in turn, provided fine-tuning for the theoretical framing and contributed to the positioning of the results relative to other scholarly work. Salovaara and Soliman contributed to improving the quality of the research and the reporting on it in the paper.

**Paper IV:** The Effects of Self-Checkout Service Discontinuance on Customer Response: Evidence from a Natural Field Experiment

Rinta-Kahila was the lead author of this paper. Penttinen proposed the research topic and Kumar came up with the research problem. Rinta-Kahila developed the research design and collected the data under the guidance of Penttinen. Kumar analyzed the data, and Rinta-Kahila wrote the paper under the guidance of Penttinen and Kumar. Kumar and Janakiraman revised the theoretical framing and contributed to the positioning of the results within the existing research.
PART I: SUMMARY
1. Introduction

“No structure, even an artificial one, enjoys the process of entropy. It is the ultimate fate of everything, and everything resists it.”

- The robot Willis
(Galactic Pot-Healer, by Philip K. Dick, 1969)

Recent decades have witnessed unprecedented proliferation of information systems (ISs) and information technology (IT) that has transformed the ways in which we work, spend our leisure time, and interact with the world more generally. As technologies permeate an ever-growing share of life, our behavior comes to revolve increasingly around digital systems rather than other people and the physical world. Yet, in a seeming paradox, this time of increasing technological ubiquity brings with it discarding of incumbent technologies, a phenomenon with growing relevance. On one hand, old systems need to give way to new innovations: most technologies have a limited life span – they deteriorate over time and also become obsolete (Swanson & Dans 2000) – and technological advances guarantee the continuous influx of ever more appropriate contemporary systems to the markets (Furneaux & Wade 2017; Gangadharan et al. 2013). In another manifestation, sometimes individuals and organizations revert to more traditional ways of operating by entirely abandoning their incumbent ISs. This might be manifested in a company revising its service strategy to offer a “more human touch” at the expense of technology-afforded interaction (The Telegraph 2015) or cutting costs by discarding an expensive system (Power & Gruner 2015). Hence, in one way or another, eventually every IS will be replaced or otherwise withdrawn, whatever that system’s purpose or the context of its use. Consequently, organizations are often faced with the decision of whether to continue maintaining their incumbent IS or instead terminate it. Increasing globalization, as it imposes new functionality demands for ISs, accelerates the abandonment of old systems and causes tensions between local and global IT needs to crystallize (Rolland & Monteiro 2002). These considerations highlight the need to understand the process in which ISs get terminated or replaced in response to emerging organizational needs. In general, organizations’ decisions to discontinue an IS can be highly complex and challenging to make and implement, especially when the systems at issue have been deployed for so long that they have become firmly embedded in the core business processes and daily routines of their users. This is why many organizations avoid or postpone the hassle of such a difficult IS change, opting to keep operating with older, even outdated technologies (Hemon-Laurens 2016; TechTarget 2015; Schneider 2013).

One complexity central to the issue of discontinuing an IS’s use is related to the deepening integration between humans and technology (Carr 2015). Although new technologies are malleable at first, they become increasingly resistant to change as they get incorporated into
physical, economic, and social infrastructure (ibid., p. 171). The rise of automation and artificial intelligence has already altered several aspects of societies by transforming our daily behaviors: activities related to organizational work routines, personal social interactions, consumers’ service experiences, and many others (Zaino 2017). These developments have come with the introduction of office automation, social media, self-service technologies (SSTs), and utilization of Big Data, to list only a few examples. With such technologies having become able to handle an increasing repertoire of tasks for us, we are growing more and more accustomed to and dependent on them (Carr 2015; Daily Mail 2013), which binds us more tightly into the socio-technical network we continuously build and expand around us. This trend highlights the potential tensions that could emerge from the conflicting yet mutually consistent flows of increasing IT ubiquity on one hand and rising numbers of IT abandonment instances on the other. Points of conflict between these two simultaneous developments can lead to gaps between the tasks we wish to perform and the means we possess to complete them. Ultimately, such gaps make the potential end-user outcomes of what the literature refers to as IS discontinuance a highly relevant consideration.

Typically, the end users considered most are those employees whose work routines are altered when the management discards the incumbent system – e.g., an intra-organization customer relationship management (CRM) or enterprise resource planning (ERP) system (Furneaux & Wade 2011) or the application of a specified standard for inter-organization invoicing (Power & Gruner 2015). That said, organizations’ IS discontinuance decisions sometimes affect customers too, with pertinent examples being a retailer removing the self-checkout systems previously available to shoppers (The Telegraph 2015; TIME 2013) and a service provider in the software business either “killing” an application it introduced earlier (The Verge 2015) or ceasing support for a particular operating system (BT 2016; ITProPortal 2015). Such decisions are often driven by the incumbent system’s stated “end of life” date, cost considerations, customer feedback, process-compatibility issues, and various other factors (see, e.g., Power & Gruner 2015). However, with the deep and only growing interwovenness of humans and technologies, IS discontinuance decisions can entail many other factors, externalities that, while not always obvious to the decision-making organization, require careful consideration. For instance, withdrawing a system used in employees’ work may have disruptive effects on work processes and reduce worker satisfaction if the discontinuation brings significant changes in the nature of the tasks. At the same time, discontinuing an IS-based service used by customers may bring consequences that extend beyond mere cost considerations, such as lower customer satisfaction with the brand or company (The Verge 2015). This can, in turn, lead to undesirable outcomes such as a surge in negative word of mouth; deterioration in brand image; and, ultimately, loss of customers and market share (Hogan et al. 2003; Lehrer 2015; McDougall & Levesque 2000).

The notion that most systems’ life ends in obsolescence (Furneaux & Wade 2010; Swanson & Dans 2000) resonates with the opening quote from the book Galactic Pot-Healer when applied in the context of organizational IS management. Since entropy is indeed the fate of all things, eventually every IS will be retired. However, it is important too that the technologies being discontinued tend to be enmeshed in socio-technical systems in complex relations (Besson & Rowe 2012; Furneaux & Wade 2011) and, hence, do not invite this process but resist it, in various ways. Moreover, end users’ reactions to disruptions that create discontinuity in their routines of IS use complicate discontinuance, for the human factor can ultimately create the specter of resistance to such decisions long after the systems are retired. While organizations
can consciously facilitate the discontinuance process (Cohn 2016), the embeddedness of ISs exerts a pull against the inevitable entropy, even to the point where that inevitability is called into question. In addition, modern technologies may be exploited to extend the life span of outdated systems, and recent initiatives to advance “antifragile” IS development (Russo & Ciancarini 2016) could call into question the assumptions of IS obsolescence and deterioration. None of this makes understanding IS discontinuance any less relevant. Quite the opposite is true: if further complicates the phenomenon, emphasizing the need for disentangling its many threads.

1.1 The research gap and objectives

Untangling the process of IS discontinuance can shed light on why so many IS change projects result in failure or wind up in the murky area between success and failure. For instance, such efforts can help us to understand why numerous obsolete and outdated legacy systems remain in place even when more agile IS solutions are available and good implementations exist (CRN 2012; Schneider 2013). Moreover, since ISs get discontinued at various stages in their service life, for a whole host of reasons, it is important to understand the impact these discontinuance decisions may have on individual users. For instance, how do employees react when the central system for their work is discontinued? How does this change influence their work performance and, at the same time, their well-being? How can their recovery from any disruptive impacts of IS discontinuance be characterized? As for the second important angle mentioned above, how does withdrawing a service technology from customers affect customer relationships? These questions are relevant for any practitioner faced with the choice of continuing vs. discontinuing an incumbent system, and they hold significant importance irrespective of whether the system is used by employees or customers and of whether the system is an in-house one or from an external party. Despite the clear importance of these questions, IS literature has done little thus far to address them (see Chapter 2).

The objective with this dissertation is to improve on the current understanding of organizational IS discontinuance by investigating aspects of the phenomenon that have received very scant attention in prior literature. Firstly, while academic interest in the topic has seemingly increased this decade, the phenomenon has still received disproportionately little attention, and it calls for better conceptual understanding (Furneaux & Wade 2010; Recker 2016). Secondly, most of today’s writings on the topic discuss individual-level IS discontinuance decisions, leaving organizational decisions sparsely addressed. Also, research on IS discontinuance has been dominated thus far by factor-based studies that focus mainly on the predictors of discontinuance while considering the process through which these translate into discontinuance to be unknown (and unknowable). Accordingly, organizations’ IS discontinuance processes emerged as a potential subject for research (Furneaux & Wade 2010). Finally, although organizational IS discontinuance decisions have been acknowledged as having significant implications (Furneaux & Wade 2010, 2011), virtually no empirical research has examined what these implications are. I set out to address these research gaps by offering a fresh conceptualization of the phenomenon, identifying organizational IS discontinuance processes, and shedding light on the end-user outcomes of decisions in this domain. Against this backdrop, my quest to gain a more comprehensive understanding of organizational IS discontinuance led me to seek answers to three main questions.
Introduction

Firstly, my search for construct clarity with regard to the dependent variable (i.e., IS discontinuance) resulted in defining and conceptualizing IS discontinuance behavior, with specific emphasis on the meanings previous literature has assigned to it:

**RQ1: What does IS discontinuance mean?**

This question is addressed in Paper I, which provides a compilation and synthesis of the definitions and senses of IS discontinuance adopted in previous IS literature. The work provides as output a conceptualization of IS discontinuance in terms of five distinct behavioral outcomes, occurring in particular stages of the life cycle of ISs’ use. Paper II sheds additional light on the matter by considering complexities related to defining the phenomenon: the findings point to the fact that sometimes IS discontinuance may be actualized only partially.

Secondly, since most of the IS discontinuance research has focused on studying static relationships between variables, we still lack understanding of the process connected with organizational IS discontinuance decisions. Since organization-level systems tend to be large, complex, and integrated with other systems, it is important to understand not just the factors that predict the likelihood of engaging in such projects but also the process in which they are abandoned. Charting this process can help organizations manage the typical caveats associated with complex change projects. Accordingly, I formulated the second question motivating my journey thus:

**RQ2: How do organizational IS discontinuance processes unfold?**

Paper I provides an aggregate-level answer to this question in positing that IS discontinuance takes place through at least five distinct process paths over the course of the use life cycle. Paper II delves more deeply into the discontinuance process in the context of organizations’ legacy systems. It reports on in-depth process analysis via which I uncovered both vertical interactions (links between people managing the replacement project and project workers and between the organization and its environment) and horizontal interactions (connections and path dependencies within the replacement projects), which coexist and shape the outcomes similarly.

Finally, with the consequences or outcomes of IS discontinuance remaining largely uncharted territory, I examined how organizational IS discontinuance decisions affect the host organization and its stakeholders:

**RQ3: What are the outcomes of organizational IS discontinuance decisions?**

Paper II addresses the topic via discussion of the contrasting perspectives of workers and managers on the outcome of partial discontinuance of a legacy system. Papers III and IV focus on this question with regard to two end-user groups: employees and customers, respectively. Paper III reports on a case of an organization wherein discontinuing an accounting system resulted in negative disruptions in processes and work routines. Paper IV presents an empirical case study of discontinuing a service technology available to customers in a retail context. Specifically, removing self-checkout points was found to have negative effects on customers’ purchase behavior and their evaluation of the service.

Figure 1 outlines the prior literature’s area of emphasis and the intended contributions of this dissertation, summarizing the focus related to each and presenting the key questions and type of answers pursued.
1.2 Definitions of key concepts

The following definitions are applied for the concepts most central to the work:

**Information system (IS).** In general terms, any mean of storing, disseminating, and presenting information can be seen as an information system. This extends even to engravings, paintings, papyrus, and books. However, for the purposes of this dissertation, I define the concept as covering computer-based systems that range from the first-generation systems introduced in the 1960s (Kelly et al. 1999, p. 4) to the commercial standardized systems of today (e.g., SAP systems and Salesforce). In an organizational context, an IS can be applied to increase collective efficiency and capability. Information systems comprise various combinations of hardware, software, data, processes, and functions.

**Information technology (IT).** The concept of IT covers the specific technological components of information systems that help humans interact with information systems. For instance, self-checkout machines are an information technology that enables consumers to use the service provider’s information system for the point-of-sale checkout transaction.

**IS use continuance.** An individual’s or organization’s IS use behavior that takes place after IS acceptance and initial use experiences is referred to here as IS use continuance. A conclusion in the acceptance stage that expectations have been met or exceeded, when coupled with high satisfaction with the IS, tends to predict IS use continuance (Bhattacherjee 2001). Among the
dimensions of continued use behavior are duration, frequency, and intensity of use (Venkatesh et al. 2008).

**Legacy system.** Organizational information systems in place that incorporate an earlier business model of the organization, from the time of their implementation, are denoted as legacy systems (Kelly et al. 1999). Often these perform back-end work for mission- or business-critical processes. Many have evolved under a development logic that can be described as evolutionary: functions get layered on top of the existing system architecture with little consideration for the overall architecture (Bannister 2001). Legacy systems are traditionally seen as being based on old or outdated technologies (Kelly et al. 1999, p. 5).

**IS architecture.** Encompassing hardware and software, operating systems, communication networks, data, applications, and work processes, the term “IS architecture” describes how these are organized and related to each other.

**Automation.** Automation is the practice of implementing technology to execute a process or task previously carried out by a human (Parasuraman 1997, p. 231). This can be achieved through combining several technologies, as with combinations of mechanical, hydraulic, and electronic devices. Control devices and interfaces are often implemented for humans’ supervision and control of the automated process. Automation has been a significant source of productivity improvements in developed societies.

**IS automation.** Automation enabled by IS implementation is called IS automation, often referred to also as office automation in an organizational knowledge-work context (McLeod & Jones 1987). It frequently involves automating knowledge-work processes. Some examples of IS automation are intelligent decision aids (Arnold & Sutton 1998), robotic process automation (Lacity & Willcocks 2016), knowledge-management systems (McCall et al. 2008), and ERP systems (Sayed 2006).

**Self-service technology (SST).** SSTs are technological interfaces or devices that allow customers to produce services without the direct involvement of a service employee (Meuter et al. 2000, p. 50), thereby replacing or diminishing the face-to-face interaction between customers and workers – e.g., automatic teller machines (ATMs), ticket-vending machines, retail self-checkouts (SCOs), and e-banking. Self-service technologies, which can be viewed as a type of automation, have been found to enable significant cost savings for the implementer and also greater convenience and time savings for customers (Collier & Kimes 2012; Meuter et al. 2005). However, some customers are disenchanted with the replacement of the human touch by a machine, experience difficulties with using the service, and even express concerns about SSTs taking jobs from human workers (Nijssen et al. 2016). Moreover, SSTs have been criticized for widening the digital divide, since they sometimes render services less accessible to people who cannot use them without assistance.

### 1.3 The structure of the dissertation

The dissertation is divided into two main parts.
Part I provides a summary of the research conducted to address the main questions outlined in Section 1.1. After the introduction provided in Chapter 1, I position my research against current IS literature in Chapter 2. With Chapter 3, I move on to discussing my research methodology, including philosophical assumptions, the approaches taken in the research, theoretical background, and the data-collection and analysis methods. Chapter 4 is devoted to reporting on the findings described in each of the four research papers, and in Chapter 5 I discuss the resulting implications for theory and practice, address the limitations of my work, and suggest areas for future research. The works cited and appendices are provided at the end of Part I.

Part II is composed of the four original research papers that provide full accounts of the research projects conducted for this dissertation.
2. Previous literature

In this chapter, I position my research in the body of work on related topics, by discussing the complexities of organizational IS change and how the IS discontinuance perspective can inform such research. Then, I review the current literature on organizational IS discontinuance.

2.1 The complexity of organizational IS change

Organizational IS discontinuance decisions represent an aspect of organizational IS change, one in which the organization’s technological components are altered, typically in response to the obsolescence of the IS (Furneaux & Wade 2017) or to environmental pressure (Boukef & Charki 2014; Power & Gruner 2015). However, such change is not easy: several organizational factors discourage, inhibit, and constrain the execution of major IS changes (Besson & Rowe 2012; Furneaux & Wade 2011, 2017; Rezazade Mehrizi & Mòdol 2012; Rinta-Kahila et al. 2016). Resource constraints, typically limits to monetary, time, and human resources, can render organizations economically inert and discourage them from conducting risky IS change projects. While such resource rigidity can be overcome when action must be taken in the face of a serious threat, it is much harder to overcome routine rigidity, “failure to change the organizational processes that use those resource investments” (Gilbert 2005, p. 741). This may be linked to organizational actors’ fear of change and reluctance to learn or to general norms and values in the organization that encourage inertia (Besson & Rowe 2012), manifested as management inability to initiate changes and/or as worker resistance to change (Lapointe & Rivard 2005). Furthermore, the degree of embeddedness of technology in today’s organizations (Volkoff et al. 2007) makes embarking on bold IS changes especially daunting. Large-scale legacy systems tend to involve high levels of technical integration: components of the system are connected to each other by sophisticated linkages (Furneaux & Wade 2011). Similar dependencies can exist in the wider socio-technical environment of an organization, where work systems may be closely tied in with various other systems, processes, and people (Besson & Rowe 2012; Rowe et al. 2017). Hence, changing one system affects multiple elements in the organization’s socio-technical network, making controlled discontinuance of large, integrated systems immensely challenging. Finally, political factors can impede IS changes, through the power dynamics between the organization and its external stakeholders (suppliers, customers, and public institutions), as well as those between departments and teams within the organization (Besson & Rowe 2012; Rezazade Mehrizi & Mòdol 2012). Political cul-de-sacs can become especially prevalent in complex matrix organizations that have numerous affected systems and stakeholders.

Very often, IS discontinuance projects entail the implementation of a new IS to replace the old one (Furneaux & Wade 2011). While the outcomes of IS discontinuance have not received
much attention in the literature, researchers of IS change have found that sometimes the implementation of a new IS has disruptive (Davis & Huffnagel 2007) and even destructive (Drummond 2008) effects on the implementing organization. Such unanticipated effects have occurred when the IS has significantly altered work content and routines, which in more extreme cases has also translated into a worse service experience for customers (ibid.). Indeed, IS implementation failures are common and come in many forms (Lyytinen & Hirschheim 1987). It has been proposed that, rather than learning from failures, organizations are, in fact, learning to fail, by constructing myths that perpetuate short-term optimization, favoring expedience over making required transformations (Lyytinen & Robey 1999). In their fear of implementation failure, organizations strive to maintain the status quo and accommodate their existing practices when implementing new ISs, often justifying this with deterministic views of how they should operate (Arvidsson et al. 2014). Such determinism was salient in the case of a paper mill discussed by Arvidsson et al. (ibid.), wherein the IS implementation in itself was a success but the mill failed to reap the expected benefits. The parent company’s strategic intent for the IS change was mistranslated at the mill level, with the result that the mill entrenched itself in its old practices and failed to strategically reengineer the processes. The authors argued that organizations may fall into strategic blindness when the system implementation and alignment between strategic intent and IT capacities is not followed by realization of the strategic intent in practice (ibid.). Poon and Wagner (2001) described a similar situation, wherein one of their case organizations succeeded with some aspects of an IS implementation but failed at others. The result was an “unresolved” case of IS success. The picture gets even murkier when one considers the views held by the organization’s stakeholders, which can be mutually contradictory. In one example, of views of a completed IS change project (Newman & Robey 1992), the project was significantly late and went over budget but was still seen as a success by managers. In another case, a technically successful implementation came at the expense of marginalizing and overruling the system’s end users (Lyytinen & Newman 2015). These examples highlight the complexity of conducting IS change – of which IS discontinuance tends to be a part – and call for a more nuanced understanding of IS change outcomes. While the focus in IS change literature has largely been on implementing new ISs, the process and outcomes of IS discontinuance are most likely no less multifaceted.

2.2 The discontinuance perspective

The field of IS research has been criticized for exhibiting pro-adopter bias: technology discontinuers are typically under-studied (Rogers 2003), and this could limit our understanding of the IS discontinuance phenomenon. While organizational IS replacement decisions have received considerable attention in the literature (e.g., Chau & Tam 2000; Teo et al. 2003), the focus has tended to be solely on implementation of a new IS. Furneaux and Wade (2010, 2011, 2017) have argued that the focus on adoption conflates the incumbent system’s life cycle with that of its replacement. Accordingly, it is argued that focusing on adoption yields relatively limited insight into the discontinuance of incumbent systems and, thereby, even the outcomes from the new IS’s implementation. Recently, Power and Gruner (2015) showed that explicitly studying why some organizations choose to terminate a previously implemented IS can cast new light on such decisions. In addition, the assumption that innovation diffusion follows linear adoption patterns has been challenged, since organizations sometimes “go backward,” scaling back their IT implementation (ibid.) or the extent of IS automation (Rinta-Kahila et al.
2.3 The IS discontinuance literature

The body of research on IS discontinuance is still limited, but the topic has begun to attract significant attention since the start of this decade (see Figure 2). This surge of interest can be attributed to increasing academic interest in post-adoption and post-usage IS behaviors as well as to the soaring popularity of social networking systems (SNSs) that have transformed the ways people interact with each other. With regard to the former, while the IS adoption and continuance research streams have reached maturity, they have been argued to provide only limited insight with regard to IS discontinuance behavior (Power & Gruner 2015; Turel 2015a), in shifting academic interest toward explicitly addressing IS termination decisions (as opposed to more extensive processes). As for SNSs, immoderate use has been found to create social and technical overload for users, leading to alleviation of the burden by ceasing SNS use (Luqman et al. 2017; Maier, Laumer, Eckhardt, & Weitzel 2015; Maier, Laumer, Weinert, & Weitzel 2015; Ravindran et al. 2014; Turel 2015a, 2016; Turel & Qahri-Saremi 2016; Zhang et al. 2016). This phenomenon has contributed to the SNS becoming a prominent research context also in the domain of IS discontinuance research.
Previous literature

Figure 2. IS discontinuance articles published in 1991–2017 (identified for Paper I).

Most studies of IS discontinuance concentrate on individuals’ decisions to discontinue use. Traditionally, individual-level IS discontinuance studies have examined either employees ceasing their use of work systems (Aggarwal et al. 2015; Cooper 1991; Recker 2016) or consumers abandoning systems designed either for utilitarian purposes (Prendergast & Marr 1995) or for entertainment (Danaher 2002; Parthasarathy & Bhattacharjee 1998). Dissatisfaction with system performance, incompatibility with the user’s needs, finding a more suitable IS for the application, and change in life situation all have been found to play a key role in users’ discontinuance decisions (Hand et al. 2009; Parthasarathy & Bhattacharjee 1998; Spiller et al. 2007). As discussed above, SNS discontinuance and SNS switching represent another prominent, currently trendy research stream.

Their practical significance notwithstanding, organization-level IS discontinuance decisions have received far less attention. Current literature on this topic is relatively scarce, and what does exist focuses heavily on the antecedents to organizational IS discontinuance. Organizations’ IS replacement decisions represent a quintessential example of this discontinuance and typically involve discontinuing an incumbent legacy system in favor of a more modern system (Furneaux & Wade 2010; Gangadharan et al. 2013). Swanson and Dans (2000) suggest that managers seek balance between the maintenance effort of an old system and its remaining life. They found that large and complex systems receive more maintenance effort and that systems’ remaining life expectancy decreases with system age. Sometimes managerial decisions on aging IT infrastructure can turn the sustaining-motivated maintenance efforts into conscious repair-to-decay by actively furthering the end of life of the old infrastructure (Cohn 2016). Furneaux and Wade (2011, 2017), who investigated key factors influencing IS replacement intentions, concluded that shortcomings in system capability lead to greater replacement intentions, while replacement risk, availability of system support, and levels of technical integration reduce them. Loss of human skills needed for supporting legacy systems represents another factor that may motivate or force an organization to discontinue its incumbent systems (Sandborn & Prabhakar 2015). On the same note, switching-related costs of IT operations, personnel replacement, and in-house learning have been found to affect firms’ willingness to discontinue
their current IT outsourcing contract or switch outsourced-service provider (Whitten et al. 2010).

Others have studied organizations’ decisions to terminate the use of incumbent ISs entirely, without bringing in corresponding new systems in their place. For instance, Power and Gruner (2015) identified various reasons for organizations paring back their IT implementation by discontinuing their inter-organizational sales invoicing system. Some of the motivations were costs related to regulatory compliance or the system itself, disadvantages that such a system incurs for operations, and uncontrollable changes within the organization and in its environment. Moreover, systems’ complexity and incompatibility with needs have been found to cause organizations to prematurely abandon already implemented systems (Tully 2015). Taking another tack, Fürstenau et al. (2016) studied why organizations discontinue their unofficial shadow systems, finding that small and non-business-critical shadow systems are likely to face the threat of elimination particularly when challenges arise with the system or its use context. Finally, examining unethical use of ISs in particular, Boukef and Charki (2014) ascertained that organizations may end up ceasing controversial online reverse-auction use if it becomes harmful for their business or when the law so dictates. Correspondingly, Charki and colleagues (2017) have proposed that legal intervention would cause organizations to limit or discontinue their related unethical IT use, and that this effect is exacerbated by increased complexity and perceived risk of using that IT.

Although some individual-level studies (e.g., Cho 2015; Hogan et al. 2003; Lehrer 2015) reach beyond the antecedents to IS discontinuance in attempts to reveal its consequences, the literature remains largely silent on the consequences of organizational IS discontinuance. To the best of my knowledge, this facet has been discussed only in connection with our case study of an organization that replaced its highly automated accounting system with a less automated one (Rinta-Kahila et al. 2018). This change had disruptive effects on the accountants and their organization because relying on the automation for years had eroded these workers’ professional expertise. Paper III provides a more detailed description of the case.

Given the prevalence of organizational discontinuance decisions in various industries, it is surprising that they have received very little consideration in the literature and that virtually no research has paid attention to the outcomes of such decisions. Moreover, although some researchers recognize the topical practical problem of killing off old legacy systems (Furneaux & Wade 2011, 2017), they tend to address the issue through models with a simple factor-based design, which rarely capture the multiple levels, time-embeddedness, and contextual nature of such endeavors. Achieving a better understanding of the phenomenon calls for process-oriented research approaches. Hence, this dissertation is focused on understanding organizational IS discontinuance from the process perspective – i.e., on unpacking the interactions of events and states that lead to abandoning incumbent IT. Moreover, to extend our understanding of the outcomes of those processes and to open a new prospective research area, I examine the effects of organizational discontinuance decisions on both the organization itself and the end users of the systems: workers and consumers.
3. Methodology

A researcher’s methodological choices should always be guided by mindful consideration of the underlying assumptions about reality and knowledge. As Morgan and Smircich (1980, p. 491) put it, “the choice and adequacy of a method embodies a variety of assumptions regarding the nature of knowledge and the methods through which that knowledge can be obtained, as well as a set of root assumptions about the nature of the phenomena to be investigated.” Therefore, both ontological assumptions about the nature of reality and one’s epistemological stance on what knowledge is and on the means that suffice for obtaining it largely determine the methods appropriate for studying a given phenomenon. Mainstream IS research operates largely under two main epistemologies, positivism and interpretivism (Wynn & Williams 2012), which are mutually contradictory in their focus – on objectivity and subjectivity, respectively. The IS research field was heavily positivist in its early days, typically relying on surveys and laboratory experiments as the main research methods (Orlikowski & Baroudi 1991). Positivism in IS research has been criticized for excessive scientism: prioritizing objectivity and precision of method over the relevance of context (Klein & Lyytinen 1985). In the end, the social reality is not easily quantifiable, and it is often argued that purely quantitative explanations cannot capture some of the highly complex phenomena central to IS research (Wynn & Williams 2012). Thus, criticism leveled at positivism as “the natural-science model of social science” (Lee & Baskerville 2003, p. 229) has, alongside the introduction of principles for conducting rigorous interpretive research (Klein & Myers 1999), facilitated embracing interpretivism as a viable and much-needed research orientation in the IS field. In one attempt to reconcile the juxtaposition between the two schools of thought, Lee (1991) has proposed an integrative approach wherein the contrasting perspectives are seen as distinct levels of understanding that inform each other. Yet it has been argued that understanding complex phenomena such as organizational IS change requires going beyond the conventional positivist and interpretivist paradigms to develop “in-depth causal explanations for the outcomes of specific sociotechnical phenomena that take into account the breadth of information technology, social, organizational, and environmental factors which may have played a causal role in their occurrence” (Wynn & Williams 2012, p. 787). To this end, critical realism (Bhaskar 1975, 1989) has been advanced as a viable philosophical lens for IS research (Williams & Karahanna 2013; Wynn & Williams 2012). For instance, Volkoff et al. (2007) have demonstrated critical realism’s potential for acting as a more suitable lens for study of technology-mediated organizational change than purely interpretive approaches. Accordingly, in this dissertation I take a critical realist approach to the research problems. Below, I will discuss the corresponding philosophical assumptions that underpin my research approach and methods, before addressing the research approach chosen and, then, the theoretical background and methods applied for the four papers included in this dissertation.
3.1 Assumptions

Overall, my philosophical assumptions and research principles reflect those of critical realism (CR) as explicated by Wynn and Williams (2012). In its purest form, CR posits that social structures and systems exist and operate independently of our conception of them, constituting an objective reality (Bhaskar 1975). Therefore, CR asserts, science should be based not purely on what we can empirically prove but on discovering the latent mechanisms that produce causal effects. However, human ability to access the latter reality tends to be limited, and our interpretation of it is often flawed. Positivism addresses this issue by disregarding the underlying mechanisms acting between causes and effects, while interpretivism maintains that reality is not objective but constructed by individuals or socially. At the core of CR, in contrast, is the assumption that reality is composed of three nested domains: real, actual, and empirical. The domain of the real encompasses reality and causal mechanisms that exist independently of our perception of it. The actual, in turn, is nested within the domain of the real. It is here that the events resulting from the causal powers of reality take place, whether they are observed by humans or not. Finally, the empirical domain, nested within the domain of the actual, encompasses the events that humans can experience through perceiving or measuring. A key aspect of CR is its attention to potential lack of synchrony among these domains of reality: an event may occur in any of them, and sometimes a mechanism translating it into another domain is not activated or is counteracted by other mechanisms. This explains why perceptions or observations do not always match the actual events.

One of the fundamental principles of critical realist research is explicit accounting for the structure and context of the phenomenon and for their relations and emergent changes. Moreover, critical realist research aims for the identification, empirical corroboration, and fleshing out of causal mechanisms, with the endeavor being to find the best explanation for the phenomenon that occurs. With regard to methodology, CR encourages triangulation since the use of multiple data-collection and analysis methods is often advisable. The aim throughout is to uncover as much of the objective reality as possible. For our purposes, one key advantage of the critical realist approach is that, precisely by embracing multimethod and multilevel approaches, it is able to yield richer and more robust causal analysis, which can result in a better understanding of IS change outcomes (Wynn & Williams 2012, p. 788).

These philosophical considerations are crucially important, because they inform my research approach and methodological choices, along with the interpretation of my findings and assessment of their implications. Overall, a critical realist stance calls for capturing multiple aspects and levels of the phenomenon of interest through extensive collection of rich data and triangulation of findings.

3.2 Research approaches

One important choice in efforts to explain complex IS change is related to the intellectual strategy applied in studying the topic: the extent of “closed-boxing” or “open-boxing” of the change

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1 In the IS field, the critical perspective has been applied primarily in research with emancipatory purposes – i.e., for exercising fundamental criticism of prevailing social structures while embracing certain value propositions at the heart of the research that align with seeking to improve life for human actors (see Myers & Klein 2011). However, this is just one approach to applying the CR paradigm, and CR can be a useful philosophical foundation for organizational research in general. With this dissertation, I strive to improve the level of IS theory via a solid general approach to the critical realist perspective that is consistent with the treatise on the topic by Wynn and Williams (2012).
process – i.e., the underlying mechanisms between causes and effects (Lyytinen & Newman 2008). Factor-based models tend to keep the IS change process in a closed box, offering only a cross-sectional glimpse of the antecedents to and outcomes of the change, limited by the characteristics of the theory that is being tested (ibid., p. 608). Because factor-based models assume variation in the outcome to be explained by variation in its predictors, they often do not explain the causal mechanism (how and why the outcomes are related to the predictors); the connection is only assumed (Newman & Robey 1992, p. 250). Moreover, many functional factor models require omitting some potentially relevant variables that are impossible or difficult to measure. Weick (1984) argues that by not considering a variable relevant to the phenomenon under investigation, the researcher assigns it a value of zero, which is the only value it cannot have. That being said, developing and testing factor models can still be immensely valuable: it may yield useful and generalizable conclusions about the inter–relations of various relevant factors. Moreover, while factor- and process-oriented models should not be combined, they can be operationalized in a complementary and mutually informative manner (Newman & Robey 1992, p. 251). My intention, then, is by no means to dispute the value of applying factor models – in fact, I took such an approach myself with Paper IV. Still, I champion the use of more open-boxed approaches especially for unraveling the complexity of phenomena such as organizational IS change. This is especially vital when the researcher is asking questions such as how and why a certain phenomenon occurs. In addition, when testing a factor model is considered appropriate, I advocate methodological triangulation and the use of additional robustness checks to strengthen the causality claims and to shed more light on the underlying mechanisms.

At the opposite end of the continuum are entirely open-box approaches. One manifestation is detailed stories, typically based on raw data gathered through highly involved ethnographic or action research and entailing very little a priori theorizing (Lyytinen & Newman 2008, p. 608). Such narratives can be used to lay out a rich history of IS change as interpreted by the researcher, but they tend to be thick and relatively unstructured explanations since they consider every minor and random event a potentially significant factor in change (ibid.). Thus, the two poles of approaches present researchers with tradeoffs related to generalizability, simplicity, and accuracy of explanation (ibid., p. 609). A process perspective has been proposed as a useful middle-of-the-road strategy, for capturing the underlying mechanics and interactions of change while maintaining the possibility of a priori theorizing and structured explanations (ibid.; Newman & Robey 1992). In general terms, process theories explain how things develop and change over time via emergence of events, states, and interactions (Markus & Robey 1988). Using process models allows one to capture these events, states, and interactions in context, and doing so can aid in achieving understanding of how an organization shifts from one state of being to another. Indeed, it has been argued that process thinking has already enhanced our understanding of complex IS change (Ahmad et al. 2011). Since organizational IS discontinuance decisions tend to be complex and have diverse externality effects, process models have an edge against factor-based models in their ability to shed light on how organizations navigate through such difficult and time-consuming change. The differences between factor and process models are illustrated in Figure 3.
Process data tend to be messy and disorganized, so the dataset must be translated into a compelling and understandable form so as to provide better explanations of the phenomena subject to study (Langley 1999; Pentland 1999). Therefore, Langley (1999) has outlined several strategies for making sense of process data. These strategies vary in their accuracy, simplicity, and generality in such a way that each choice of strategy represents a tradeoff: high accuracy comes with the cost of losing simplicity and generality, and vice versa. The most commonly applied strategy is to build a detailed narrative from the data, whether it represents the main output of the research effort, an analysis tool, or merely a stepping stone for building a chronology of events that are to be further analyzed. Of the possible strategies, the narrative yields the most accurate process description, while quantification represents the other end of the spectrum, at which complex process data get reduced to a quantified form that can be analyzed with statistical methods. Between these two extremes lie several other strategies. For instance, visual mapping represents a more moderate method of data reduction and synthesis than quantification: process data get distilled into a graphical presentation. Closely related to this, temporal bracketing groups the data by successive time periods, giving the dataset a sequential structure (Pentland 1999). This strategy is often applied in combination with visual mapping.

While I argue that the process perspective is an immensely valuable yet underutilized approach for studying organizational change, factor models may be preferable if the context and purpose of the study point to this. For instance, in the context of consumer services it could be more relevant for managers to understand the aggregate effects of altering their IT services than to consider the unique experiences of individual customers. Accordingly, the work for Paper IV employed a positivist-oriented natural experiment wherein we captured consumers’ reactions to discontinuance of retail self-service technology via longitudinal survey data. This approach dovetails with the purposes of the study: with survey-based data, one can reveal the aggregate impact of SST discontinuance and its extent, for informing the managerial decision-making. While that addresses the organizational perspective, which is the focus of this dissertation, the statistical analyses are supported with qualitative evidence gathered both from consumers affected by SST discontinuance and in an interview with the relevant store’s manager, in the spirit of my critical realist stance. I believe that triangulating the findings and reconciling
contrasting perspectives lends considerable credibility to our propositions in that it allows us to part the curtains that shroud the domains of real and actual. This renders them ever so slightly more accessible.

3.3 Choice of approach and method

Wynn and Williams (2012) identify the case-study method as especially suitable for conducting critical realist research aimed at yielding causal explanations for complex phenomena (p. 788). Since my philosophical assumptions are close to those of CR and my research is focused on the multi-faceted process and outcomes of organizational IS change, I find the case study a highly appropriate research method for my purposes. Moreover, generating explanatory process theories is highly appropriate under the CR paradigm: rather than predicting or describing events, these explain them by identifying the mechanisms that generate the observed events in the empirical domain (Volkoff et al. 2007). In keeping with the recommendations by Wynn and Williams (2012, p. 805), each of the dissertation’s constituent empirically oriented papers is an attempt to identify and explicate those generative mechanisms at multiple levels of analysis. My realist stance is especially apparent in papers II and III: both report on case studies in which I conducted process analysis of an organizational IS change. This approach allowed me to gain a rich understanding of critical events and interactions in their organizational and environmental context. Also, in the methodological sense, I attempt to reconcile and triangulate the perceived realities of different organizational actors and entities to discover the objective reality behind those perceptions. The PSIC model (see Subsection 3.4.2), applied as a sensitizing device for Paper II and as a source of inspiration for Paper III’s process model, is rooted in realist assumptions in that it constitutes an effort to construct an objective understanding of a socio-technical process by accounting for socio-technical and context-situated entities’ horizontal (single-level) and vertical (multiple-level) interactions both (Lyttinen & Newman 2008, p. 601). Still, the model invites the use of interpretive analysis for understanding the actions and perceptions of organizational actors within their context (ibid.). In a similar vein, while I exploited moderate interpretivism for understanding the role of automation and the manifestation of “deskilling” for Paper III, with the analyses I sought to discover the mechanisms that operate in the domain of the real and get translated into events in the domain of the actual, regardless of the realities formed by individuals and socially. It is inherent to the multimethod nature of CR that the objective reality can be accessed through both quantitative and qualitative methods, which may be used to complement each other. This view is salient for Paper IV: although we performed a rather positivist-oriented statistical analysis of survey data, we triangulated the findings by collecting and examining qualitative data from two levels of analysis (individual customers and store manager). We also employed difference-in-differences analysis to account for the limitations of survey-based factor models and capture the causality between IT discontinuance and its consequences. Moreover, we controlled for alternative explanations through supplementary analyses and qualitative triangulation. While Paper IV reports on not a case study but a survey-based consumer study, it nevertheless presents a particular case of organizational IT discontinuance and consequences thereof.
3.4 Motivations, research contexts, and theoretical background

Each paper included in the dissertation and dealt with in this synthesis presents a standalone study situated in a distinct research context. Hence, I have applied numerous theories, depending on the research question and the study’s context. I will now present the research questions and framework for each study, along with why these are appropriate devices for understanding IS discontinuance.

3.4.1 Paper I

For Paper I, we set out to gather and study current work on IS discontinuance to find answers for the following question: what does IS discontinuance mean? For this purpose, we developed an analytical framework based on Pettigrew’s (1985) contextualist approach. Contextualism was developed as a mode of analysis for studying organizational change, which Pettigrew suggests to involve an interplay of context of change, process of change, and content of change, combined with regulation of relations among all three (p. 62). We found the notions of context, process, and content to represent particularly strong potential as sensitizing devices (Gregor 2006) with regard to the IS discontinuance phenomenon, so we anchored our analysis in these three key aspects. Here, a process is a “sequence of actions and events which is being used to explain the origins, continuance, and outcome of some phenomena” (Pettigrew 1985, p. 64). Applying this sense of the term, we considered the archetypal IS use life-cycle process, which starts with exposure, advances to adoption and continued use, and ends with discontinuance. We drew on the diffusion of innovations theory (Rogers 1962, 2003), the model of IS discontinuance (Bhattacherjee 2001), and the user transformation model (Maier, Laumer, Weinert, & Weitzel 2015) to bring further nuance to the accounting for process. Specifically, we addressed knowledge, persuasion, and decision (Rogers 2003) as relevant steps the IS user may take during the exposure stage. Next, implementation and confirmation represent important steps occurring in the adoption stage (ibid.; Bhattacherjee 2001). If the initial use experience fulfils the user’s expectations of the IS, the user moves on to the stage of continued use in the IS use life cycle, which eventually ends with the termination of IS use (Maier, Laumer, Weinert, & Weitzel 2015). Secondly, content reflects concrete outcomes of the change process. While literature on continued IS use has distinguished among qualitatively distinct aspects of IS use such as frequency, duration, intensity, and comprehensiveness of use (Turel 2015b; Venkatesh et al. 2008), we strove to uncover the content of IS discontinuance behavior as it is presented in the literature. This involved considering how the nature of IS discontinuance is presented and whether this involves intentions or actual behavior. Finally, considering context highlighted relevant aspects of the IS use environment that shape (and are shaped by) the process and content. To this end, we considered three dimensions – namely, system type, the system’s immediate use context, and the level of analysis. For characterizing the system types presented, we applied the traditional utilitarian–hedonic division (van der Heijden 2004) on the basis of the system’s primary use purpose as reported for each study (Wu & Lu 2013). We captured the immediate use context and level of analysis by distinguishing, respectively, between organizational and non-organizational use environment and between organization- and individual-level analysis.
3.4.2 Paper II

With Paper II, I wanted to delve more deeply into the process of IS discontinuance from the organizational point of view and explain ambiguous IS discontinuance outcomes in cases of complex organizational IS change, specifically in the context of replacing legacy systems with a modern IS. Therefore, I investigated the following question: how does an organization get caught in between old and new system architectures when conducting IS change? To this end, I took an immersive look at a multinational organization that had executed a major IS change at one of its factories in Finland, which I refer to as EngineShop. The organization had revised its strategy by shifting from single-country manufacturing toward international collaboration between factories, and this brought a need for centralized ISs for the global organization. For EngineShop, this entailed discontinuing an old legacy system (“DG”) and replacing it with modern off-the-shelf systems. The dismantling of DG began with replacement of its product-data management (PDM) and ERP functions by well-known commercial systems: Teamcenter and an SAP system, respectively. Though the ensuing IS change project resulted in deployment of two new systems, the factory was unable to entirely kill off its legacy system. In fact, DG is in operation even today, eight years after the IS change project. The background offered by the IS discontinuance perspective (Furneaux & Wade 2011, 2017; Power & Gruner 2015; Swanson & Dans 2000; Turel 2015a) helps to explain why the IS change was left half-done. The case study was informed by previous research on organizational IS life-cycle management, IS discontinuance, and IS replacement decisions.

Further theoretical grounding was provided by Lytinen and Newman (2008), who proposed a Punctuated Socio-Technical Information System Change (PSIC) model as a structured but flexible theoretical sensitizing device for producing rich yet generalizable process-oriented explanations of organizational IS change. The PSIC model is able to address IS change at several levels of analysis, with the most relevant ones being the work-system level (the level of current work processes in the organization), the building-system level (involving the resources and activities assembled for conducting the IS change), and the context-linked levels of IS change: the elements of the organization (e.g., the top management) and its environment (e.g., the economy and competition). The model draws from Leavitt’s (1964) socio-technical theory (also known as Leavitt’s Diamond), wherein organizational socio-technical systems are made up of four interrelated components: actors, tasks, structure, and technology. In the PSIC model, IS change occurs through both incremental and punctuated changes in the interrelationships of these components, with oscillation between spans of stability and radical upheavals, creating socio-technical balances and imbalances. For instance, a work-system-level imbalance may arise through a gap between technology and actors if employees resist the organizational IS or lack the skills to use it, or a building-system-level imbalance might emerge through a gap between structure and tasks if the top management fails to allocate sufficient resources for implementation of the new system.

A key benefit of the PSIC model is its ability to simultaneously account for horizontal and vertical interactions – i.e., to consider the horizontal temporal dynamics of socio-technical systems’ work- and building-system balances throughout the change while also addressing how these vertically interact with the organizational and environmental states and events. In addition, the model enables taking historical developments as the starting point for IS change, by examining its antecedent conditions at several levels of analysis. While the PSIC model offers a readymade structure, it remains inclusive and flexible, allowing one to extend and modify it in accordance with the characteristics specific to the change process under investigation. This
can be done by adding or omitting particular levels of analysis and applying various theoretical lenses (e.g., Lyytinen et al. 2009).

3.4.3 Paper III

Paper III was motivated by a desire to explore the consequences of organizational IS discontinuance decisions from the perspective of automation and “deskilling,” discussed below. The case study was conducted at “AccComp,” an IT service provider that had discontinued its fixed asset management (FAM) system, called “FamSyst”, in one part of a larger accounting-system replacement. Since the company’s accountants had become used to relying on FamSyst’s automated features, the transition to a less automated IS architecture led to malfunction in accounting processes and to disruptions in accountants’ daily work. By exploring this context, we sought also to advance theoretical understanding of the connections among automation, deskilling, and organizational IS implementation practices. We set out to investigate the following research questions: 1) how does organizational automation implementation lead to deskilling of knowledge workers?, and 2) how may an organization cope with deskilling?

Typically, IS implementation entails a certain degree of task-automation. While automation can result in significant performance improvements, its effect on worker skills is a source of concern. Specifically, it has been suggested that automation tends to mask the logic and mechanics behind work processes, thereby causing workers to lose fundamental understanding of the underlying principles. Implementing automation such that it gets seen as a “black box” that conjures up results could turn the professionals who had been in charge of manually performing the operations into mere outside observers. The notion of deskilling is often applied to describe this process wherein reliance on automatic actions erodes operators’ skillset. These concerns have salience in the theory of technology dominance (Arnold & Sutton 1998), according to which, in the example context of auditing, use of intelligent decision aids could lead to deskilling of auditors. The theory suggests that, overall, effective automating of complex tasks leads to over-reliance on automation, which ultimately results in skill erosion first at the level of individuals and later for the profession as a whole. Deskilling due to IS automation has been witnessed with such contexts as accounting systems (Rinta-Kahila et al. 2018), knowledge management systems (McCall et al. 2008), and the aforementioned decision aids in auditing (Dowling et al. 2008). Then again, literature on automation bias (Parasuraman & Manzey 2010; Parasuraman et al. 1993) suggests that there is an additional critical factor behind the ill effects of automation, one related to complacency, a “feeling of calm satisfaction with your own abilities or situation that prevents you from trying harder” (Cambridge Dictionary 2018). It is possible that operators’ complacency and reliance on automation could encourage skill erosion, especially in contexts wherein high task complexity provides incentives for implementing highly reliable automation. While there has been academic interest in the effects of automation on human workers, the process in which organizational automation implementation causes deskilling of knowledge workers has not been studied.

In the ideal case, organizations would implement IS automation in their processes mindfully, in such a manner that the employees retain their expertise in the process that has been

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The literature uses the term “deskilling” to refer to two parallel but distinct phenomena (Orlikowski 1991): an occupation or industry not requiring as advanced a set of skills as before (e.g., in response to the introduction of technology, resulting in cost savings from hiring less skilled labor; see Braverman 1974) and a person becoming less skilled (e.g., on account of over-reliance on technology; see Arnold & Sutton 1998). From an organization’s perspective, the former effect is often intentional while the latter effect tends to be an unintended side-effect. In Paper III, we employ the concept in the latter sense.
automated but also gain more holistic understanding of its larger context since they no longer have to reserve a portion of their cognitive capacity for handling the process manually. A process of upskilling could ensue, with employees elevating themselves to a wholly new level of understanding without losing the essential practical know-how (Gallie 1991; Orlikowski & Barley 2001; Zuboff 1988). For instance, accountants have been found to mitigate the potential deskillning effect of ERP system implementation by learning new skills and redefining their work roles (Sayed 2006).

Ultimately, the manner in which systems are implemented has a direct impact on the sense-making of their users (Griffith 1999) and, hence, on how the users eventually react to their discontinuance. Indeed, the deskillning perspective puts IS discontinuance decisions in a new light: when IS implementation has caused skill erosion, the consequences of the system’s discontinuance are potentially more severe if absence of adequate technology creates a gap between users and their work tasks. One would expect this to create disruption not only for the users but also for the processes in which the users and the IS participate. If users have been deskilled, they and their organization will probably need to address a gap between task and skills (Agnew et al. 1997). The coping model of user adaptation (Beaudry & Pinsonneault 2005) is a useful framework for studying user adaptation to such disruptive IT events. The model suggests that after becoming aware of the IT event, users will appraise it as either an opportunity or a threat. This assessment is followed by secondary appraisal wherein the users evaluate the extent to which they have influence over three components with regard to the event: work, self, and technology. These assessments determine their selection of a coping strategy, which may entail (under opportunity appraisal) benefits’ maximizing / satisficing or (under threat appraisal) disturbance-handling and self-preservation. When the event involves automation being decreased through IS discontinuance, deskilled users would presumably form a threat appraisal and apply a specific coping strategy on the basis of the extent they may alter themselves (e.g., relearning), their work (e.g., forming new routines), and the technology (e.g., influencing the features of any new system).

3.4.4 Paper IV

The objective behind Paper IV was to investigate the impact of technology discontinuance on customers in the context of a specific retail self-service technology: self-checkout units. We set out to investigate the following research question: what are the effects of retail SCO service discontinuance on customer response? We were especially interested in changes in purchase behavior and service evaluation. Purchase behavior, which reflects the practical aspects of customer response, was captured in terms of a) basket size, a relevant and frequently cited metric for it (Bell & Lattin 1998; Liu 2007), and b) level of preference for paying in cash, which shapes consumers’ spending behavior (Hirschman 1979). Service evaluation represents customers’ overall experience and relational outcomes of SST use through a) customer satisfaction with the service (Meuter et al. 2000) and b) customers’ enjoyment of their shopping (Dabholkar & Baggozi 2002; Koufaris 2002).

In the context of consumer service technologies, Scherer et al. (2015) suggest that people who rely on a single method of delivery of services (be they human- or technology-delivered services) are less loyal to the service provider than are those who use multiple means of service delivery. Accordingly, changes that result in narrowing of the range of service-delivery options (e.g., discontinuance of a service technology) may be detrimental – in an effect opposite that whereby augmenting a service environment with a technology may benefit customer
relationships. This draws attention to the need to capture the end users’ beliefs related to the discontinued IT and the service environment. To this end, one can apply belief elicitation to capture the constellation of people’s salient beliefs and experiences associated with a given subject (Holden & Karsh 2010). This approach is embodied in the belief-adjustment model (Hogarth & Einhorn 1992), which has been successfully utilized in prior service research examining how consumers form opinions of changing service environments on the basis of their existing beliefs and new information (Dagger & Danaher 2014; Vanhoof et al. 2005). The model expresses the postulate that people update their beliefs by introducing new information to their existing belief set through a process of anchoring and adjusting, wherein an older belief or perception serves as an anchor in terms of which people judge when adjusting upon exposure to the new information. Thus, the resulting service estimations are highly influenced by the initial anchoring beliefs. This suggests that customers, when exposed to service changes, evaluate the new service environment against the backdrop formed by their anchor beliefs from before the change, creating adjusted estimations in accordance with their perceptions of the change. Since discontinuing an IT can be seen as downgrading the service environment, customers’ perceptions of the new situation may involve estimates below the anchor’s reference value, rendering their overall evaluation less favorable than the earlier one. Proceeding from this model and its applications in consumer research (e.g., Dagger & Danaher 2014), I posit that customers form their beliefs about an IT service through an anchoring and adjusting process when they are subjected to new information and experiences related to that service. I consider SST discontinuance as a source of new information that customers incorporate into their set of beliefs. The assimilation of new knowledge with existing beliefs translates into updated customer beliefs about the service in its new form and, thereby, into the end-user reactions to the IT discontinuance.

3.5 Collection and analysis of the data

Next, I discuss the methods of data-collection and analysis employed for the four papers.

3.5.1 Paper I

Since the objective for Paper I was sensitization to the various meanings IS literature has given to IS discontinuance, the study reported upon was a purely conceptual one based on a disciplined and comprehensive review of the literature (Paré et al. 2015) on the topic. The data were gathered through review and analysis of the current literature on it in line with the approach of Webster and Watson (2002). We commenced the project in October 2015 and conducted several rounds of literature searches, with the final one taking place in November 2017.

Data collection. We performed the initial search by using the following query for the Scopus database: (TITLE-ABS-KEY(“IS” or “Information Systems” or “IT” or “Information Technology”) AND (“Discontinuance” or “Discontinue” or “Discontinued Use”)). All told, this yielded 7,542 results. We then limited the search results to the English language and also excluded subject areas beyond the scope of our interest (e.g., medicine, biochemistry, and the environment). The subsequent search produced 473 results. Examining abstracts for the search items returned led to omission of studies that were irrelevant to the topic at hand. This left, in total, 72 studies to be analyzed in more detail. From that pool of studies, a further 39 in all were filtered out because either a) they did not actually address the IS discontinuance phenomenon, instead referring to it only in passing, or, b) although there was a claim of insight
into IS discontinuance, their focus was entirely on explaining continued IS use. Accordingly, the first search stage resulted in discovery of 33 studies that specifically addressed IS discontinuance. To complement this search, we performed the same query with Google Scholar, and it yielded two additional studies, which we hence added to the sample. In the second stage, we executed backward and forward citation reviews (ibid.) for the 35 studies identified in our search procedure. As we investigated these studies, we found references to additional potentially relevant papers, which our search queries had not captured. After this, we scanned our own academic libraries in search of other studies that might be eligible for consideration. Thus, the second stage resulted in adding 27 studies to our corpus. Finally, four further pieces were filtered out, because they were found to represent incomplete work: they were research-in-progress papers. The final sample from the search procedure consisted of 54 articles.

**Data analysis.** We compiled a conceptual matrix (ibid.) covering all 54 studies, wherein we compiled the information extracted on their methods, theory, empirical context, unit of analysis, and main findings, along with the IS characteristics considered. We also analyzed how the researchers defined, conceptualized, and operationalized IS discontinuance in their studies. Moreover, we tabulated the independent and dependent variables reported upon in the studies, to obtain a good overall sense of what kinds of constructs and relationships were investigated in those studies. Our elaboration of a contextualist analytical framework (Pettigrew 1985) guided this stage of the process, in which we focused on discriminating the paths IS discontinuance takes (i.e., process) and characterizing the meaning of discontinuance behavior (i.e., content) within that context.

### 3.5.2 Paper II

For Paper II, I conducted an in-depth case study taking a realist approach (Lyytinen & Newman 2008) to ascertain how the factory became “caught in between” the old and the new IS architecture.

**Data collection.** I collected the data for this study in three stages (see Table 1). Firstly, to gain general understanding of the situation and specify a research question, I conducted a group interview with the key IS managers at the factory. The second stage involved a series of semi-structured interviews with key personnel identified in the group interview. I formulated an interview protocol, using earlier literature on organizational IS change and IS discontinuance as a sensitizing device. The main themes for the protocol were the following: the informant’s perception of and relationship with the legacy system, his or her perceptions as to the decision to transition from the legacy system, and the complexities of the transition. When doing so was relevant, I allowed the interviews to make even substantial deviations from the interview outline. I took notes during the interviews and also allowed the informants to illustrate the process and system architectures on paper and via a flipchart. The process utilized snowball sampling: at the end of each interview, I asked whether the informant was aware of anyone else in the organization who could shed light on the topics of interest. This led to the identification of four additional individuals for subsequent interviews in this stage. Then, in the third stage, I conducted four more interviews. Two of these were follow-up interviews with second-round informants, and the other two were with new informants identified in the previous stage. This time, I took a more detailed look at the events that had led to the current IS architecture situation at EngineShop. To this end, I produced a new interview protocol, guided by the levels of analysis and socio-technical components in the PSIC model (ibid.). Applying the logic of temporal bracketing (Langley 1999), I organized the protocol in terms of three
periods: the time of the antecedent conditions from when the change was initiated (–2000–2005), that of the IS implementation projects and their context (2006–2010), and the time of subsequent system-development efforts and new replacement initiatives (2011–2018). All interviews were recorded and transcribed. In awareness that the IS change was perceived as a divisive issue in the organization and also that many of the events related to it had occurred quite some time in the past, I employed measures recommended by Klein and Myers (1999) and by Huber and Power (1985) to improve the data’s reliability. For instance, I requested to interview such people as would be especially knowledgeable about the topic and those who had held or were currently in relevant positions with respect to the events of interest. To offset the effect of potential informant biases, I asked to interview people who held contrasting perspectives or who knew about differing aspects of the topic. Furthermore, I assured the informants of the interviews’ anonymity and confidentiality, stressing that I would not disclose any information they did not wish to be recorded or reported. In all, the three data-collection stages yielded 147 pages of transcribed interview data, eight pages of fieldnotes, and various physical and digital exhibits related to the IS change.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Month</th>
<th>Job titles of interviewees</th>
<th>Interview length</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGE I: Orientation via a group interview</td>
<td>November 2017</td>
<td>Application Manager, Application Specialist, Factory Business Engagement Manager, Head of Engineering Applications, and Teamcenter Application Owner</td>
<td>40 minutes</td>
</tr>
<tr>
<td>STAGE II: One-on-one interviews</td>
<td>December 2017</td>
<td>Business-Unit Manager</td>
<td>54 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Head of Engineering Applications</td>
<td>58 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product-Group Engineering Tool and Process Manager</td>
<td>63 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teamcenter Application Owner</td>
<td>64 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Country IS Manager</td>
<td>60 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product-Group Product Development Manager</td>
<td>27 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory Business Engagement Manager</td>
<td>45 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application Specialist</td>
<td>50 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purchasing Manager</td>
<td>47 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application Manager</td>
<td>42 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Business-Unit Product Manager</td>
<td>54 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory Production Manager</td>
<td>52 minutes</td>
</tr>
<tr>
<td>STAGE III: Follow-up interviews</td>
<td>March 2018</td>
<td>Product-Group Product Manager</td>
<td>100 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Country IS Manager</td>
<td>81 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Manager</td>
<td>105 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory Business Engagement Manager</td>
<td>78 minutes</td>
</tr>
</tbody>
</table>

**Data analysis.** My goal was to build a process model of IS change at EngineShop that would explain how the IS change in question resulted in the factory getting caught in between old and new IS architectures. Therefore, I conducted a PSIC process analysis (Lyytinen & Newman 2008) using the ATLAS.ti software application. The PSIC model supports use of various strategies for making sense of process data (Langley 1999; Pentland 1999). Building a detailed narrative grounded in longitudinal process data is at the core of PSIC analysis, but the model extends further, offering readymade frames for visual mapping and temporal bracketing of
process data (Langley 1999) that can be helpful for transforming complex and disorganized data into more digestible material.

I began by familiarizing myself with the data – reading the transcripts and taking notes. This work was followed by constructing an overall narrative of EngineShop’s IS change, wherein I coded individual statements and paragraphs in the data that indicated critical events. Then, I built a more structured change description on top of the critical events through distinguishing the building-system (BS) and work-system (WS) narratives. Here, I identified gaps and balances between the components of Leavitt’s (1964) socio-technical model. On that basis, I coded the critical events to identify which socio-technical components they involved: task (T), actors (A), structure (S), or technology (Te). I examined the components’ mutual relationships and deemed them either to be balanced or to show gaps (e.g., a gap between technology and task in a work system is denoted as “WS: Te–T”). Moreover, I studied whether the resulting developments led to filling of the gaps or instead to the gaps persisting or even new gaps emerging. I then identified vertical interactions in the change process by connecting organizational and environmental events and conditions to the work- and building-system events, and I examined the antecedent conditions that formed the backdrop for the IS change. Finally, I created a graphical map of the IS change process (see Appendix A). The coding process was messy and iterative: I kept returning to the data after reflecting on and writing up the findings. I validated each event and assessed its impact by comparing and evaluating the informants’ reports (Lyytinen & Newman 2008). Furthermore, I applied some degree of interpretive analysis (Klein & Myers 1999) to reconcile the informants’ occasionally sharply contrasting perspectives.

3.5.3 Paper III

The objective with Paper III was to shed light on consequences of IS discontinuance for the discontinuing organization and its employees. For this purpose, we conducted a revelatory case study (Yin 2009) at AccComp, which had discontinued its highly automated accounting system.

Data collection. Data were collected in three stages between November 2016 and June 2017 (see Table 2). In the first stage, we conducted 13 initial interviews with accountants at AccComp, to understand their work tasks, how automation affected them, and how the employees perceived automation. We used a semi-structured interview protocol rooted in prior literature on accounting and automation. The discussion was allowed to flow naturally and to deviate from the outline if the informant wanted to elaborate on interesting issues. One such deviation led to the identification of our research topic: the downgrading of an IS from a fully automated system to a semi-manual one, along with the resulting effects. In the second stage, our objective was to gain better understanding of the context – the specific accounting process that previously has been automated and the type of IS used to automate it. For this, we conducted two interviews at “FamComp,” the company that had developed FamSyst and was its vendor. Our goal was to understand 1) precisely what makes the process so complicated that there is market demand for software specifically designed to automate it and 2) how FamSyst renders it automated. In the third and final stage, we returned to AccComp for follow-up interviews with those accountants who had used both the old (more automated) system and the new (less automated) one. We formulated a new interview protocol, based on the outcomes from the first two data-collection stages and the literature on automation and deskilling. The protocol was structured in terms of a timeline with the following stages: 1) the introduction and continued use of FamSyst at AccComp; 2) the discontinuance of FamSyst (including the
decision and reactions); and 3) post-discontinuance events (coping/recovery methods). To gain managerial perspective on the events, we interviewed the head of Finance Process Services (FPS) at the company and, after this, discussed our early-stage findings with her. In total, the three stages of data collection resulted in 249 pages of transcribed interview data.

Table 2. The data-collection stages for Paper III.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Company</th>
<th>Interviewees</th>
<th>Interview length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AccComp</td>
<td>13 accountants (incl. accountants 1 &amp; 2)</td>
<td>45–90 minutes/interview</td>
</tr>
<tr>
<td>2</td>
<td>FamComp</td>
<td>Sales manager</td>
<td>30 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CEO/owner</td>
<td>25 minutes</td>
</tr>
<tr>
<td>3</td>
<td>AccComp</td>
<td>Accountant 1</td>
<td>55 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accountant 2</td>
<td>51 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accounting manager</td>
<td>48 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Head of FPS</td>
<td>46 minutes</td>
</tr>
</tbody>
</table>

Data analysis. The collection and analysis of data were iterative and overlapped throughout the stages, with each stage always informing the subsequent one. In our analysis of the data, we applied open thematic analysis (Boyatzis 1998) in the ATLAS.ti software. The process involved familiarizing ourselves with the data by reading and taking notes, then systematically working through the data to inductively assign codes to the sections of the dataset that tied in with our research questions – e.g., material on automation, deskilling, coping, and automation’s discontinuance. Again, the process was iterative: we kept returning to the data and the codes after reflecting on the emerging themes and their relationships. We assigned both semantic and latent codes, added new relevant codes, combined existing codes into more appropriate ones that emerged, and split existing codes that were found to have more than one dimension or meaning. The emergent themes and their patterns were further analyzed and revised. For instance, we investigated the causal and temporal interdependencies among the perceived reliability of automation, trust, complacency, reliance, and deskilling. Finally, we reexamined the interview data to ensure that the final themes accurately represented the informants’ accounts.

3.5.4 Paper IV

For testing the causal relationship between SST discontinuance and customer response, we conducted a natural field experiment using three waves of survey with customers of two national retail chains: Retailer 1, which maintained its SCO implementation, and Retailer 2, which discontinued its SCOs.

Data collection. The first survey wave was in January 2013, after both retail chains had introduced SST. A link to an online questionnaire was e-mailed to a sample randomly selected
from among those customers who used their loyalty cards in the stores where the SCO service had been introduced (two Retailer 1 stores and one Retailer 2 store). This instrument identified the primary retailer for the customers in the sample, along with their background information. We conducted a follow-up round, with the same respondents, in May 2013, then another in October 2013, after the Retailer 2 store’s SST discontinuance. The second and third survey waves thus captured customers’ purchase behavior and service evaluation pre- and post-discontinuance, with the same set of questions. In addition, the form always included a section where the respondents could give free-form feedback related to SCOs, the survey, or any other topic of their choosing. In the final round there were 972 responses, for a response rate of 63.2%. After removal of duplicate responses (some respondents were in customer-loyalty programs with both retailers and had visited outlets of both during the sampling period so received the form from both retailers) and of forms from subjects who exhibited random or dishonest response behavior (e.g., giving the same response for every question), we ended up with a usable sample of 719 loyal customers from Retailer 1 and 173 from Retailer 2 who took part in all three rounds of the survey. We divided these customers into two groups: treatment-group customers, who had experienced the intervention effect of SST discontinuance (i.e., Retailer 2 customers), and control-group customers, who had not (i.e., Retailer 1 customers). Customer e-mail addresses were used as the key to connect the responses from a given individual across questionnaire rounds. The timeline of the foregoing events is presented in Figure 4. The final data-gathering event was to interview the manager of the Retailer 2 store that had discontinued SCOs. This interview was recorded and transcribed.

Data analysis. We used a two-period difference-in-differences (DID) model specification (Huang et al. 2012; Shi et al. 2017) to capture the causal effect of SCO service discontinuance with regard to the change in customer response within the treatment group. For instance, for basket size, we performed the following modeling for customers from both the treatment and the control group:

\[ BsktSz_{ht} = \alpha_0 + \alpha_1 TreatD_h + \alpha_2 ScoD_{ht} + \alpha_3 (TreatD_h \times ScoD_{ht}) + AX_h + \epsilon_{ht}^{Bsktsz} \]

In this equation, \( BsktSz \) is the variable corresponding to basket size, \( h \) represents the customer (from either the control or the treatment group), and \( t \) denotes the time period. \( TreatD_h \)
is a dummy variable that takes the value 1 for treatment-group customers, and $ScoD_{ht}$ is a dummy variable that refers to discontinuance of SCO service and has a value of 1 or 0, for the “post-” and “pre-” period, respectively, for customer $h$. $X_h$ is a vector of customer demographics, and $A$ is the corresponding coefficient. The error term $\varepsilon_{ht}$ is distributed normally. The main parameter of interest is $\alpha_3$, because it captures the change in the response of treatment-group customers post-SCO-discontinuance relative to the response of control-group members, whose focal stores did not discontinue SCO service. Thus, $\alpha_3$ captures the causal effect of SCO discontinuance on the basket size of the treatment-group customers between the pre- and post-SCO-discontinuance spans (as contrasted against the basket size of the control-group customers). The statistical model included corresponding equations for all four variables of interest – namely, basket size, amount of preference for using cash for payment, customer satisfaction, and shopping enjoyment. In addition, we performed supplementary analyses to rule out effects of any confounding factors. For this, we developed an alternate model with a sample consisting of random pairs of a control- and a treatment-group customer. Secondly, from these we selected a subsample of treatment- and control-group customers who were similar to each other in background variables by using the propensity score matching technique, then tested our statistical model with this sample. Finally, we evaluated the extent to which the customer feedback in our survey and our interview with the store manager support the statistical results.
In this chapter, I present the empirical findings reported in each paper featured in the dissertation. Then, in the final section, I summarize the results as a whole.

4.1 Paper I

The objective with Paper I was to provide construct clarity (Rivard 2014) with regard to the IS discontinuance phenomenon by sensitizing to the meanings it has been given in the IS literature. Our review and analysis of 54 studies showed IS discontinuance to be manifested as various, qualitatively distinct behaviors. We synthesized these behaviors into a conceptualization of IS discontinuance wherein five outcomes occur, each in a distinct stage in the IS use life cycle: rejection, regressive discontinuance, quitting, temporary discontinuance, and replacement. This conceptualization was then represented in a diagrammatic model of the IS use life cycle (shown in Figure 5). Rejection represents discontinuance behavior in the exposure stage: the user decides at the outset to reject the IS instead of adopting it. These rejection decisions tend to be based mostly on preconceptions and assumptions, in the absence of actual interaction between the technology and its potential adopter. The second behavior, regressive discontinuance (or the acceptance–discontinuance anomaly (Bhattacherjee 2001) occurs when the user has adopted the IS but decides to abandon it shortly after the implementation and initial usage. Expectation (dis)confirmation theory (Oliver 1977; Oliver & DeSarbo 1988) has been applied to explain this behavior: regressive discontinuance occurs especially when the actual IS use experience does not meet the user’s expectations formed prior to adoption. Quitting differs from both of these forms in that it involves bringing an end to a relatively long time of stable IS use, wherein use had become routinized to a certain extent. Next, in temporary discontinuance, the IS user takes a break or “vacation” (York & Turcotte 2015) from the IS by ceasing its use while intending to resume use sometime in the foreseeable future. The final behavior, replacement, typically involves a comparison between the incumbent IS and an alternative IS in the user’s environment. This form reflects the end of the incumbent IS’s use life cycle and the beginning of an alternative one. Despite the distinctive nature of each of these IS discontinuance outcomes, the literature was found to conflate them frequently, in some cases even treating them as interchangeable measures of the same theoretical construct.

Overall, our analysis suggests that considering the content, the process, and the context that shape the origins and outcomes of IS discontinuance decisions is crucial for gaining comprehensive understanding of the phenomenon. Content is embodied in the distinct forms that IS discontinuance takes, with each form representing a separate kind of behavior. In turn,
variation in the temporal occurrence of the forms is linked to the processual aspect of the behavior. Finally, the IS use context describes the IS artifact and the accompanying use conditions and motivations. For instance, mainly hedonic systems tend to create an immersive and satisfying user experience that can culminate in excessive use of the system and, ultimately, discontinuing use in order to improve one’s well-being (Ravindran et al. 2014; Turel 2016) – a situation very different from one wherein an employee abandons a work-routine system that is perceived as not efficient (Recker 2016). At the same time, unpredictable individual-specific, environmental, and organizational influences too can unexpectedly trigger discontinuance. Among these are major life events related to the IS user’s health or family situation (Hand et al. 2009) and sweeping economic and organizational changes that affect companies’ IS implementations (Power & Gruner 2015). In addition to acknowledging these factors, we address implications for theory, methods, and practice.

**Figure 5.** The IS use life-cycle model.

### 4.2 Paper II

For Paper II, I embarked on investigating the complexity of organizational IS discontinuance by digging deeply into the process and outcomes of replacing a major legacy system with commercial systems. My investigation revealed that case company EngineShop had become trapped between two IS architectures: it was unable to discontinue its legacy system in spite of having implemented two replacement systems. My process analysis uncovered sequences of events connected to the two local IS implementations as well as larger, organization-wide change programs that contributed to the factory’s state at the time of the study. Firstly, I found that horizontal factors (i.e., interactions within a single level) shaped this outcome on both work- and building-system level: decisions made both before and during the implementations determined the emergence of gaps in work and building systems. Some informants reported that, while some key systems had been modernized, the process reengineering potential of the change was not realized. Accordingly, operational needs to maintain the incumbent structures and processes while moving over to new systems resulted in several tradeoffs, wherein the new systems were modified to accommodate the existing processes and IT architecture. In addition, zero-sum-game interactions between the two new implementations shaped the outcome, with the SAP implementation sucking resources away from Teamcenter development. Thereby, the
performance of the latter suffered, and its integration was unsatisfactory. Secondly, vertical interactions across levels of analysis played a major role in the IS change: the top management defined the implementation goals and moderated project resources, in a pattern that continued after the implementations, stalling further development of Teamcenter. The environmental context too affected the outcome: while a slump in customer orders that arose from economic stagnation made it easier to implement new systems, the global economic climate at the same time imposed constraints on future IS development projects. This supported the legacy system remaining in place indefinitely. The process in its entirety is illustrated in Appendix A.

Overall, the IS change that had been expected to simplify and modernize EngineShop’s IS architecture actually rendered it more complex, produced less integration, and was accompanied by performance decreases. Since data did not flow as smoothly between systems as with the monolithic legacy system, the amount of manual work increased, since users now had to record the same data in numerous places. This created strong and persistent dissatisfaction among EngineShop’s workers. Still, from the perspective of the top management, the change was a success because it was considered a step toward realizing the global strategy, in that manufacturing of products could now be globally coordinated and division of tasks across geographical locations had been facilitated. These contrasting perceptions led me to extend the PSIC model with multiple interpretations of socio-technical systems, which depend on the level of analysis. This is illustrated in Figure 6, which takes the aggregate model shown in Appendix A further by unpacking the work-system events for each level of analysis. In the illustrations (Figure 6 and the diagram in Appendix A), gaps between the socio-technical components technology (Te), actors (A), task (T), and structure (S) are depicted as gray boxes connected by dotted arrows, whereas balances are shown via white boxes connected with solid arrows. Deepening of gaps or emerging of additional gaps between sets of socio-technical components is illustrated with a darker shade of gray in Appendix A. Figure 5 depicts differing socio-technical interpretations of the PDM work system before and after its replacement. The IS change was initiated by the global management, which saw that the incumbent legacy IS structures were not aligned with the new, globally oriented structures and strategy (S–Te gap). In contrast, the main concerns of IS managers at EngineShop were related to the legacy system’s end-of-life issues: the maintainability of the aging technology (T–Te gap) and the disappearance of expertise as older employees neared retirement (A–Te gap). Yet, from the engineers’ and some other managers’ standpoint, DG was an efficient and well-functioning system with strong future maintenance and development potential (balanced socio-technical system). Once the replacement system Teamcenter had been implemented, the global management deemed the work system to be balanced enough and did not assign any further development resources for Teamcenter, while, on the ground, engineers at EngineShop were struggling with poor performance (T–Te gap), low integration (S–Te gap), and resistance to change (A–Te gap). Hence, success in the Teamcenter and SAP implementations came with the cost of Teamcenter end users’ marginalization (Lyytinen & Newman 2015).

In sum, this case study uncovered complexities of organizational IS discontinuance that had not been fully captured in previous IS literature. Because the replacement systems implemented at the case factory had not been able to take over certain critical processes, the factory ended up caught in between the two system architectures. Taking advantage of the PSIC model, I identified the events that had led to this situation. I found that horizontal and vertical interactions throughout the process of discontinuing DG and implementing the SAP and Teamcenter ISs shaped this outcome greatly. The interaction and tug-of-war for priority
between the two implementation projects affected the success of the overall IS change. Opening the work system level of analysis to inspection assists in gaining deeper understanding of the multifaceted outcomes of legacy systems’ discontinuance.

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<tr>
<th>Aggregate View</th>
<th>Detailed View: Stakeholders’ Perspectives</th>
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<td>Work system events: PDM</td>
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<td>Factory end-users</td>
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**Figure 6.** Various socio-technical perspectives on EngineShop’s PDM system change.

### 4.3 Paper III

The motivation behind Paper III was a desire to examine the effects of organizational IS discontinuance from the angle of automation and its effect on worker know-how. Our case study laid bare the process by which deskilling develops and causes disruption when automation is discontinued, thereby necessitating active coping. We found that the deskilling that occurred while automated operations were in place remained unacknowledged by the workers and their organization over those years. Consequently, the organization was not prepared for disruptions that discontinuing the automation could cause. The discontinuance forced the latent deskilling to surface in the individual and organizational consciousness as it became apparent that the workers could not handle manual execution of the accounting tasks that previously had been automated. Disruptions to accounting processes ensued (see Figure 7).

We found that two key concepts connected to conducting a work task – **control** and **execution** of the task – help to make sense of our findings. Control reflects the supervisory part of workflow and has traditionally been discussed in terms of managerially supervision of workers’ performance (Anderson and Oliver 1987; Challagalla and Shervani 1996). However, here we applied the concept to analyze how workers govern their own work tasks. Different types of control include activity control that refers to the specification and monitoring of work-task activities, capability control that deals with maintaining and developing one’s skills and abilities, and output control that relates to monitoring the output quality (Challagalla and Shervani 1996). Execution, on the other hand, reflects carrying out the work task – the concrete execution of its procedures. Without control, it is impossible to conduct a work task, as one would not what activities it involves, which abilities it requires, and what are its desired outputs. We found that although the purpose of implementing FamSyst was to automate task execution while leaving human workers in control, the accountants gradually handed off task control too
to the automation. They relinquished **activity control** as they felt no need to understand what was happening under FamSyst’s “hood”; they gave up **capability control** as they stopped maintaining and developing their FAM know-how; and finally, they even loosened **output control** as they blindly trusted in FamSyst’s outputs and were later unable to manually produce tax reports on fixed assets. Thus, the task control slowly slid from workers to the automation software and its provider. We analyzed this process on multiple levels: environment level, organization level, and the cognitive level of individual workers. Regarding environmental factors, we found that implementing effective and reliable automation in a context of high task complexity created conditions favorable for deskilling. Organizational implementation practices had a key role in the process: AccComp allowed human workers to relinquish the task control to the automation to the extent that this became institutionalized, and the company never introduced effective measures of skill maintenance. At the individual level, workers’ firm trust in FamSyst contributed to the cycle of reliance and complacency, thereby leading to further skill erosion over time. Although FamSyst had a feature that exposed the logic of its functions, thereby allowing the accountants to maintain their understanding of the process, this feature was rarely used. The accountants described feeling relaxed about relying on FamSyst and found no compelling reasons to maintain or develop their related knowledge – a clear sign of automation complacency. The multilevel process described here is illustrated in Appendix B.

Furthermore, by examining the later events through the lens of coping theory (Beaudry & Pinsonneault 2005), we analyzed how the organization overcame the disruption. Our results included identifying a coping process – wherein coping emerged during and after the automation’s discontinuance – at the levels of individual workers, their team, and the organization. Prior to the actual discontinuance, the accountants saw the replacement of the automation-rich accounting system as an opportunity. They felt optimistic about it. During the transition, the accountants tried to communicate their wishes related to features for the new system, indicating that they envisioned having influence over **technology**. However, many of the requested features were not implemented, and the accountants became aware (at least by the post-discontinuance stage) that the new system would not be as automated as FamSyst and that they could not affect this. With that realization came a shift from optimism to perceiving the IS transition as a threat that had to be coped with. While emotion-focused coping was produced, in the form of complaining and passive acceptance, the accountants engaged in problem-focused coping too, since they could still alter their **self** and **work** to a certain extent. They adapted their work by reverse-engineering FamSyst’s logic into an Excel spreadsheet, exploited the old FamSyst interface to access the data still in that system (historical customer data), and spent more of their work time on manually performing the previously automated processes. Moreover, they adapted with regard to self by relearning the forgotten skills, principally by studying the FamSyst manual and tax-reporting legislation. At team level, the accountants collaborated and shared knowledge to overcome the emerging difficulties. Finally, at organization level, the AccComp management organized extensive training courses for the accountants after becoming aware of the deskilling that had occurred. The managers also applied changes in knowledge-distribution practices, designed to guarantee everyone’s adequate understanding of the processes. In this way, the organization recovered its FAM knowledge in response to the disruption caused by deskilling and the discontinuance of automated operations.
The paper presents a case of IS discontinuance wherein a latently developed “dark side of IS” phenomenon (Tarafdar et al. 2015), unintended deskilling of knowledge workers, became apparent in consequence of IS discontinuance. We showed how environmental context (task complexity and the IS effectiveness and reliability) and the organizational surroundings of the IS implementation (work roles and implementation practices) allowed that deskilling to take place and how the IS being discontinued made that deskilling manifest, with negative outcomes for the organization resulting in the short term. We also shed light on how the organization coped with the outcomes.

**Figure 7.** The surfacing of deskilling after discontinuing of automation.

### 4.4 Paper IV

In the work described in Paper IV, we investigated the effects of SCO discontinuance on customer response. Overall, we found support for two of our hypotheses (Figure 7 presents the results). Firstly, the discontinuance had a significant \( p \leq 0.01 \) negative effect on customers’ basket size, which may be related to inhibition of purchase behavior arising from a lower level of perceived service convenience. Secondly, we found that SCO discontinuance led to a significant decrease in customer satisfaction, which can be explained in terms of the process of belief-updating as characterized earlier in the thesis. Specifically, customers reassess the service by anchoring their new beliefs in relation to those formed when the SCO service was still available, and the evident contrast leads to a lower appraisal. Robustness checks performed with an alternative sampling technique and propensity score matching of demographic factors corroborate our findings. Moreover, qualitative evidence collected from customer feedback and our interview with the store manager lend support to our conclusions. To our knowledge, no internal or external events apart from the SCO discontinuance occurred that could explain the changes observed in customer behavior. In addition, our analysis indicates that continued SCO utilization brings rewards: we found increases in customers’ basket size and willingness to choose a payment card over cash within the control group (i.e., among the customers who did not experience SCO discontinuance).

Paper IV illustrates the effects of IT discontinuance in the context of retail self-service technology. Our empirical analysis demonstrates that customers react negatively to downgrading of their retail servicescape (Bitner 1992). From a theoretical standpoint, ours was the first study to explore the causal effects of IT discontinuance with regard to customer behavior. It has
practical relevance also: it is important that service providers account for potentially disruptive effects of IT discontinuance on their customers.

![Figure 8](image)

**Note:** ***p ≤ .01, n.s. p > .10

**4.5 Summary of findings**

Overall, the findings highlight the multifaceted nature of the IS discontinuance phenomenon and the complexity of organizational IS decisions. Each empirically oriented paper emphasizes the significance of multiple, contradicting perspectives on both IS implementation and IS discontinuance. These may vary greatly between an organization’s stakeholders. Collectively, the papers demonstrate well that organizational IS discontinuance decisions tend to have outcomes that come as a surprise after the discontinuance, with negative disruptions ensuing. The studies hence highlight the need for taking the aforementioned perspectives into account in organizational decision-making.

The “shape” of the body of work as a whole can be described thus: Paper I conceptualizes the IS discontinuance phenomenon by focusing on the meanings of the discontinuance outcome (the dependent variable). It also proposes generic process paths that IS discontinuance may take in the course of the IS life cycle. Paper II provides a thorough analysis of a legacy-system discontinuance process, and it offers in-depth discussion of a particular kind of organizational IS discontinuance outcome that reflects failed or partial discontinuance (an outcome I refer to as getting caught in between two IS architectures). Thus, papers I and II address organizational IS discontinuance in the conceptual sense and identify the processes in which the phenomenon occurs. In addition, Paper II ventures beyond the discontinuance event itself, for investigation of post-discontinuance processes that shed light on the complexity of discontinuing the legacy system in its entirety. Processes after the discontinuance itself are relevant also for Paper III, which examines the consequences of organizational IS discontinuance from a process perspective. In addition to explaining the process of automation deskillting the IS operators, it
identifies and unpacks a process in which deskillling that had remained latent surfaces after IS discontinuance, and it describes a subsequent coping process of overcoming the resulting disruption. Papers II and III thus examine the outcomes of IS discontinuance from the process perspective. Finally, Paper IV applies a variance-based approach to investigate the aggregate outcomes of organizational IT discontinuance from the customer angle. It reports on research that applied robust methodology to unravel causal relations between SST discontinuance and customer behavior.
5. Discussion and conclusions

The overall contribution of this dissertation is to identify and address important but frequently overlooked elements at the core of the IS discontinuance phenomenon. As output of taking these as research areas, the four papers included in the dissertation offer several specific theories, representing a broad spectrum in Gregor’s (2006) typology, that all could be employed in IS research to advance our understanding of both IS discontinuance and various related phenomena. Paper I provides an analytical Type-I theory: its purpose is to answer a “what is...” question by analyzing and describing scholars’ current understanding of IS discontinuance. Papers II and III, in turn, present building of Type-II theories to explain the phenomenon of interest. Such explanatory theories tell “what is, how, why, when, and where” without presenting any testable propositions. Finally, Paper IV proposes a Type-IV theory for explanation and prediction of the relevant phenomenon; i.e., it provides predictions, testable hypotheses, and causal explanations. Taken together, the four papers lay out a Type-I theory for high-level understanding of the phenomenon – namely, an analytical framework for IS discontinuance (depicted in Figure 9). Covering the research areas identified and the contributions of each paper, it provides a general description of the nature of (organizational but also generic) IS discontinuance and what it encompasses as a phenomenon. Specifically, IS discontinuance has antecedents that can lead to multifaceted actualization of discontinuance behavior through various processes. As IS discontinuance takes place, outcomes emerge through post-discontinuance processes. The theories proposed in the individual papers sit within this high-level framework. The model yields a more nuanced understanding of the IS discontinuance phenomenon, upon which future research can build. With this general framing outlined, I can now proceed to discuss my contributions to theory and practice in more detail.
Figure 9. The framework for analysis of IS discontinuance.

5.1 Theoretical implications

In a theoretical sense, with this dissertation I have attempted to draw together the somewhat fragmented research on the topic of IS discontinuance by improving the related construct clarity (Rivard 2014). This is important because, if we wish to stimulate and improve discussion and debate within this research field, it is paramount that the actors operating in the domain continuously strive to develop a shared understanding of the central concepts and related terminology. This can be achieved by means of clear conceptual definitions for the constructs (ibid., p. vii). While the term “IS discontinuance” has been applied for various distinct behaviors, on both individual and organization level, the theory-focused literature review (Paré et al. 2015) reported on in Paper I compiled the findings from prior research under a single, inclusive framework in which IS discontinuance can take five main forms over the IS use life cycle. Moreover, the dissertation serves this project by more fully illuminating the process of organizational IS discontinuance through disentangling the threads of complex IS change processes from the discontinuance perspective. Finally, I have probed the outcomes of organizational IS discontinuance by examining its effects on organization-internal and consumer IS end users (i.e., workers and customers both). The research presented here is the first to explore how IS discontinuance may result in disruption of day-to-day work in organizations and to establish a causal effect of IT discontinuance on customer behavior. In doing so, it should serve as a significant reference point for future research into the consequences of organizational IS discontinuance. As a whole, the dissertation proposes a coherent analytical theory of IS discontinuance (see Figure 9) that covers the salient aspects of the phenomenon with a single framework that can be used for both positioning further studies and pointing to areas for additional research on the topic.

The findings from the four studies in the dissertation project make a strong case for considering the IS discontinuance perspective when one is examining organizational IS transitions. Understanding the challenges and outcomes of discontinuing incumbent systems may have a key role in explaining IS implementation outcomes. More generally, my work taken alongside previous IS discontinuance literature suggests that the IS discontinuance perspective can be of
assistance in studying various IS use phenomena, whether at the level of individual users’ behavior or in organizations’ decision-making, be the application of the technology in question for utilitarian or for hedonic purposes. Hence, I found support for a dual-factor conceptualization of IS continuance and IS discontinuance (Turel 2015a) wherein contradicting intentions and behaviors may coexist. The case study reported upon in Paper II exemplifies the utility of this approach. The case organization had persistent intentions to discontinue the legacy IS architecture and even regularly undertook initiatives to follow through on those intentions, yet the organization was unable to realize the discontinuance and even exhibited ambivalence as to what should be done with the legacy system. Accordingly, accounting for both continuance and discontinuance intentions and behaviors simultaneously is necessary when one is attempting to explain the corresponding IS outcomes. Paper III similarly demonstrates how concentrating on IS discontinuance in our research helped us understand how the discontinued IS had affected worker skills, shedding more light on the outcomes of IS implementation. Had we simplistically considered only the implementation of the new system, we would have been left with only limited insight as to the process that led to the unanticipated effects. The increasing ubiquity of technologies suggests that understanding IS discontinuance will only grow in importance – the higher the rate of new systems’ introduction and integration, the greater the need to discontinue incumbent systems will become. Rising complexity of socio-technical networks could complicate evaluation of the possible externality effects of IS discontinuance. On the other hand, it might transpire that the systems of the future are increasingly modular, in a deviation from the more traditional evolutionary approach. Such development could make it easier to dismantle incumbent IS architectures in a controlled manner (Serrano et al. 2014). In any case, it is clear that enhancing theoretical understanding of IS discontinuance remains an important area for research.

Overall, my findings suggest that the role and the meaning given to IT/ISs in an organization is an important consideration, for it is closely connected to the relationship between humans and technology, and thereby to the future we are headed toward. This is illustrated well in Paper IV, whose discontinued system is unlike the information systems presented in papers II and III in that it is a physical IT. When its plug was pulled from the wall, customers lost a tangible technological tool that used to mediate their interaction with the retail organization. While loss of a tangible tool can cause disruption, the negative consequences may be no less severe in cases of intangible systems that are visible “merely” as interfaces on a computer screen. This boils down to the questions of what the IS does for its users and what meanings the users assign the IT. Considering such questions is rapidly becoming more relevant in light of the growing interwovenness of humans and technology in systems. Paper III illustrates the perils of treating accounting automation as a black box by charging the system with the associated process while not ensuring the preservation of human skills: the organization and its accountants set themselves up for eventually facing the consequences of eroding knowledge capital. The paper provides novel analytical tool for examining the interplay between human workers and automation through dividing the workflow activities into control and execution of the task. The case demonstrates that while using IS automation for mindless task execution can be justified, it can turn out dangerous if human workers choose to relinquish mindful task control as well. Zuboff (1988, 1991) discussed this dilemma in terms of a contrast between using IT to “automate” and to “informate,” arguing that IT has a unique capacity to “informate” its users by translating the tacit knowledge embedded in the automated process into explicit textual information. This resonates with the discussion of organizations’ use of IT as a
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substitute for human labor vs. a complement to it (Hitt & Snir 1999). In a purely substitutive implementation of knowledge-work automation, workers are likely to outsource much of their cognitive load to the automatic IS, whereas a complementary implementation is focused on the opportunity for upskilling of workers. This points to an immensely important question: how to prevent erosion of skills when automating knowledge work. While automating physical work can make the heretofore tacit aspects of the work processes explicit and allow the operators and their organization to become informed (Zuboff 1988, 1991), knowledge work is already informed by definition. Therefore, combating the negative effects of automation is likely to present a mounting challenge as the percentage of knowledge-work-dominated occupations rises. End users’ automation-related complacency and tendency toward mindless reliance on automation is likely to exacerbate this dilemma, since these users are likely to resist returning to manual modes of operation after having “tasted” the irresistibly light load from outsourcing their thinking to the technology. Such a phenomenon is strikingly visible in Paper III, where we describe the accountants’ negative reactions to withdrawal of automation as reverse Luddism. Instead of fearing that machines would “steal their jobs,” these knowledge workers invited the automation to take care of the cumbersome and inconvenient work tasks. Unfortunately, this came with the cost of gradual loss of their procedural knowledge of the now-automated task.

Another important implication that can be highlighted is related to process theorizing from case studies (Langley 1999). My work demonstrates that a process perspective is sorely needed for understanding complex IS change, including IS discontinuance. The benefits of process theorizing are especially apparent in the complex case described in Paper II: capturing all relevant factors with factor-based models would have been next to impossible, while building a purely interpretative and subjective story from the case would have severely limited the conclusions that one could draw from the work. The PSIC model (Lyytinen & Newman 2008) and particular process theorizing strategies (Langley 1999; Pentland 1999) helped me to obtain a more objective, well-structured understanding of the case without losing much of its richness and interesting nuances. I showed how using the model does not need to be limited to describing the IS change process alone – it can also capture relevant post-implementation or post-discontinuance processes. In a similar vein, Paper III demonstrates how simultaneous consideration of multiple levels of analysis can yield a far richer understanding of the phenomenon of interest than focusing on events occurring at just a single level.

Papers II and III are especially noteworthy for offering a novel treatment of socio-technical theory (Leavitt 1964) as the cornerstone of the PSIC model. Paper II shows the PSIC approach’s socio-technical model in a new light, in that the findings suggest that the model could be extended to account for various alternative perspectives on socio-technical system stabilities. In fact, such extension is proposed in that paper, where the work system level is disaggregated into three sublevels that represent individual alternative interpretations of socio-technical balance. Open-boxing of this sort yields richer understanding of the IS change process and its outcomes, revealing any vertical misalignments that might get in the way of IS change. Interestingly, findings from the case study discussed in Paper III lead to a similar insight when reflected upon in terms of the socio-technical theory. Specifically, a gap had emerged between actors and task in the work system: the accountants, by relying on automation, lost the skills required for conducting FAM. The organization was not aware of the gap, however. It became apparent only when discontinuing the automation revealed latent deskilling. Even then, the accountants themselves refused to see this gap for what it was – they interpreted it as a gap
between task and technology. In their view, the new system was insufficient and not fit for purpose. Therefore, I suggest that future research on complex IS change processes should consider whether diverging interpretations of socio-technical systems play a role in explaining IS change processes and their outcomes.

Finally, with this dissertation I have taken a critical realist approach to IS research. By doing this, I have sought to answer calls “to create generalizable theories explaining precisely why an IS phenomenon occurred in a particular setting” (Wynn & Williams 2012, p. 805). The case studies conducted for papers II and III provide rich and detailed accounts of the occurrence of the respective IS phenomena of interest in the form of process theories. Moreover, the empirical consumer study for Paper IV serves as an attempt to overcome the usual shortcomings of positivist factor-based models, by exemplifying methodological triangulation that illuminates the causal mechanisms of a phenomenon and supports robustness of the model’s results. These research efforts demonstrate the benefits of taking a critical realist stance. Accordingly, I hope that my work will further facilitate the acceptance of critical realism as a useful epistemological and methodological approach in the realm of IS research.

5.2 Practical implications

From the managerial perspective, it is vital to understand that users and organizations may discontinue a core (or supporting) IS at any of several stages in its use life cycle, with the motivations and triggers for discontinuance varying with the content, process, and context of the discontinuance-oriented IS use behavior (Pettigrew 1985). The characteristics specific to the system, its use environment, and the stage in the IS use life cycle can each contribute greatly to how decisions to discontinue are shaped. Awareness of this is vitally important for any organization that wishes to understand the landscape related to the IS it provides, preclude their premature discontinuance, or fully consider how best to discontinue an incumbent system.

Another important aspect is that of the consequences of IT/IS discontinuance decisions for workers, business processes, customer relationships, and customer behavior. In this dissertation, I have probed the types of responses that discontinuance may elicit from the employees and customers of an organization. The findings provide concrete input that can support managers’ decision-making on whether to continue or discontinue a given system and on the factors to take into consideration.

I have looked at the effects of IS discontinuance in three distinct contexts: resource-planning, design, and production systems’ implementation at a manufacturing company; use of accounting software within an IT service organization; and self-service technology in grocery retailing. My findings from all of these contexts highlight the importance of organizations’ implementation practices. Among the more important outcomes from examining the discontinuance decisions in my empirical work is outlining of problematics uncovered in relation to the earlier implementation of the technologies that were discontinued. These implications can further inform managers. Among the dilemmas revealed are treating IT / an IS as a substitute for vs. complement to human labor and the customization of systems to accommodate existing processes vs. strategic process-reengineering. While self-checkout facilities can be seen as IT that automates the work of cashiers, accounting software automates knowledge work in the organizations in such a way that tacit knowledge once possessed by the employees becomes embedded in the software’s code. The discontinuance cases I have presented demonstrate that the manner in which the IT’s role is communicated to customers or embedded in work roles and
routines shapes the end-user reactions to its eventual abandonment. Another of the considerations is one connected with operation- and process-related aspects of IS implementation, calling into question whether the organizational processes and structures should be shaped around the core IS of the organization or, rather, the IS implementation should always be subordinate to existing and emerging structures. This dilemma gains salience when the IS has grown so large and embedded that it starts to shape the organization and not the other way around.

Through detailed accounts of organizations that have encountered and struggled with the issues and tradeoffs discussed above, I have uncovered the factors, interactions, and consequences that I present in readily digestible form here for decision-making managers’ consideration. In essence, my dissertation supplies a collection of previously untold stories about IS change in organizations (Ramiller & Pentland 2009), specifically concentrating on IS discontinuance and IS replacement processes, along with their outcomes. These stories can help managers to understand reasons behind unexpected and disruptive outcomes of IS discontinuance, thereby aiding them in preparing and equipping their organization to prevent or mitigate the potential negative effects.

5.3 Limitations and avenues for future research

This work brings with it certain limitations that must be acknowledged. The first is related to the conceptualization of IS discontinuance. Paper I provides a very generic treatment of the phenomenon. The model for the IS use life cycle proposed in the paper does not explicitly account for behaviors that fall into the gray area between continuance and discontinuance, such as neglect of use or the partial discontinuance described in Paper II. However, the model is not intended to do this; its purpose is to serve as a generic framework for making sense of the current IS discontinuance literature, one on which further research can build in examining distinct IS discontinuance behaviors in depth.

Secondly, whereas this dissertation is among the first forays into research charting the outcomes of organizational IS discontinuance decisions, it sheds light on those outcomes mostly in the short term. While Paper II does provide insights also into long-term effects of IS discontinuance, papers III and IV are limited to investigation of the effects with a relatively short time horizon, so they give only suggestions as to some degree of persistence of the observed effects. Hence, it would be enlightening to gather evidence on whether the disruptive effects of discontinuing technologies such as the ones considered in the dissertation endure or wane over time, and which conditions affect this.

Also, papers II and III represent single-case studies. This could limit generalizability. Specifically, the mechanisms identified (whether related to oscillations in socio-technical balances of IS implementation projects, deskillling, coping, or something else) may not exist in other kinds of organizations. An interesting continuation from this research, then, would be to conduct comparative case studies examining the phenomena surrounding large legacy systems and office automation in terms of how the embeddedness of those systems shapes the respective organizations. Examples are cross-organization comparison of the realization and outcomes of dismantling legacy IS architectures, where the organizations may be either similar or different, and research into long-term effects of automation on skills in two or more comparable organizations that have used the same software for automating operations. Moreover, a more in-
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A depth look at managers’ practices in implementing automation at knowledge-work organizations could inform as to how deskilling might be prevented.

The case studies are limited also in terms of the temporality of the events at the case companies. While the events discussed in Paper III were relatively recent at the time of the data-collection, a large share of those reported on in Paper II were 8–12 years in the past when the interviews were conducted. It is possible that informants did not recall all events that significantly influenced the discontinuance processes and their outcomes. As always in such work, some informants might have displayed personal biases in how they recollected and interpreted the events. While I made conscious efforts to offset such potential sources of bias (e.g., by interviewing various organizational stakeholders, at multiple levels in the companies), informant biases nonetheless could have affected the findings. However, I believe that any such effects have not led to significant distortion. Overall, this temporal consideration with papers II and III represents a tradeoff between gaining accurate, timely access to the events while they are taking place and capturing the long-term effects of those events.

In an ideal scenario, one would conduct a longitudinal case study by collecting data along the entire timeline of relevant events contemporaneously with their occurrence. For instance, with Paper IV it would have been interesting to start collecting data related to customer behavior before the SCO systems were introduced. However, such research settings tend to be difficult to set up. Still, scholars could attempt to tap into organizations’ IS discontinuance processes when they are first mooted and then track subsequent developments to capture their long-term effects. This could yield a more detailed and accurate picture of how such decisions may shape and disrupt organizations and their stakeholders. Along similar lines, a fundamental limitation with Paper IV is that we had to rely on self-reporting for data on customers’ purchase behavior. Accurately reporting basket size might be a difficult task for the average consumer – arguably, more reliable conclusions could be drawn from actual sales data. While we could not gain access to such data, future research could investigate the effect of IT service discontinuance on purchase behavior by looking at stores’ sales data.

Finally, the complex structures of today’s organizations pose a challenge for any researcher attempting to comprehend the logic systems within which they operate. In each of the empirical studies, the discontinuance events were outcomes of organizational decision-making that took place at several levels in the company. For instance, the global matrix structure of Paper II’s case organization when coupled with the complex IS infrastructure rendered interpreting the interactions and outcomes of contextual factors and the IS change projects especially challenging. A similar issue presented itself with regard to papers III and IV: the gulf between the organizational unit doing the decision-making and the part of the company where the decision was executed and given concrete form increased the complexity of assessing the outcomes and implications in both cases. Ascertaining and accounting for the significance of the multilevel nature of modern organizations in conditions of IS change calls for the development of novel theoretical tools. One such attempt was made with Paper II, wherein I proposed an extension to the PSIC model.

My empirical work demonstrates well that, although the concept of organizational IS discontinuance often ties in with a process in which something better or more advanced replaces the incumbent system (Furneaux & Wade 2010, 2011), it can equally represent divestment or outsourcing of activities or downgrading of IS architecture. Some particularly interesting paths for research involve examining how such divesting or downgrading is going to affect technology assimilation more broadly. Will it facilitate larger-scale acceptance of IS-enabled real-time
solutions by pruning out less useful systems, or might discarding such systems contribute to stalling of the overall progress made? While that is for future research to address, the dissertation has offered a starting point for the discussion.

5.4 Summary of conclusions

In this dissertation, I have drilled down into an under-researched information-system-related phenomenon, IS use discontinuance, with the primary objective of improving the understanding of organizational IS discontinuance decisions. This quest was guided by three main research questions: 1) What does IS discontinuance mean?; 2) How do organizational IS discontinuance processes unfold?; and 3) What are the outcomes of organizational IS discontinuance decisions? These questions were addressed in the four studies presented: one conceptual inquiry and three empirical investigations. The findings from those studies indicate that IS discontinuance is a multifaceted phenomenon and that we have taken only the first steps toward reaching comprehensive understanding of it. The model of IS discontinuance in Figure 9 gives a general overview of what IS discontinuance involves and identifies the core components for consideration in study of this phenomenon. Regarding the overall meaning of IS discontinuance, I identified at least five distinct forms that discontinuation behavior can take over the course of the IS use life cycle. Moreover, I call attention to a manifestation in which discontinuance occurs only partially, thereby leading the discontinuing entity to implement a new system while mired in simultaneously maintaining an old one. When examining the process leading up to an organization’s IS discontinuance, I saw how complex the network of interacting events, activities, decisions, states, and surrounding context can be, clearly requiring nuanced explication of the process. This indicates that taking a process approach to studying organizational IS discontinuance can deepen both theory- and practice-oriented understanding of the phenomenon. My final conclusions stemmed from illuminating examinations of the outcomes of organizational IS discontinuance in which I unbundled the effects of discontinuing legacy system components, automated accounting systems, and self-checkout facilities. The results indicate that such discontinuance decisions have primarily harmful effects that create disruption for the IS end users. However, it is highly significant that perceptions of these effects may depend on the stakeholder and the level of analysis. Moreover, in the case of “rolling back” IS automation, an organization can channel the disruptive effects into positive developments through organizational learning. With insights in these areas, this dissertation offers a more nuanced understanding of organizational IS discontinuance and of IS discontinuance behavior in general. Thereby, it sows the seeds for further work to advance our understanding of various other phenomena connected with IS use.
References


References


References


Appendices
<table>
<thead>
<tr>
<th>Environment</th>
<th>Organization</th>
<th>Human worker</th>
<th>Worker cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAM conducted manually, workers learn FAM legislation changes in training courses.</td>
<td>FamSyst introduced, enables the separation of control from execution with the capacity to take care of execution and leave control to workers.</td>
<td>One worker assigned as FamSyst key user: takes courses and shares FAM knowledge; others participate voluntarily.</td>
<td>Workers possess control over the process that they execute; they maintain their FAM skills through hands-on work.</td>
</tr>
<tr>
<td>FAM legislation is notoriously complex in Finland, especially regarding tax reporting. This incentivizes companies to find automated solutions to facilitate FAM.</td>
<td>No complaints from the tax office as FamSyst produces tax reports accurately. When the tax office requires further information, FamSyst provides it without effort.</td>
<td>No organizational initiatives are launched to ensure that workers retain task control, especially in terms of activity and capability control. Relinquishing task control to automation becomes institutionalized.</td>
<td>Perception of FamSyst's reliability and high cognitive fit in the context of high task complexity leads to high satisfaction with handling task execution to automation.</td>
</tr>
<tr>
<td>Continued automation implementation</td>
<td>Automation introduction</td>
<td>Automation discontinuation and resulting disruption</td>
<td></td>
</tr>
<tr>
<td>Automation discontinuation and resulting disruption</td>
<td>Automation discontinuation and resulting disruption</td>
<td>Automation discontinuation and resulting disruption</td>
<td></td>
</tr>
<tr>
<td>The process of deskilling, disruption, and recovery.</td>
<td>Automation discontinuation and resulting disruption</td>
<td>Automation discontinuation and resulting disruption</td>
<td></td>
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<tr>
<td>Disruption brings deskilling into organizational awareness. This is followed by organizational initiatives that aim to recover workers' FAM skills and to regain task control.</td>
<td>Disruption brings deskilling into organizational awareness. This is followed by organizational initiatives that aim to recover workers' FAM skills and to regain task control.</td>
<td>Disruption brings deskilling into organizational awareness. This is followed by organizational initiatives that aim to recover workers' FAM skills and to regain task control.</td>
<td></td>
</tr>
<tr>
<td>FamSyst evokes deep trust among workers. They start to relinquish task control to automation.</td>
<td>Perceptions of automation's reliability in the context of high task complexity leads to high satisfaction with handling task execution to automation.</td>
<td>Trust</td>
<td></td>
</tr>
<tr>
<td>Workers increasingly rely on FamSyst and feel competent; they no longer attempt to accumulate and maintain their FAM knowledge; the control is increasingly shifted to automation.</td>
<td>FamSyst evokes deep trust among workers. They start to relinquish task control to automation.</td>
<td>Trust</td>
<td></td>
</tr>
<tr>
<td>Over time, relinquishing the control to automation leads to deskilling, which is not a problem for the organization as long as the system is in place. Thus, deskilling remains latent and unacknowledged.</td>
<td>Workers increasingly rely on FamSyst and feel competent; they no longer attempt to accumulate and maintain their FAM knowledge; the control is increasingly shifted to automation.</td>
<td>Trust</td>
<td></td>
</tr>
<tr>
<td>The Accomp management decides to simplify their IT infrastructure and discontinues automation implementation.</td>
<td>Over time, relinquishing the control to automation leads to deskilling, which is not a problem for the organization as long as the system is in place. Thus, deskilling remains latent and unacknowledged.</td>
<td>Trust</td>
<td></td>
</tr>
<tr>
<td>Both control and execution is required again from accountants as Accomp lacks this capability because of worker deskilling. Results in organizational disruption.</td>
<td>The tax office complains about mismatches between accounting and tax reporting.</td>
<td>Trust</td>
<td></td>
</tr>
<tr>
<td>Knowledge-sharing practices altered to ensure the maintenance of skills.</td>
<td>The tax office complains about mismatches between accounting and tax reporting.</td>
<td>Trust</td>
<td></td>
</tr>
</tbody>
</table>

Appendix B
PART II: THE ORIGINAL RESEARCH PAPERS
Paper I

Soliman, W. & Rinta-Kahila, T. Toward a Refined Conceptualization of IS Discontinuance: Reflection on the Past and a Way Forward.

Unpublished manuscript.
Toward a Refined Conceptualization of IS Discontinuance: Reflection on the Past and a Way Forward

Abstract

Interest in studying information systems discontinuance has increased during the current decade, yet, there is no consensus on what it actually means. In situations where a phenomenon is multifaceted and ill-defined, analytic theorizing is strongly invited. Based on a review of current literature and guided by a contextualist analytic framework, we reveal that there exist at least five distinct forms of IS discontinuance: rejection, regressive discontinuance, quitting, temporary discontinuance, and replacement. These forms vary in process and content and occur at different temporal points in the IS lifecycle. After elaborating these distinctions, we discuss their theoretical, methodological and practical implications.

Keywords

IS theory; IS discontinuance; IS lifecycle
1 Introduction

Analytic theories (i.e., classificatory frameworks) are a fundamental first step in advancing any scientific discipline, since they answer the basic question of ‘what is’. Such theories are typically referred to as theories of classification, which, unlike traditional modes of theorizing, focus primarily on ontological aspects of the phenomenon under study, i.e., they are motivated by the questions ‘what is it that we are studying?’ and ‘what are its constituent components?’. Exemplary work of this nature in the information systems (IS) literature includes Gregor’s work on the nature of ‘theory’ (2002, 2006), Schwarz and Chin’s (2007) elaboration on the nature of ‘IS acceptance’, as well as Lee et al.’s (2015) work on the nature of the ‘IS artifact’, to name a few. For instance, at the peak of technology acceptance research – i.e., studies based on technology acceptance model (TAM, Davis 1989) and unified theory of acceptance and use of technology (UTAUT, Venkatesh et al. 2003) – Schwarz and Chin (2007) proposed to take a “reflexive pause” and reexamine what the term IT acceptance actually meant. Their resultant classificatory theory helped clarify the IT acceptance concept, and more importantly, was a foundation for richer and more sophisticated future empirical research on IT acceptance (Schwarz et al. 2014). Following this line of reasoning, we believe that we have reached a point where we need a reflexive pause and a reexamination of what we mean by ‘IS discontinuance’.

Despite the fact that IS discontinuance is a commonly occurring phenomenon, it has received far less attention among IS scholars when compared with the voluminous adoption and acceptance research. For instance, it is acknowledged that organizations discontinue their seemingly beneficial information systems for various reasons that may not be comprehensively explained with theories of IS adoption or usage (Power and Gruner 2015). In a similar fashion, individual users make decisions to discontinue their previously adopted ISs, and such behavior often involves motivations that are largely unacknowledged by the major IS adoption/usage theories (e.g., Turel 2015). Also, industry reports show that low user retention and high churn rates are among the most critical challenges digital businesses face today (Gryta 2014; Yoree 2014), which poses a major existential threat both to large firms – such as Twitter (Cashmore 2009) and Facebook (Griffin 2016; Sulleyman 2018) – as well as to less affluent ones (Chen 2015). Thus, gaining a better understanding of what IS discontinuance means and how it may unfold is critical for ensuring the success of any system.

Interest in IS discontinuance is not a novelty. In fact, scholars have sensitized and studied it since the early 1990s. However, it is only recently (specifically, from 2010 onward) that IS scholars have started to pay more attention to the phenomenon. Yet, compared to the ample contributions made to the adoption/continuance literature (see, e.g., Legris et al. 2003; Shaikh and Karjaluoto 2015), the number of studies on discontinuance is incomparable. But more importantly, there is no clear consensus on what IS discontinuance means beyond the simple notion of ‘not using’ an IS. In fact, the term discontinuance is used in the IS literature to mean conceptually and temporally different things. For instance, the term describes
abandoning a technology shortly after adopting it (aka acceptance-discontinuance anomaly, Bhattacherjee 2001) as well as quitting a technology after extended periods of continued use (Maier, Laumer, Weinert, et al. 2015). Still, the term is used to describe the act of permanently discontinuing a technology in order to switch to a competing alternative (Spiller et al. 2007), in addition to the act of vacationing (i.e., temporarily taking a break) from a technology with the possibility of returning back some time in the future (York and Turcotte 2015). Somewhat surprisingly, even moderating one’s technology use by using it less has been referred to as IS discontinuance (Maier, Laumer, Eckhardt, et al. 2015). Hence, while IS discontinuance appears to have multidimensional meanings in the literature, no systematic efforts have been made to provide a conceptualization of what these different meanings refer to.

Considering the criticality of IS discontinuance to the IS field, and the ambiguity in its characterization, we believe there is a need for analytic theorizing on the IS discontinuance phenomenon. Such effort would yield an illuminating reference point for future research on the topic. We believe that gathering and synthesizing findings from previous research under an inclusive classificatory framework (Gregor, 2006) can help us to obtain a much-needed conceptual clarity on the phenomenon. Hence, the objective of this study is twofold. First, based on a disciplined literature review, we answer the question what IS discontinuance means. Second, based on the resulting answer, we elaborate its implications to theory and practice.

Against this backdrop, the paper is organized as follows: in Section 2 we discuss our analytic framework. Section 3 describes our methodological approach. In Section 4, we present and discuss the main findings. In Section 5, we provide implications for theory and practice and discuss our study’s limitations and directions for future research. The final section provides a conclusion.

2 Analytic framework

In our attempt of making sense of the various literature on IS discontinuance, we developed a framework emphasizing the importance of process, content, and context. This framework is consistent in spirit with Pettigrew’s (1985) contextualist approach. Although contextualist analysis is commonly used to make sense of empirical investigation (e.g., Napier, Mathiassen and Robey, 2011), we find the distinction a contextualist framework makes between process, content, and context (Pettigrew 1985) extremely beneficial to our analytic purpose (see, e.g., Middleton et al., 2014). In fact, in his treatise of the contextualist approach, Pettigrew (1985) noted that it was merely “an idealized view never to be completely realized and certainly to be tuned according to the vagaries and surprises of different contexts” (p. 63). In this sense, we adapt the framework, and particularly the notions of process, content and context as sensitizing devices (Gregor 2006) in our analysis. In the following subsections, we briefly discuss and clarify these three building blocks.
2.1 Process

A process in contextualist sense reflects the “interdependent, sequence of actions and events which is being used to explain the origins, continuance, and outcome of some phenomena” (Pettigrew, 1985, p. 64). Broadly speaking, IS discontinuance has been commonly represented as the final stage in the technology use life cycle (Swanson and Dans 2000), temporally following the adoption and continued use stages (Furneaux and Wade, 2011; Maier et al., 2015). These sequences reflect an archetypical life cycle process, with its phasic transitions through inception, growing and maturing, before its eventual termination (Van de Ven 1992; Van de Ven and Poole 1995). For instance, the user transformation model by Maier et al. (2015) describes a process that begins with an IS being adopted, after which it transits to being continuously or repeatedly used, and as the process matures, usage is eventually discontinued.

Then again, Rogers (1962; 2003) describes a five-stage decision-making process in which the diffusion of an innovation may occur. These stages include knowledge, persuasion, decision, implementation, and confirmation. The first two stages precede adoption, as the potential adopter becomes aware of the innovation’s existence and finds (persuasive) information about its characteristics – generally speaking becomes exposed to it. This is followed by a decision to adopt or reject the innovation. If the outcome is adoption, the user moves to implementation which may include activities like installation, configuration, and training of use. Finally, the user assesses whether the innovation fulfills the expectations set for it and evaluates his/her satisfaction with it. A full system use life cycle starts to take shape when we extend Roger’s process model with the one by Maier et al. (2015). The fulfillment or exceeding of expectations and high satisfaction experienced in system adoption are typically good indicators of a user moving to the state of continued use (Bhattacherjee 2001), which may include sporadic, routinized, habitual, or even excessive use behavior. Finally, user would move to discontinued use by terminating system usage. Figure 1 outlines the aforementioned process.

<table>
<thead>
<tr>
<th>EXPOSURE</th>
<th>ADOPTION</th>
<th>CONTINUED USE</th>
<th>DISCONTINUED USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Persuasion</td>
<td>Implementation</td>
<td>Continuation</td>
</tr>
<tr>
<td>• First exposure</td>
<td>• Adoption</td>
<td>• Installation</td>
<td>• Sporadic use</td>
</tr>
<tr>
<td>• Awareness</td>
<td>• Information seeking</td>
<td>• Configuration</td>
<td>• Routine use</td>
</tr>
<tr>
<td>• Trialing</td>
<td>• Training</td>
<td>• Training</td>
<td>• Habitual use</td>
</tr>
<tr>
<td>Decision</td>
<td>Confirmation</td>
<td>• Analysis</td>
<td>• Excessive use</td>
</tr>
</tbody>
</table>

**Figure 1. Key stages in IS use lifecycle** (Maier, Laumer, Weinert, et al. 2015; Rogers 2003)

Our initial conceptualization (i.e., pre-understanding, Butler, 1998) of the process was largely influenced by the ‘exposure → adoption → continued use → discontinued use’ process. Specifically, this generic process view can help to conceptualize the various phases technology usage goes through from initiation until termination (Van de Ven 1992; Van de Ven and Poole, 1995). In particular, we believe that adopting such generic process view enabled us to construct a framework that captures both the static and dynamic nature
of IS discontinuance phenomenon (Shaw and Jarvenpaa 1997; Van de Ven and Poole 2005). However, Rogers notes that a user may reject or discontinue the innovation already in any of the five stages that precede continued use. Accordingly, as the reviewed literature will reveal later, IS discontinuance takes several other forms (i.e., content) that may follow different paths (i.e., process).

2.2 Content

One cannot understand a process in the absence of its content. Content may be described as a reflection of how a certain phenomenon transforms in substance as it transits through the phases of a change process (Napier et al. 2011). For instance, continued IS use behavior has been suggested to encompass qualitatively different aspects, i.e., frequency, duration, intensity, and comprehensiveness of use (Turel 2015a; Venkatesh et al. 2008). In our case, we conceptualize content as the various forms IS discontinuance takes as it occurs at different stages in a typical IS usage life cycle. When investigating any of these forms, one can conceptualize and operationalize them in terms of behavioral intentions or actual behavior. This is an important division to consider as it relates directly to the content of the study. On the one hand, realization of intentions into actual behavior is not always certain or straightforward, questioning the validity of intentions as proxies for actual behavior (Limayem et al. 2007; Schwarzer 2008). On the other hand, sometimes examination of intentions rather than behavior, can be well-justified if, for instance, intention formation is seen as a method of self-therapy or self-regulation (e.g., Turel 2015). This methodological notion brings up the importance of the IS use context. For instance, in utilitarian IS use contexts, realization of discontinuance intentions may be abruptly by habit (Bhattacherjee et al. 2012) or inertia (Polites and Karahanna 2012), or because the user suddenly decides to replace the incumbent system without any prior intentions to do so, if a better alternative emerges. By contrast, in hedonic use contexts desires or impulses may override otherwise strong intentions to discontinue excessive system use (Soror et al. 2015; Turel 2016). We discuss this further next.

2.3 Context

Whereas process and content shed light on the sequence of events that explain the origins, continuance, and outcome of a particular phenomenon; context emphasizes salient aspects in the surrounding environment that shapes and is shaped by the process under study.

For the purpose of our analysis, we focus primarily on two salient and interrelated dimensions shaping IS use context: immediate use context, and system type. Immediate context reflects the surroundings that the system use takes place in, for instance whether the system is used in organizational or non-organizational setting. Moreover, we divide systems into utilitarian and hedonic types (van der Heijden 2004), depending on what is their original purpose and typical nature of use. While the use of utilitarian ISs can occur in either professional work environments (e.g., enterprise-class systems) or private leisure contexts (e.g., mobile banking or map services) their use is typically argued to be mainly driven by extrinsic motivational factors,
e.g., their perceived usefulness (Davis 1989; Karahanna et al. 1999). Hedonic ISs by contrast, are largely
driven by intrinsic motivations, e.g., the perceived enjoyment of spending time online or playing a game (van
der Heijden 2004; Lin and Bhattacherjee 2010). While the use of hedonic systems occurs mainly in non-
organizational leisure environments, they can also be utilized within the organizational context, for instance
in the form of gamification components that provide a fun way of improving productivity (Blohm and
Leimeister 2013; Hamari et al. 2014). Hence, along with these two dimensions, we can see four largely
distinct archetypical IS use contexts (Table 1).

The reader should note that this is merely an idealized framework for analytic purposes and that boundaries
between these contexts are not as sharp as the archetypical framework purports, and in real life contexts
the lines between them may blur. For instance, what is known as mixed systems (Gerow et al. 2013) or
dual-purposed IS (Wu and Lu 2013) represent a class of IS that “have combined features from utilitarian
and hedonic systems such that productive use and sense of fun can be realized simultaneously” (Gerow et
al., p. 361). While this is indeed a limitation of the framework, it still offers a useful classification to
conceptualize four largely dissimilar IS use contexts. Indeed, this framework represents an answer to
previous research calling for ways to classify IS types/contexts. In fact, Wu and Lu (2013), for a lack of
better options, adopted a trichotomy to distinguish different IS types/contexts following the 80/20 “rule of
thumb”, which argues that “a system is classified as utilitarian if it is used in a work or education environment
to improve job or school performance more than 80 percent of the time, or as hedonic if it is employed in
the home for fun and relaxation more than 80 percent of the time, or as dual-purposed if the first two
conditions are not met” (p. 155).

An inherently contextual concern is the level of analysis. Considering that decisions to discontinue IS use
occur on both individual and organizational levels, we need to distinguish these contrasting levels of
analysis. While on the individual level, users abandon systems they have previously adopted and used
based on individual reasoning and/or emotions, organizational level IS discontinuance is usually an outcome
of collective and strategic decision-making that affects all those parts of the organization that are interacting
with the system. Consistently, the literature shows that individual and organizational decisions are very
different in nature (Maier, Laumer, Weinert, et al. 2015; Williams et al. 2009), and typically different theories
are applied when studying each. A notable exception is DOI (Rogers 1962, 2003), which, as in the IT
adoption research (Jeyaraj et al. 2006), has been utilized on both individual and organizational levels.
<table>
<thead>
<tr>
<th>System type</th>
<th>Immediate context</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Organizational</strong></td>
</tr>
<tr>
<td>Utilitarian IS</td>
<td>(Context-1) U-IS use in the workplace (e.g., ERP; group support systems). This context covers utilitarian IT/IS use within organizations. Both individual- and organizational-level of analysis are expected to be studied.</td>
</tr>
<tr>
<td>Hedonic IS</td>
<td>(Context-3) H-IS use in the workplace (e.g., gamified organizational systems). This context covers hedonic IT/IS use within organizations. Both individual- and organizational-level of analysis are expected to be studied.</td>
</tr>
</tbody>
</table>

Table 1. Four Archetypical IS Use Contexts

3 Methodology

3.1 Literature review

We provide a detailed discussion on the review procedures in Appendix A. Nonetheless, in this section, we briefly explain our review procedures. As our purpose was to conduct a predominantly theoretical literature review (Paré et al. 2015), it is important to highlight that our review represents a disciplined, rather than systematic, endeavor (Rowe, 2014). Gregor (2006) emphasizes this position when she chooses relying on "considerable literature" rather than systematicity in developing her analytic classification of theories (p. 619). That said, our main objective has been to investigate how the IS literature has addressed the topic of IS discontinuance. To ensure that our review is as comprehensive and inclusive as possible, our search queries inclusively targeted all IS/IT studies containing the keywords “Discontinuance”, “Discontinue”, and “Discontinued Use”. Furthermore, and consistent with Webster and Watson's (2002) recommendations, we incorporated a backward and forward citation reviews in our search procedure. Altogether, this procedure resulted in the final sample of 54 relevant studies published between 1991-2017 that specifically discuss IS discontinuance. The selected studies are listed in Appendix B, and Appendix C provides a descriptive overview of the sample.

3.2 Conceptual analysis

Having identified the relevant studies for review in the search phase, we initiated our analysis phase. Our objective at this phase was twofold. First, to sensitize with the different meanings attached to the term 'IS
discontinuance’ keeping in mind its multifaceted temporal connotations. Second, based on the resulting answer, to suggest areas for future research. Thus, we compiled a conceptual matrix (Webster and Watson 2002) of the 54 studies, where we extracted information about methodology, theory, empirical context, unit of analysis, and IS characteristics used for each study. Moreover, we analyzed how discontinuance has been defined, conceptualized, and operationalized in the studies and made notes of other relevant issues, such as interesting findings. Where relevant, we tabulated the independent and dependent variables reported in the studies to get an overall understanding of what kinds of constructs and relationships had been investigated in those studies.

Using our analytic framework as a sensitizing device, we analyzed the process, content, and context of each study. As we sought to develop a clear conceptualization of the IS discontinuance behavior, the processual synthesis of our analytic framework played a key role in achieving this goal. The primary question that occupied our thought while reviewing the literature has been: What does IS discontinuance mean at different stages of the IS lifecycle? In line with Schwarz and Chin’s (2007) etymological investigation of the ‘IT acceptance’ concept, we strived to (a) unfold the different meanings the term takes across the studies, and (b) anchor these meanings to the IS lifecycle discussed in Section 2.

Regarding process, we aimed to identify the temporal stage in which IS discontinuance behavior takes place. We applied the generic process described in our analytic framework, i.e., ‘exposure → adoption → continued use → discontinued use’ (Figure 1), bearing in mind that IS discontinuance may also occur through various other paths (Rogers, 2003). For instance, we found that while some studies focus on discontinuance that occurs shortly after the adoption stage, others focus on discontinuance after extended periods of continued use. In terms of content, we studied the meaning and implications of the behavior, e.g., whether the discontinuance decision means abandoning the system permanently or temporarily; whether the decision concerns the incumbent system alone or it incorporates the adoption or consideration of an alternative system; and whether the study focuses on intentions or behavior. Finally, we classified the studies according to their context, i.e., the use context (work or home), the type of the system (utilitarian or hedonic), and the level of analysis (individual or organizational).

Analyzing each article in the lines of these questions led us to identify distinct forms of IS discontinuance that form conceptually and temporally different behavioral outcomes. We present these findings in the next section.

4 Findings

Consistent with the origins of technology acceptance research stream (Davis, 1989), utilitarian systems in the organizational use context (i.e., context 1) emerged as the dominant area of interest as altogether 16 studies situate within work or study context where the focal system is provided for the users by their occupational institution. However, also personal and hedonic motivations of system use (i.e., context 4) are
gaining increasing momentum as the recent attention in social networking services has spawned altogether 15 studies on SNS discontinuance, all of them published within the last five years. Also, utilitarian systems in non-organizational contexts (i.e., context 2) are getting attention, including ISs such as online grocery shopping and location-based mobile services. While the discontinuance of home and mobile Internet has been a popular topic in the previous two decades, it is possible that this trend is already turning downwards as in developed countries Internet is being increasingly considered as a ubiquitously used basic commodity rather than a system meant for a specific purpose. As an interesting notion, despite the dominance of organizational context in the selected studies, most of them actually investigate the phenomenon on the individual level of analysis (i.e., the IS user is an individual rather than a collective), leaving only nine studies that address organizational level discontinuance decisions. Despite the soaring popularity of gamification, and the recognition that “organizations frequently have difficulty sustaining user engagement with a gamified information system” (Suh et al. 2017, p. 268), we found no studies on IS discontinuance in this context (i.e., context 3).

Regarding content, we observed various forms of IS discontinuance in the literature where it has been referred to as intention to discontinue, discontinued use, quitting, switching intentions, un-adoption, churning, and several others. Out of the 49 empirical studies in our sample, altogether 32 capture these outcomes in terms of actual behavior, while 17 in terms of intentions.

We examined the processes that produced the identified discontinuance forms in the studies, and we were able to connect each form to one (or in some cases several) of the three general stages in the IS use lifecycle: exposure, adoption, and continued use. Following the logic of temporal bracketing\(^1\) (Langley 1999), we found that the identified forms could be classified into five general categories, depending on their process and content. Table 2 illustrates the different forms discontinuance can take during a typical IS lifecycle. We dedicate the following five subsections to discuss these different forms IS discontinuance identified in the literature.

<table>
<thead>
<tr>
<th>Discontinuance form</th>
<th>Terms used to describe the phenomenon in the IS discontinuance literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejection</td>
<td>Continuous non-adopter (Zhu and He 2002); Outright rejection (Cenfetelli 2004); Rejection (Cenfetelli 2004; Cenfetelli and Schwarz 2011; Miller et al. 2009; Tully 2015; Zhu and He 2002); Resister (de Graaf et al., 2017).</td>
</tr>
<tr>
<td>Regressive discontinuance</td>
<td>Discontinued use (Tully 2015); Early discontinuance (Aggarwal et al. 2015); Rejecter (post-adoption, de Graaf et al., 2017).</td>
</tr>
</tbody>
</table>

\(^1\) Temporal bracketing is an analysis strategy for processual data. It is a technique used to temporally decompose a phenomenon into its constituent components in a successive manner, “without presuming any progressive developmental logic” (Langley, 1999, p. 703)
<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quitting</td>
<td>Abandoning (Geri and Naor-Elaiza 2008); Decreased IT implementation (Power and Gruner 2015); Disadoption (Hogan et al. 2003); Discontinuance (Aggarwal et al. 2015; Boukef and Charki 2014; Cho 2015; Cooper 1991; Geri and Naor-Elaiza 2008; Recker 2016; Zhu and He 2002); Discontinuance intentions (Turel 2015b, 2016); Discontinued adopter, continuous non-adopter (Zhu and He 2002); Discontinued use (Boukef and Charki 2014; Chesney and Lawson 2013; Coursaris et al. 2013; Hand et al. 2009; Hoxmeier and DiCesare 2000; Khan et al. 2015; Kim et al. 2008; Kim 2011; Miller et al. 2009; Pollard 2003; Power and Gruner 2015); Discontinuer (de Graaf et al. 2017); Discontinuous usage behavior (Maier, Laumer, Weinert, et al. 2015); Discontinuous usage intention (Maier, Laumer, Eckhardt, et al. 2015; Maier, Laumer, Weinert, et al. 2015); Disenchantment discontinuance (Parthasarathy and Bhattacharjee 1998; Prendergast and Marr 1995); Inactive user (Coursaris et al. 2013); Quitting (Salo and Frank 2017; Turel 2015b); Quitting intention (Lu and Gallupe 2016); Un-adoption (Whitacre and Rhinesmith 2016).</td>
</tr>
<tr>
<td>Temporary discontinuance</td>
<td>Discontinued adopter, returning adopter (Zhu and He 2002); Reinvention (Zhu and He 2002); Stalling (Pollard 2003); Rest-break (Ravindran et al. 2014); Suspended activity (Ravindran et al. 2014); Technological pause (Rosenbaum and Wong 2015); Temporary discontinuance (Cho 2015; Geri and Naor-Elaiza 2008; York and Turcotte 2015); Vacationing (York and Turcotte 2015).</td>
</tr>
<tr>
<td>Replacement</td>
<td>Backsourcing (Whitten et al. 2010); Churning (Khan et al. 2015); Discontinuance intention (Furneaux and Wade 2010); Discontinuous usage intention (Maier, Laumer, Eckhardt, et al. 2015; Maier, Laumer, Weinert, et al. 2015); Intention to use the new system (Polites and Karahanna 2012); Replacement discontinuance (Parthasarathy and Bhattacharjee 1998; Spiller et al. 2007); Replacement intention (Furneaux and Wade 2011, 2017); Switching intention (Bhattacharjee et al. 2012); Switching behavior (Bhattacharjee et al. 2012; Whitten et al. 2010; Ye, D. Seo, et al. 2006).</td>
</tr>
</tbody>
</table>

Table 2. Different Forms of Discontinuance

4.1 Rejection

The concept of IT rejection may be traceable to the roots of technology acceptance and innovation diffusion research when the central question was why some employees refuse to adopt a system that would presumably make their work more productive (see e.g., Davis, 1989; Rogers, 2003). While we are aware that some might not consider rejection as a form of discontinuance in the technical sense of the word (since the user did not adopt the innovation after all), for the sake of “analytic completeness” (Gregor, 2006, p. 631), we still include it as one potential outcome of post-exposure. Although our review procedure garnered only a limited number of studies on IS rejection (Cenfetelli 2004; Cenfetelli and Schwarz 2011; Tully 2015; Zhu and He 2002), we note that a richer body of research could be found elsewhere under terms like ‘user resistance’ (see Ali et al., 2016 for a detailed review on the subject). We treat rejection as a special case of IS discontinuance since such process emphasizes a lack of actual interaction between the technology and
its potential users. IS discontinuance in the form of rejection may be seen as a two-stage process, beginning
with exposure and immediately ending with a rejection decision. Rogers (2003) has discussed this process
when he noted that after an individual is exposed to a new innovation (be it an IT, a tool, or even an idea),
he/she “may mentally apply the new idea to his or her present or anticipated future situation before deciding
whether or not to try it” (p. 175). As such, a rejection decision is often made based on mere expectations
and assumptions. The archetypal process for IS rejection takes the form:

\[ \text{exposure} \rightarrow \text{rejection} \]

All of the IS rejection studies included in our review focus on utilitarian IS at both individual (Cenfetelli 2004;
Cenfetelli and Schwarz 2011; Zhu and He 2002) and organizational levels (Miller et al. 2009; Tully 2015).
On the individual level of analysis, Cenfetelli (2004) refers to the phenomenon as ‘outright rejection’ and
highlights that such behavior is likely to occur when a user experiences the unfortunate combination of the
presence of ‘high inhibitors’ and ‘low enablers’. More specifically, adoption is unlikely to take place for an IS
that combines high levels of inhibiting/negative attributes (e.g., intrusiveness) and low levels of positive/enabling attributes (e.g., information quality, Cenfetelli, 2004; Cenfetelli & Schwarz, 2011). In a
similar vein, Tully’s (2015) study shows various forms of organization-level discontinuance decisions and
illustrates how these decisions made sense at the distinct stages of the use lifecycle/process, with pre-
adoption rejection being one of them when the system was considered incompatible with previous practices
and needs of the organization. Sometimes IS adoption fails if it lacks the commitment of the staff or the
support of the management, as illustrated by Miller et al. (2009) who highlight the importance of gaining
both individual and organizational level support. In their study, the implementation of a computer aided
design (CAD) system in a construction project ended up being rejected because the staff were not convinced
about its usability and benefits to their work.

Thus, studies on rejection suggest that the key impetus for IT rejection is rooted in pre-adooption expectations
and perceptions about the IT itself. The main emphasis is on the balance between enablers and inhibitors
of adoption, highlighting the importance of perceived compatibility with the user’s needs. Effective use of
apt communication channels to provide knowledge and persuasion for the user (Rogers 2003) would thus
be paramount in overcoming the rejection hurdle from happening at the exposure stage.

4.2 Regressive discontinuance

Regressive discontinuance reflects a decision to discontinue an IS shortly after a first-hand use experience.
Bhattacherjee (2001) introduced the term ‘acceptance-discontinuance anomaly’ to describe a behavior
where “some users discontinue IS use after accepting it initially” (p. 352). Abrahm and Hayward (1984)
explain that regressive discontinuance generally happens when a user bases the initial adoption decision
on misapprehensions about innovation characteristics, user’s own capabilities, or consequences of use.
From a process perspective, the key distinguishing characteristic about regressive discontinuance is that it occurs shortly after the adoption stage, before user enters the continued use stage where the use could become routinized. Hence, an archetypical process for this type of discontinuance follows the form:

\[ \text{exposure} \rightarrow \text{adoption} \rightarrow \text{regressive discontinuance} \]

Probably the most recognized theoretical explanation for this phenomenon comes from the expectation (dis)confirmation theory (EDT, Oliver, 1977; Oliver & DeSarbo, 1988). In its original form the theory posits that satisfaction (resulting from positively disconfirmed expectations) is the key antecedent to repurchase behavior; while dissatisfaction (resulting from negatively disconfirmed expectations) is key to complaining and non-repurchase intention. Thus, researchers applying these core EDT ideas to IS contexts have argued that prior to adopting a certain technology (i.e., at the exposure stage), users form certain expectations, and discontinuance would occur when their firsthand experience (i.e., at the adoption stage, after implementation and confirmation, Rogers 2003) proves to be below these expectations (Bhattacherjee 2001; Chang 2013; Lee 2010; Zhao et al. 2015).

Interestingly, while a significant number of IS discontinuance studies refer to acceptance-discontinuance anomaly (Bhattacherjee, 2001), only three studies in our sample have actually captured this form of discontinuance (namely, Aggarwal et al. 2015; de Graaf et al. 2017; Tully 2015). In line with EDT, Graaf et al. (2017) find that some adopters of a ‘home robot’ regressively discontinued2 it after a short period of initial use if the robot performed tasks not excepted from it. On the other hand, Aggarwal et al. (2015) show how “early discontinuance” may stem from misalignment between users’ self-perception and actual IT skills. The study by Aggarwal et al. (2015) illustrates how medical representatives high in self-perceived IT skills but low in actual IT skills adopt new technology fast but also discontinue it very quickly after the adoption and first trials. This finding highlights the importance of considering user characteristics along with the ones of innovation. Furthermore, it is suggested that misapprehensions about user’s own capabilities (Abraham and Hayward 1984) may trigger rapid adoption of a technology, those same misapprehensions may then cause its regressive discontinuance.

On the organizational level of decision-making, Tully (2015) illustrates how one firm adopted an IT platform but abandoned it shortly after that due to incompatibility with its needs. Specifically, the employees did not understand how the system would help the organization to achieve its goals, and the system was discontinued only a few months after its adoption. Thus, it appears that in line with EDT, disconfirmation of users’ expectations takes a key role regarding discontinuance decisions. Once the IS has been adopted, a negative disconfirmation may trigger regressive discontinuance. Somewhat surprisingly, most of the studies referring to the acceptance-discontinuance anomaly appear to address a form of discontinuance that happens at a much later point in time, reflecting what is best described as ‘quitting’.

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2 It is worth noting that these authors refer to this behavior as rejection in their study, while calling pre-adoption rejecters “resisters”.

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4.3 Quitting

Quitting is perhaps the most recognizable form of IS discontinuance, and it is in fact the most researched form of discontinuance in IS research; more than 50% of the reviewed articles focus on this form of discontinuance. Here, the purpose of discontinuance is to abandon the IS altogether after a period of continued use, such as quitting the use of Facebook (Maier, Laumer, Eckhardt, et al. 2015; Maier, Laumer, Weinert, et al. 2015; Turel 2015b) or making an organizational level decision to abandon a certain technology (Power and Gruner 2015). While quitting is frequently referred to as discontinuance or discontinued use, Whitacre and Rhinesmith (2016) use the term ‘un-adoption’. Other terms have been used as well, including ‘disadoption’ (Hogan et al. 2003), ‘dropping’ (Danaher 2002; Lemon et al. 2002), and ‘continuous non-adoption of discontinued adopters’ (Zhu and He 2002). However, we find that the behavior of discontinuing an IS intendedly indefinitely (i.e. with the intention of not taking it back into use, at least at the time the quitting decision is made) is best described with the term ‘quitting’ (Lu and Gallupe 2016; Turel 2015c, 2016; Vaghefi and Qahri-Saremi 2017).

From a process perspective, the key distinguishing factor between regressive discontinuance and quitting is whether or not a user has made a transition from the adoption stage to the continued use stage. As such, an archetypical process for IS quitting follows the form:

\[ \text{exposure} \rightarrow \text{adoption} \rightarrow \text{continued use} \rightarrow \text{quitting} \]

Typically, research focusing on this form of discontinuance investigates how and why discontinuance happens using theoretical lenses beyond the often-cited expectation disconfirmation theory, and Bhattacharjee’s (2001) notion of acceptance-discontinuance anomaly. Accordingly, the studies in our sample leverage a wide range of theories, most often cited being diffusion of innovations, technology acceptance model, uses and gratifications, and theory of planned behavior. Considering that quitting is the most studied form of IS discontinuance, it is not surprising that both individual and organizational levels of analysis have been covered in all the different contexts of our analytic framework (with the exception of context 3, i.e., hedonic IS inside workplace).

On the individual level, it appears that system performance, institutional support, and social environment have key roles in explaining the discontinued use in context 1, i.e., productivity enhancing work systems (Pollard 2003; Recker 2016). Recker (2016) suggests that intentions to quit using an inventory replenishment system are determined by the competing positive and negative beliefs about system performance. On the other hand, Pollard (2003) finds that while low reliability and poor task-technology fit predict discontinuance, the presence of a “champion” user prevents it.

In context 2, i.e., utilitarian systems used outside the workplace, quitting is often explained by ‘disenchantment’ (de Graaf et al. 2017; Parthasarathy and Bhattacharjee 1998) or ‘dissatisfaction’ with the system itself or the quality of service it facilitates (Hand et al. 2009; Hoxmeier and DiCesare 2000; Lehrer
Such disenchantedness is more likely to happen with late adopters, as they may rely more on internal sources of information, like friends and family, regarding system’s benefits (Parthasarathy and Bhattacherjee 1998). Interestingly, Prendergast and Marr (1995) find no support for the occurrence of disenchanted discontinuance in the context of banking self-service technologies – they argue that the discontinuance of some users is better explained by diffusion saturation, which resonates with Cooper’s (1991) finding that accumulating experience of system use inhibits its discontinuance. Expectedly, technology breakdowns (Park et al. 2012) and changing user needs (Lehrer 2015) have been found to trigger users to quit their IT use. However, these decisions are often shaped by environmental factors like social influence (Kim et al. 2008; Park et al. 2012). Salo and Frank (2017) focus specifically on the effect of the IS use environment on use behavior, and their findings suggest that users are more likely to entirely quit IS use if negatively perceived IS incidents happen indoors rather than outdoors or in a vehicle. Also major life-events were found to render the system useless in the case of online shopping (Hand et al. 2009).

The research on hedonic systems used outside the workplace (context 4) seems to exclusively focus on SNSs, most prominently Facebook. Satisfaction and dissatisfaction with the system play key roles also in this context. However, an interesting division can be observed within these studies, as some focus on the functional aspects of the technology and others address the consequences of system use on the individual’s psychological welfare. When studying Twitter usage, Coursaris et al. (2013) found that compared to continuers, discontinuers had different motivations for adopting the system in the first place, and this distinction determined users’ post-adoption behavior. While continuers’ adoption decisions were initially motivated by favorable characteristics of the system such as relative advantage and popularity, discontinuers were incentivized by the potential for social interaction, which, however, the system did not offer them to satisfying extent, causing them to discontinue using it (p. 73). By contrast, other studies consider the psychological burden from SNS use (aka, the dark side of IT) in the form of technostress (Luqman et al. 2017; Maier, Laumer, Weinert, et al. 2015), social overload (Maier, Laumer, Eckhardt, et al. 2015), SNS fatigue (Ravindran et al. 2014; Zhang et al. 2016), exhaustion (Luqman et al. 2017), as well as frustration (Wirth et al. 2015). Dissatisfaction with SNS is often attributed to the aforementioned forms of psychological burden, and it has been found to invoke discontinuance intentions (Wirth et al. 2015; Zhang et al. 2016). On that note, findings on how Facebook users cope with disturbances caused by their system use are especially interesting. In addition to significantly reducing system usage time, the coping techniques include two distinct levels of quitting the system use: deactivating Facebook account, and deleting the account for good (Cho 2015; Ravindran et al. 2014). In this context, also guilt feelings from excessive SNS use have been repeatedly found to contribute to SNS discontinuance intentions (Turel 2015b, 2016; Vaghefi and Qahri-Saremi 2017).

The organizational level of analysis understandably focuses mainly on context 1 (i.e., utilitarian IS in the workplace), and there the fit between the IS and organization’s strategy is paramount. Echoing Tully’s (2015) findings, Power and Gruner (2015) find that companies abandon seemingly beneficial and current inter-
organizational IT systems when the system implementation is no longer in line with the firms’ strategies. However, while Tully finds that the shortly perceived misfit between the IS and organizational strategy caused a regressive discontinuance of the system, in Power and Gruner’s study systems that used to have a good fit with strategy are rendered incompatible with it due to organizational and economic changes. Moreover, also costs and operational disadvantages were identified as reasons for IT discontinuance. Furthermore, Fürstenau et al. (2016) investigate why organizational shadow systems get discontinued and find that systems with narrow scope of use and low functional scope are more likely to get abandoned than those with higher organizational embeddedness. Moreover, changes in IT architectures and organizational conditions sometimes render systems useless if they are not robust against such changes. Boukef and Charki (2014) and Charki et al. (2017), by contrast, shed light on the ethical and legal reasons for discontinuing organizational systems: if the system use in not in line with the company’s values or the rule of law, it may be discontinued. In addition, Tully’s (2015) study awoke the question of how quitting decisions relate to the extent of continued use: firms that adopted and continued using the system stayed in the cycle of continued use with varying success. For example, in one firm, the use of the platform remained limited because the employees found it rather complex to operate. This notion may warrant further investigation: what is the relationship between the extent of system use (Venkatesh et al. 2008) and its discontinuance?

Overall, the findings on IS quitting demonstrate the significance of temporal considerations: the system has been in continuous use but changes in the user or the surroundings over time alter the situation so that discontinuance of that technology may follow. In other words, in contrast to rejection and regressive discontinuance, post-continuance quitting involves a ‘drastic’ change in relatively long and stable history of interaction between the user and the focal IT. Thus, whether the change concerns a user who is no longer satisfied with oneself due to excessive SNS use, or an organization that no longer has the resources to maintain a system that is not crucial for its operations, it appears that if certain developments take place during the continued use stage, the user may (re)consider the earlier motivations of system use as no longer valid and end up quitting the system use.

4.4 Temporary discontinuance

Probably one of the most interesting empirical findings show that discontinuance is not always terminal since sometimes the discontinuing user returns to using the system after a temporary period of inactivity. This practice has been described in the literature using various terms like ‘vacationing’ (York and Turcotte, 2015), ‘stalling’ (Pollard, 2003), and even ‘reinvention’ (Zhu and He, 2002). Also, the study by Geri and Naor-Elaiza (2008, p. 231) that surveyed students who had seemingly abandoned an online assignment submission system exhibits a likely case of temporary discontinuance. In this particular case, the sample of students reported generally high intentions to use the system in the future, which indicates that their discontinuance may have been only temporary. Going back to using the system returns the user to the continued use stage in the use lifecycle.
In line with Pollard (2003, p. 178), we define a temporary discontinuer as someone who has used a system and discontinued it but later returns to use it or intends to do so. Thus, the key distinction between quitting and temporary discontinuance (or vacationing) is predominantly cognitive in nature. Specifically, temporary discontinuance differs from quitting in that in the former, the IS discontinuance decision is associated with an intention of re-using it at a later point in time; quitting is not. From a process perspective, temporary discontinuance takes the form:

\[
\text{exposure} \rightarrow \text{adoption} \rightarrow \text{continued use} \neq \text{temporary discontinuance}
\]

Five studies have explored temporary IS discontinuance, all of which have been conducted at the individual level of analysis, leaving the organizational level of analysis entirely unexplored. Similar to quitting research, contexts 1, 2 and 4 are the contexts that have enjoyed research attention. With utilitarian IS in the workplace (context 1), factors such as unavailability of the system, lack of institutional support, poor task-technology fit, and complexity were found to be the main causes of temporary discontinuance (Geri and Naor-Eliaza 2008; Pollard 2003). These studies indicate that the users tend to be willing to return to use the system if the identified problems get resolved. One explanation for employees and students reporting intentions to return to using the system in the future points out to a general understanding that the final decision to abandon the technology is ultimately an organizational one. Whether this is the case or not, it warrants future research.

Research on temporary discontinuance in hedonic use environments (context 4) focuses solely on social media in general and Facebook in particular. Here, temporary discontinuance, similar to quitting, tends to happen as a modest coping strategy to the system use becoming a bit of a disturbance or distraction in the user’s life. Specifically, Facebook can become a burden on personal time, cognitive, and social resources (York and Turcotte 2015), causing fatigue (Ravindran et al. 2014) or social turbulences (Cho 2015) that were found to trigger the user to take a vacation from Facebook use. It would seem that users who opt for drastic coping measures, such as quitting (in contrast to vacationing), are those whose technology use has caused severe personal and social disturbances. Finally, Rosenbaum and Wong (2015) find that users may resort to vacationing while on (actual) vacation. For instance, hotel guests were found to take a ‘technological pause’ if they felt that the technology disturbed their holiday (ibid).

In sum, with organizational systems, users’ temporary discontinuance tends to occur if the system does not receive enough institutional support, resulting in a lack of incentives to use the system. On the other hand, in the case of hedonic IS, if the system use causes too much distraction in one’s life, the user may choose to remedy the situation by taking a break from its use. From a process perspective, temporary discontinuance represents an interesting phenomenon: a discontinuance behavior that occurs parallel with the continued use stage as the user may keep looping between the two stages. In fact, it was found that find that users may take either short rest-breaks from SNS or suspend its use for a longer time (Ravindran
et al., 2014). This points out to a question that may warrant further investigation: what is the relationship between the extent of system use prior the break, the length of the break, and the resulting effects?

4.5 Replacement

The final form of IS discontinuance we identified is replacement, representing the event in which an incumbent information system is replaced with a new, presumably more advanced or attractive one (Bhattacherjee et al. 2012; Furneaux and Wade 2011; Polites and Karahanna 2012; Spiller et al. 2007; Xu et al. 2014; Ye, D. Seo, et al. 2006). Contrary to examining why users might stop an IT use behavior entirely (whether this refers to getting off the grid by discontinuing Internet contract or alleviating social overload by discontinuing SNS use), these studies are typically concerned with situations where users continue performing the same behavior as before but with a different IT artifact. For instance, discontinuing the use of the incumbent Internet Explorer web browser and adopting the Opera browser (Bhattacherjee et al. 2012) is a typical example of IT replacement where an incumbent system is replaced with a corresponding but potentially more advanced alternative system. Then again, in other studies the incumbent IT is replaced with a very different kind of IT. For instance, Polites and Karahanna (2012) study how students replace e-mail with Google Docs as the medium of choice for collaborating and exchanging files in group projects; Maier, Laumer, Weinert, et al. (2015) study how SNS users continue their social activities by using other ITs after discontinuing their SNS use; and Furneaux and Wade (2011; 2017) discuss replacing old organizational systems with drastically different new IT solutions. Generally speaking, in replacement discontinuance, one IS use lifecycle comes to an end and another begins as the user exits the use lifecycle of the incumbent system and shifts into a new one. Thus, in its core the process of replacing a previously adopted system would take the following form:

\[ \text{exposure} \rightarrow \text{adoption} \rightarrow \text{continued use} \rightarrow \text{replacement} \]

We note that there exists a large body of IS switching research, of which only a few representative studies appeared in our sample, including examples of both individual and organizational level decision-making. Such studies (e.g., Bhattacherjee et al., 2012) tend to focus on factors that determine the adoption of an alternative IS to replace the old one, thus, highlighting the beginning of the alternative IS’s use lifecycle. Recker (2016) argues that such approach offers only limited insight on the reasons why the incumbent IS gets abandoned, and thus extending our search procedure with IS switching would have been unlikely to provide significant insight into our focal interest: IS discontinuance. Nonetheless, it is evident that replacement is one special case of discontinuance, consisting of two parallel processes: discontinuing an incumbent IS and adopting an alternative IS (however, not necessarily in this order, and the stages of these two processes may intertwine).

Individual-level replacement studies often leverage the push-pull-mooring (PPM) framework due to its suitability in studying migration in general (Bansal 2005). However, since the adoption of an alternative IS tends to have a focal role in the replacement literature, also combinations of DOI, EDT, and TAM have been
applied. Almost all the individual level studies in our sample that focus exclusively on replacement, discuss utilitarian systems outside workplace (context 2), with the exception of one SNS-migration study (context 4, Xu et al., 2014). Although some attempt to chart user characteristics that predict IS switching (Khan et al. 2015), typically the most important explanatory factors focus on alternatives and their advantages. Examples include ‘relative advantage of alternative IS’ (Bhattacharjee et al. 2012; Polites and Karahanna 2012; Spiller et al. 2007; Xu et al. 2014; Ye, D. Seo, et al. 2006), ‘availability of alternatives’ (Cooper 1991; Parhasarathy and Bhattacharjee 1998; Spiller et al. 2007), and ‘attraction from alternatives’ (Lehrer 2015; Xu et al. 2014). It is also worth noting that satisfaction with the incumbent system (Bhattacharjee et al. 2012; Ye, D. B. Seo, et al. 2006) and switching costs (Maier, Laumer, Weinert, et al. 2015) tend to impede replacement decisions, but dissatisfaction might cause the user to switch to an alternative (Xu et al. 2014).

On the organizational level, Furneaux and Wade (2010, 2011, 2017) investigate the factors that explain replacing an incumbent IS with a new one, concentrating on the end part of incumbent IS’s lifecycle. They find that organizational IS replacement decisions are mainly driven by system capability shortcomings, while system support availability, high technical integration, and replacement risk inhibit discontinuance. Whitten et al. (2010) bring yet another perspective into the discussion as they describe two different kinds of organizational-level IS replacement. As an example of more conventional type of replacement, they find that about 25% of the respondent companies had switched their IT outsourcing vendor. However, the study also demonstrates a more special type of switching: some companies discontinue their IT outsourcing contract altogether and bring the IT function back in-house; a practice commonly referred to as ‘backsourcing’. Different types of switching costs, such as in-house learning costs, were the key in understanding why companies chose to undertake either of these two distinct decisions.

In sum, like in quitting, also in replacement the changes occurring either in the needs of the IS user or the use environment explain discontinuance behavior. Logically, in replacement cases, environmental changes often relate to the emergence of notable alternative IS that may not have been available during the adoption stage. On the other hand, changed circumstances may also elevate the level of user’s requirements for the IS, and this may result in the incumbent IS being seen as inadequate to fill its intended purpose. A focal consideration divides replacement decisions into two distinct types: switching the current IS into another corresponding one (e.g., one e-mail service to another, Kim et al. 2006) or replacing the current IS with a disrupting alternative (e.g., moving from using feature phone to using smartphone, Fan and Suh 2014).

5 Discussion

This article has been primarily motivated by the question ‘what does IS discontinuance mean?’ We argued that analytic theorizing provides one approach to answering this question. As noted before, this type of work – what Gregor (2006) calls ‘Type I’ theory – represents the most basic form of theory since they are more concerned with classifying or typifying the dimensions of a relatively under-researched phenomenon (ibid). The findings we presented in the previous section demonstrate that IS discontinuance cannot be understood
by merely referring to the ‘non-use’ aspect. Of course, this aspect (i.e., an IS not being used by its intended user) is a critical element of the definition. However, as the findings show, IS discontinuance is a multifaceted phenomenon composed of three core components: process, content, and context. First, process fundamentally emphasizes the temporal element of IS discontinuance, i.e., IS discontinuance is a socio-historical phenomenon, where different historical paths lead to qualitatively different manifestations. These different manifestations are the focal interest of the second element: content. Here, content is a matter of form, i.e., the five forms of IS discontinuance discussed earlier. These five forms of IS discontinuance are seen as distinctly different behavioral outcomes that occur in different temporal stages of the IS use lifecycle. Finally, context emphasizes the situatedness of the phenomenon, that is, the meaning of IS discontinuance will alter significantly depending on the immediate use context (e.g., at home vs. at work), as well as on the nature of IS itself (e.g., videogame vs. accounting system).

![IS Use Lifecycle](Image)

**Figure 2. The IS Lifecycle (IN=Individual Level; OR=Organizational Level)**

Figure 2 illustrates the various forms IS discontinuance takes during an IS use lifecycle that encompasses three general stages in the IS acceptance and use process: exposure, adoption, and continued use. The circular arrows in each stage represent that users engage in recurring activities in that stage, whether they are about merely being aware of the IS; trialing the IS; training the IS use; using the IS in a sporadic or habitual manner. **Rejection** represents the first and shortest process where the decision is made shortly after exposure. Generally, a decision to reject an IT is entirely made based on assumptions, as it emphasizes a lack of actual interaction between the technology and its potential users. **Regressive discontinuance** may be seen as an extended version of rejection with the main difference being having an actual experience with the IT. Expectation (dis)confirmation theory (EDT, Oliver, 1977; Oliver & DeSarbo, 1988) serves as the most used theoretical explanation for this form of discontinuance. Generally speaking,
regressive discontinuance is likely to occur when actual experience with the IT at the adoption stage fails to meet the user’s expectations formed at the exposure stage, or as EDT would state it, due to dissatisfaction resulting from negatively disconfirmed expectations. **Quitting** represents a rather unique form of discontinuance since, contrary to the two previous forms, it involves a break in a relatively long and stable relationship between the user and the IT. Here, investigators are expected to find out how and why users decide to abandon a once-satisfactory IT. **Temporary discontinuance** is the fourth form of discontinuance we identified. It is interesting that this form of discontinuance reflects the co-occurrence of both IS use continuance and discontinuance stages, since users exhibiting this form of discontinuance tend to alternate between periods of ‘vacationing’ from IS use and ‘returning’ back. **Replacement** is the final form of discontinuance we identified, and despite some commonality with quitting, replacement typically involves a comparison between a focal IT and an alternative in the user’s environment. Such conceptual clarification has important implications for theory, methodology, as well as practice, as we will point out next.

### 5.1 Theoretical Implications

We have demonstrated that IS discontinuance can materialize in various forms, and thus, we echo Pollard’s (2003) and Turel’s (2016) notion that this phenomenon is more than simply the flipside of ‘IT use’ and it merits its own theorizing. One of the central theoretical implications of our work is demonstrating that IS discontinuance may manifest in at least five distinct forms, each of which follows a different path or process (namely, rejection, regressive discontinuance, quitting, temporary discontinuance, and replacement). This is not to say that there are no other forms of discontinuance, rather, our classification serves as a first step towards providing conceptual clarity. Next, we provide our key implications to theory.

We find that while some recent literature has acknowledged the importance of making a distinction between the various forms of IS discontinuance (Ravindran et al. 2014), mainstream IS research remains insensitive to these distinctions. This concern is especially visible in recent work on SNS discontinuance (Luqman et al. 2017; Maier, Laumer, Eckhardt, et al. 2015; Wirth et al. 2015; Zhang et al. 2016), where it is customary to aggregate conceptually distinct behaviors (e.g., taking a temporary break from SNS use; switching to use another SNS; and quitting SNS use entirely) in the same theoretical construct (i.e., the dependent variable). Such frequently used constructs include ‘discontinuous usage intention’ (Maier, Laumer, Eckhardt, et al. 2015; Zhang et al. 2016) or ‘discontinuance intention’ (Luqman et al. 2017; Wirth et al. 2015). Arguably, quitting an IS use entirely is a different decision to replacing the IS with a competing alternative. For instance, while quitting SNS use can be an effective way to alleviate technostress (Maier, Laumer, Weinert, et al. 2015), it is not clear why switching SNS to another one would have a corresponding effect. Moreover, especially the act of decreasing the extent of one’s IS use is conceptually related to the continued use of the system rather than discontinued use: one’s use duration, frequency, or intensity (Venkatesh et al. 2008) just becomes lower. Thus, while decreasing usage could be a significant predictor of IS discontinuance behavior (Khan et al. 2015), we argue that it should not be considered as a reflection of discontinuance.
Our concern is that conflating behaviors of such different nature will inhibit the emergence of rich insights regarding the IS discontinuance behavior.

Second, our analysis points to the need for multi-level theorizing when studying IS discontinuance. While we acknowledged the level of analysis through the traditional individual/organizational classification relating to the IS user, we discovered that other important multi-level considerations exist too, most prominently the level of analysis concerning the IS artifact. For instance, when a particular IT system (e.g., a web browser) or service (e.g., an Internet service provider) gets replaced with a corresponding one (e.g., another web browser or another Internet service provider), the previously adopted technology or innovation itself (i.e., web browsers in general; Internet connection in general) continues to be used – just with a different device or service. In this sense, if we view the IS use lifecycle from a higher-order perspective of a technology or an innovation, replacement would happen only when the user switches into using a system that is fundamentally different. In such broad view of technology use lifecycle, replacing one web browser or ERP system with another corresponding one would not qualify as discontinuance as the user would still remain in the stage of continued use of that technology. This insight raises an important question: what kind of IS qualifies as fundamentally different or disruptive enough so that its adoption would mean the end of previous technology’s lifecycle? For instance, when talking about mobile phone switching, what kind of behavior constitutes as disruptive: is it switching between smartphones; or switching from feature phone to a smartphone (as in Fan and Suh 2014); or switching from ‘dumbphone’ to smartphone; or are all mobile phone technologies similar enough to be considered belonging into the same technology lifecycle? Most articles dismiss the significance of these different levels or acknowledge them only implicitly. While several articles focused on IS quitting acknowledge that it is possible that users who discontinue the specific IS would switch into using similar competing alternatives (e.g., Coursaris et al., 2013; Luqman et al., 2017; Zhang et al., 2016), they rarely attempt to verify whether this is the case and what implications that could have on their results. Future research could benefit from a more explicit consideration, both conceptually and methodologically, of what IS discontinuance means regarding the incumbent IS artifact, its affordances, and the technology behind them. Thus, an interesting direction of research would be to investigate the discontinuance of specific IT affordances, e.g., as the popularity of a particular SNS declines (Sulleyman 2018), do service providers simply switch the SNS platform, or will they move to an alternative IS medium (e.g., a web page), or possibly revert back to traditional media (e.g., local newspapers; outdoor advertising)?

Third, we emphasize the importance of context (Davison and Martinsons 2016; Urquhart 2016) and our framework provides an avenue for future research to be more context-sensitive. Specifically, the framework we advance, with its emphasis on immediate use context and system type (see Table 1), opens up directions beyond the traditional utilitarian/hedonic IS dichotomy (van der Heijden 2004). Such (re)frameing points to gaps in our current body of knowledge. For instance, our framework points our attention to the lack of research exploring discontinuance (in any of its five forms) of hedonic IS in organizational context, despite the notable surge in interest in introducing game-like mechanisms (i.e., gamification) in non-game contexts.
such as organizations (Blohm & Leimeister, 2013; Hamari et al., 2014). In fact, Suh et al. (2017) recently recognized the struggle organizations face with sustaining employees’ interest in using gamified IS, thus stressing, though only implicitly, the importance of studying IS discontinuance in such contexts. Research of this nature is much needed, since in addition to consuming large resources (e.g., implementation, communication, training, etc.), gamification efforts also require radical changes in management philosophy (Singh 2012). Considering such serious dedication, it is critical to understanding explore whether discontinuance of these efforts occur, in what form (e.g., rejection, regressive discontinuance, quitting, etc.), and most importantly, why?

Fourth, our work also points to an interesting paradox with theoretical implication in the cases of problematic IS use. In such context, in addition to its negative and direct impact on discontinuance intentions, satisfaction with the system was reported to have a positive but indirect impact on discontinuance intentions, through formation of habit, addiction, and guilt (Turel 2015b). This notion could be explained by the distinction between ‘(dis)satisfaction with the technology’ and ‘(dis)satisfaction with the self’. This distinction is particularly critical for technologies that offer multiple options and functionalities. For example, a Facebook user might be satisfied with the ‘instant messaging’ functionality while dissatisfied with a sense of ‘loss of privacy’. Najmul Islam’s (2014) theoretical treatment of the sources of satisfaction and dissatisfaction offers a notable starting point.

Finally, while the current literature is mostly focused on antecedents of IS discontinuance, only a few studies address the implications of such decisions (Cho 2015; Hogan et al. 2003; Lehrer 2015). Reaching beyond adoption and continuance, IS discontinuance studies have complemented our understanding of the overall IS use phenomenon. Going still further by investigating the implications of discontinuance behavior could yield significant insights. For instance, does permanent or temporary SNS discontinuance improve the quality of life for those who need a break from its excessive use?

5.2 Methodological implications

The first methodological implication relates to the importance of distinguishing the different discontinuance forms in the operationalization of variables. As noted earlier, some studies conflate these forms on conceptual level, and this seems to be the case also in their operationalization. For instance, Maier et al. (2015) operationalize the construct ‘discontinuous usage intention’ using the following three items: “I will unregister Facebook”, “In the future, I will use another social network site”, and “In the future, I will use Facebook far less than today”. Although the authors claim that they used reflective indicators, they are in fact formative: the indicators define the construct, they are not interchangeable, and they do not necessarily possess the same antecedents and consequences (Petter et al. 2007). This is an example of a misspecification of a structural model common in IS literature, where a construct of formative nature is modeled as reflective (Petter et al., 2007, p.633). Similar misspecification occurs in Wirth et al.’s (2015) work as well. Yet, other studies (Luqman et al. 2017; Zhang et al. 2016) that follow similar operationalization
fail to even report whether their corresponding constructs have been modeled as reflective or formative. While the appropriateness of using formative measurement in theory testing research is already a subject of debate in itself (see, e.g., Bagozzi 2007; Howell et al. 2007; Lee et al. 2013; Wilcox et al. 2008), we encourage researchers to pay closer attention to construct specification and be explicit about their modeling approach when reporting their methods.

Second, it is obvious that the IS discontinuance phenomenon is a fertile ground for theory development (Eisenhardt and Graebner 2007; Gregor 2017), and requires more qualitative and contextual research efforts in order to be able to convey those ‘untold stories’ to the wide IS audiences (Ramiller and Pentland 2009). Evidently, current research is dominated by a static, variable-centered paradigm, and typically tested in cross-sectional settings (Schwarz et al. 2014). It has been argued that over-emphasis on studying ‘variables’ at the expense of ‘actors’ and their ‘actions’ has contributed to the widening gap between research and practice (Ramiller and Pentland 2009). Another concern is that while the variables-centered approach enables us to identify the key factors responsible for a certain behavioral outcome at a certain point in time, its main shortcoming is that it omits the impact of time on behavior change. For instance, as we demonstrated with the archetypical processes, each form of IS discontinuance follows a different path, thus warranting the developing of different theories for the different paths (Pentland 1999). As a starting point, one should keep in mind that these different processes emphasize that even if users adopt an IS, they might regressively discontinue it shortly after. However, if they continue using the IS after adoption, they can be considered to have moved to the stage of continued use, which might vary in length and use intensity depending on the type of IS and its use context. The lifecycle comes to an end when the user quits the IS use or replaces it with an alternative IS. Sometimes discontinuance is not permanent as the user may return to use the system after a period of discontinued use.

Finally, we would like to highlight the choice of dependent variable in IS discontinuance studies. While we found that most studies attempt to capture actual discontinuance behavior, many recent studies are still limited to measuring discontinuance intentions, even in contexts where addressing actual behavior could be important. Such examples include studies in context 4, where habit, addiction, and hedonic rewards from system use can powerfully obstruct the realization of discontinuance intentions, rendering them as potentially insufficient proxies for actual behavioral outcomes. Thus, we encourage researchers to move beyond mere intentions and try to identify novel ways to capture actual behavior. However, we understand that this is a common challenge in survey-based research, where researchers may only have a limited access to research subjects’ self-reported, cross-sectional behavior. Building on the concept of behavioral expectation (Lemon et al. 2002; Venkatesh et al. 2008) could be one approach to tackle this challenge.

5.3 Practical implications

It is safe to argue that in most cases, the ultimate purpose of IS is for it to be used (as long as possible), and to delay the different forms of discontinuance (as much as possible) in its typical lifecycle. By this we
mean that both the provider and user of an IS are probably motivated to inhibit the premature discontinuance of their product or service, since they have both invested in the IS, whether by developing it or by spending money and/or time on it. However, we realize that IS discontinuance can often be a desired outcome. From a system provider’s perspective, it is considered necessary for the long-term prosperity that their users discontinue older releases and move on to buying the more recent ones. From a user’s perspective, discontinuing an IT (in any form) might be to her or his best interest if the said technology is deemed disruptive or inconvenient. A fine balance exists there: while it is in the IT provider’s interest to keep their customers ‘locked-in’, moral and ethical considerations must not be overlooked in the way.

Understanding the process, content, and context of IS discontinuance points to a simple but very critical notion: IS discontinuance potentially means different things depending on when it occurs in the IS lifecycle. A greater awareness of what may cause use discontinuance at each of the usage stages is important for the IS provider since the applicable strategies depend on this. For instance, strategies to inhibit early discontinuance due to negatively disconfirmed expectations (regressive discontinuance) can be very different from those to counter later discontinuance that is triggered by a desire to switch into using an alternative IS (replacement). Thus, understanding the different forms of discontinuance can help practitioners to develop strategies to prevent premature or undesired forms of discontinuance. Moreover, understanding the multi-level nature of the IS use lifecycle points to the insight that sometimes the end of system life is a matter of perspective. While customers who stop using a certain digital service appear as discontinuers to the service provider, the customers themselves may not consider their behavior as discontinuance if they simply switched service provider, especially in the case of IS service where switching can happen almost seamlessly. In addition, practitioners should be aware of the general state of technology lifecycle behind their products and services to understand whether the potential risk of customers discontinuing relates to attractive competing alternatives or the overall obsolescence of the technology.

5.4 Limitations and future research directions

It is important to note that this paper comes with a number of limitations that should be acknowledged. First, although we made a thorough effort to obtain the relevant literature on IS discontinuance, it is possible that we have missed some studies that our methodology might have failed to capture. Secondly, we would like to acknowledge that we did not expand our search procedure beyond the IS domain. We are aware that the discontinuance phenomenon is a topic of interest for scholars in various other domains, like healthcare research (Riemer-Reiss and Wacker 1999, 2000), and it is possible that a wider search scope could provide further insight on the topic. Also, we would like to highlight that while our proposed IS lifecycle model comprises the main forms of IS use and discontinuance behaviors that could be identified in our sample of literature, it is by no means a perfect illustration of the IS use (discontinuance) phenomenon, and indeed future research is invited to identify other forms that our synthesis does not capture. Finally, our proposed framework of the five different discontinuance forms calls for further enquiry and empirical validation. It
would be enlightening to investigate how the predictors of these distinct outcomes vary in different contexts; e.g., studying whether quitting and temporary discontinuance of SNS share the same antecedents or are some of the predictors unique to either form. Furthermore, different levels of certain discontinuance forms could be further examined, such as differences between deactivation of SNS account and permanent elimination of the account, or the impacts of different lengths of temporary discontinuance periods. Another interesting question to address would be whether we could widen our perspective on IS replacement by studying the temporal sequence of events as well as considering the fate of incumbent IS: does the adoption of an alternative system happen before or after abandoning the incumbent IS? In either case, is the incumbent IS always abandoned for good or does it sometimes remain in use parallel to the new IS?

6 Conclusion

In this paper, we have set out to investigate the IS discontinuance phenomenon with two central questions in mind: (1) What does IS discontinuance mean in different IS studies? and (2) What implications does the answer has on theory and practice? Our review has resulted in a total of 54 studies giving explicit attention to the topic with varying levels of depth and focus. Analysis of this literature has shown that there exists multiple forms and varying conceptualizations of IS/IT discontinuance leading to potentially differing outcomes. We have synthesized these conceptualizations into the five forms of discontinuance: rejection, regressive discontinuance, quitting, temporary discontinuance, and replacement (see Section 4.2). We have elaborated them with a visualized model illustrating how different types of discontinuance decisions may take place at any phase of the IS use lifecycle (see Figure 2).

Furthermore, our analysis has unraveled the significance of IS use context in untangling the antecedents of discontinuance. This has become especially apparent in more special use cases, such as mainly hedonic systems where good system design can create a smooth and satisfying user experience, which can then incentivize the user to use the system excessively up to the point where the user becomes dissatisfied with oneself (Turel, 2015; 2016). Then again, unpredictable individual, environmental, and organizational influences can also create unexpected triggers of discontinuance, such as major life events related to IS user’s health or family situation (Hand et al., 2009); or economic and organizational changes that affect companies’ IS implementation (Power and Gruner, 2015). Thus, we suggest that a comprehensive understanding of IS discontinuance behavior cannot be achieved without considering the process, the content, and the context that shape the origins and outcomes of such decisions.

We wish to conclude by noting that in order to prevent unnecessary convolution, future research should strive to specify what exactly is being meant by IS discontinuance when studying the topic: which action or process the term discontinuance refers to (e.g., whether it is quitting or replacing; temporary or permanent) and where in the IS use lifecycle it occurs (e.g., whether it takes place in the phase of exposure, adoption, or continuance). While in most parts the past research on the topic has been relatively clear in describing the behavior under investigation, a lack of overarching synthesis has resulted in terminological
inconsistency. We argue that a mindful consideration of the different possible discontinuance forms we have identified here could enable future researchers to achieve an even richer understanding of the phenomenon.

References


Griffin, A. 2016. “Facebook Posts Becoming Less Personal as Site Looks to Encourage People to Post about Their Lives,” Independent.


Appendix A: Review procedure

We initiated this research project in October 2015 and conducted several rounds of literature search, the latest of which was in November 2017. To ensure that our review is as extensive and inclusive as possible, we performed the search queries on two major databases, namely, Scopus and Google Scholar. We first performed the searches in Scopus with the following query: (TITLE-ABS-KEY("IS" or “Information Systems” or “IT” or “Information Technology”) AND (“Discontinuance” or “Discontinue” or “Discontinued Use”)). This yielded altogether 7542 results. We then limited the search results to the English language, and also excluded subject areas that are beyond the scope of our interest. For example, we excluded search results in peripheral domains such as medicine, biochemistry, dentistry, and environment. The subsequent search produced 473 results.

Executing an analysis of abstracts of our search results revealed that, despite of applying specific filters in our search query, most of them discussed topics beyond the IS domain, like agricultural, construction and environmental studies, so those deemed irrelevant were dropped. One apparent reason for such non-IS studies turning up was most likely that information systems and technologies have become increasingly ubiquitous in many domains, so the keywords are often mentioned in studies that do not actually address the IS use phenomenon. Moreover, in many cases the search code understandably interpreted the abbreviation “IS” as verb “is” and “IT” as pronoun “it”; this further contributed to the number of the irrelevant studies that emerged. This resulted in altogether 72 studies to be analyzed in more detail.

From this pool of studies, altogether 39 were filtered out despite of being IS studies either because, a) they did not actually address the IS discontinuance phenomenon but referred to it only passingly (e.g., Briggs, Reinig, & de Vreede, 2008), or b) although they claimed to provide an insight on IS discontinuance, their focus was fully on continued use (e.g., Chea and Luo, 2007; Lee, 2010; Zhao, Deng and Zhou, 2015). This first search stage resulted in discovering 33 studies that specifically addressed IS discontinuance. To complement this search, the same query was run in Google Scholar, and it produced two additional studies to be added into our sample.

In the second stage, consistent with Webster and Watson's (2002) recommendations, we incorporated a backward and forward citation reviews of the 35 identified studies in our search procedure. As we investigated these studies, we found references to other, potentially relevant, papers that were not captured among the hits produced by our search queries. We also found out that more recent and complete versions have been published of some of the conference papers that were found in the initial searches (e.g., Recker, 2014; Ye, Seo, Desouza, Sangareddy, et al., 2006). In these cases, we replaced the earlier versions with the newer ones. Then, we went through our own academic libraries and scanned for potentially eligible studies to be considered. The second search stage resulted in adding 27 more studies in our literature sample. Finally, four more studies were filtered out as they were found to be incomplete research-in-progress papers (e.g., Alam & Wagner, 2013; Bian, Bengler, Zhao, Wu, & Liang, 2015). The overall search procedure resulted in the final sample of 54 relevant studies specifically discussing IS discontinuance (listed in Appendix B).
### Appendix B: Summary of the studies included in this review

<table>
<thead>
<tr>
<th>No.</th>
<th>Reference</th>
<th>Discontinuance form</th>
<th>Method</th>
<th>Theory/literature background</th>
<th>IS</th>
<th>Main Findings/Arguments</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charki et al. (2017)</td>
<td>Quitting</td>
<td>Qualitative</td>
<td>Rational choice theory</td>
<td>ORA: online, real-time dynamic auction</td>
<td>Legal intervention may mitigate unethical use of information technology through influencing users’ cost-benefit analysis of use.</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>de Graaf et al. (2017)</td>
<td>Rejection, Regressive discontinuance, Quitting</td>
<td>Mixed</td>
<td>HRI literature and technology acceptance theories</td>
<td>Home robot</td>
<td>People reject, regressively discontinue, and quit home robot use for distinct reasons.</td>
<td>2/4</td>
</tr>
<tr>
<td>3</td>
<td>Furneaux &amp; Wade (2017)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Protection motivation theory</td>
<td>Organizational systems</td>
<td>Replacement risk, system complexity, system investment, and institutional norms are impediments to organizational IS replacement intentions.</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Luqman et al. (2017)</td>
<td>Quitting, Temporary discontinuance, Replacement</td>
<td>Quantitative</td>
<td>The SOR model: stimuli (S) that affect the internal states (O) of people, which in turn, drive their behavioral responses (R)</td>
<td>Facebook</td>
<td>Environmental stimuli from excessive SNS use create an internal state of technostress and SNS-exhaustion, which trigger a behavioral response in the form of discontinuance intentions.</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Salo &amp; Frank (2017)</td>
<td>Quitting</td>
<td>Mixed</td>
<td>Literature on IS-related incidents, situational context, and post-experience behaviors</td>
<td>Mobile applications</td>
<td>Negatively perceived incidents may cause mobile IS users to discontinue application use, but discontinuance is less likely to happen if the incident takes place outdoors.</td>
<td>2/4</td>
</tr>
<tr>
<td>6</td>
<td>Vaghefi &amp; Qahri-Saremi (2017)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>IT addiction, cognitive dissonance theory</td>
<td>SNS</td>
<td>Guilt feelings and self-efficacy to discontinue influence SNS discontinuation intentions.</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Furstennau et al. (2016)</td>
<td>Quitting, Replacement</td>
<td>Qualitative</td>
<td>Categorizations of shadow systems</td>
<td>Several organizational shadow systems</td>
<td>Shadow systems with small functional scope and narrow scope of use are more likely to get discontinued than larger systems.</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Lu and Gallupe (2016)</td>
<td>Quitting, Replacement</td>
<td>Conceptual</td>
<td>Intentional and habitual perspectives to post-adoption</td>
<td>SNS</td>
<td>The authors propose a process model of SNS quitting and switching.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Author(s) (Year)</td>
<td>Type of Study</td>
<td>Methodology</td>
<td>Themes</td>
<td>Title of Study</td>
<td>Citation</td>
<td></td>
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<tr>
<td>9</td>
<td>Recker (2016)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Technology acceptance model, status quo bias, inertia, Inventory replenishment system</td>
<td>Positive and negative beliefs about system performance drive continuance and discontinuance intentions, respectively.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Turel (2016)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Theory of planned behavior, guilt</td>
<td>Guilt feelings, subjective norms regarding discontinuance, and attitude toward discontinuance have positive effects of discontinuance intentions. Guilt moderates the influences of subjective norms and attitude.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whitacre &amp; Rhinesmith (2016)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Prior literature on barriers to adoption and rationale behind non-adoption</td>
<td>Socio-economic factors such as low income and old age were identified as main predictors of home broadband discontinuance.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Zhang et al. (2016)</td>
<td>Quitting, Temporary discontinuance, Replacement</td>
<td>Quantitative</td>
<td>SNS overload and fatigue</td>
<td>Three types of overload contribute to social network fatigue and dissatisfaction, which turn into discontinuance intentions.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Aggarwal et al. (2015)</td>
<td>Regressive discontinuance, Quitting</td>
<td>Quantitative</td>
<td>U-shaped relationship between self-perceived and actual knowledge</td>
<td>Users low in actual IT knowledge are both early to adopt as well as early to discontinue.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Chesney &amp; Lawson (2015)</td>
<td>Quitting, Replacement</td>
<td>Quantitative</td>
<td>Critical mass theory</td>
<td>If the number of discontinuers reaches a critical mass, it may cause an SNS to fail. The influence of critical mass can be facilitated by network structure.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Cho (2015)</td>
<td>Quitting, Temporary discontinuance</td>
<td>Qualitative</td>
<td>Heideggerian theory</td>
<td>Discontinuance is a potential result of modifying technological practices after experiencing technical and/or social turbulences.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Khan et al. (2015)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Prior literature on churning, Mobile phone contracts</td>
<td>Naxicity of using the mobile service was found to be a strong predictor of discontinuance.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Lehrer, C.</td>
<td>Quitting, Replacement</td>
<td>Mixed</td>
<td>IS success model, IS replacement, word-of-mouth, Mobile location-based services</td>
<td>Discontinuance due to finding a better alternative leads to post-discontinuance dissatisfaction, that translates into negative word-of-mouth.</td>
<td>2,4</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Authors and Year</td>
<td>Methodology</td>
<td>Theoretical Framework</td>
<td>Platform</td>
<td>Issue and Description</td>
<td></td>
<td></td>
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<td>----</td>
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<td></td>
</tr>
<tr>
<td>18</td>
<td>Maier, Laumer, Weinert, et al. (2015)</td>
<td>Quitting; Replacement</td>
<td>Mixed</td>
<td>Technostress</td>
<td>Facebook</td>
<td>SNS-exhaustion contributes to discontinuance intentions, while switching-exhaustion hinders them. Intention to discontinue leads to actual discontinuance.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Power &amp; Gruner (2015)</td>
<td>Quitting</td>
<td>Mixed</td>
<td>Diffusion of innovations</td>
<td>GS1 standards-based inter-organizational IT</td>
<td>Several firms abandon IT over time due to low satisfaction with the results of the systems, as well as because changes in circumstances make discontinuing the IT the most beneficial choice for firms.</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Tully (2015)</td>
<td>Rejection, Regressive discontinuance</td>
<td>Qualitative</td>
<td>Diffusion of innovations</td>
<td>Ushahidi crowdsourcing platform</td>
<td>Incompatibility with needs was identified as a key antecedent of discontinuance, also limited support and insufficient commitment to the system caused failures in adoption.</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Turel (2015)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Social cognitive theory</td>
<td>Facebook</td>
<td>Guilt feelings and self-efficacy to discontinue Facebook use have a positive effect on discontinuance intentions, while satisfaction with the site has a negative effect.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Wirh et al. (2015)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Technology acceptance model, social aspects of SNS</td>
<td>Facebook</td>
<td>Frustration and dissatisfaction with SNS determine discontinuance intentions.</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>York &amp; Turcotte (2015)</td>
<td>Temporary discontinuance</td>
<td>Quantitative</td>
<td>Diffusion of innovations</td>
<td>Facebook</td>
<td>Facebook users perceive the site is a burden on personal time and resources, and due to this temporarily discontinue its use.</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Boukef &amp; Charki (2014)</td>
<td>Quitting</td>
<td>Qualitative</td>
<td>Reflective sensemaking</td>
<td>B2B online reverse auctions</td>
<td>Users enact their use through their interaction with the IT as they engage in reflective sensemaking, which may result in discontinuance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Study (Year)</td>
<td>Methodology</td>
<td>Approach</td>
<td>Framework/Model</td>
<td>Source</td>
<td>Notes</td>
<td></td>
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</tr>
<tr>
<td>27</td>
<td>Ravindran et al. (2014)</td>
<td>Mixed</td>
<td>Fatigue literature</td>
<td>Facebook</td>
<td>Social network fatigue may lead to taking SNS break, moderating SNS use, or deactivating SNS account.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Xu et al. (2014)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Push-pull-mooring framework</td>
<td>Several SNSs</td>
<td>Dissatisfaction with the site and attraction of alternatives contribute to replacement intentions.</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Coursaris et al. (2013)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Uses and gratifications, diffusion of innovations</td>
<td>Twitter</td>
<td>Inactive users’ adoption and continuance is motivated by user-related needs, while active users are motivated by technology characteristics.</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Bhattacherjee et al. (2012)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Expectation-disconfirmation theory, unified theory of acceptance and use of technology, diffusion of innovations</td>
<td>Web browser switching</td>
<td>Relative advantage and satisfaction with prior IT were found to determine IT switching intention, which was found to determine IT switching behavior.</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Park et al. (2012)</td>
<td>Quitting, Replacement</td>
<td>Qualitative</td>
<td>Theory of Emotion Process</td>
<td>Discussion forum about tablets, laptops, desktop, printing equipment, and servers to consumers and businesses</td>
<td>IT provider's failure to solve user’s problems leads to user’s emotion process which may result into discontinued use of the IT.</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Polites &amp; Karahanna (2012)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Technology acceptance model, diffusion of innovations, habit, inertia</td>
<td>E-mail</td>
<td>Intention to replace the old system is determined by attitudinal beliefs (relative advantage &amp; perceived ease of use), normative beliefs (subjective norm), and inertia (which is determined by habit, sunk costs and transition costs)</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Cenfetelli &amp; Schwarz (2011)</td>
<td>Rejection</td>
<td>Quantitative</td>
<td>IS Success Model, technology acceptance model</td>
<td>Travel websites</td>
<td>Inhibitors of technology adoption are distinct from enablers of adoption.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Author(s) (Year)</td>
<td>Method</td>
<td>Data Source</td>
<td>Topic</td>
<td>Context</td>
<td>Reference</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>34</td>
<td>Furneaux &amp; Wade (2011)</td>
<td>Replacement</td>
<td>Mixed</td>
<td>Technology-organization-environment framework</td>
<td>Organizational information systems</td>
<td>Organizational IS replacement intentions are driven by system capability shortcomings, while system support availability and technical integration inhibit them.</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Kim (2011)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Diffusion of innovations</td>
<td>Internet</td>
<td>Social status affects the discontinuance so that less privileged individuals are more likely to discontinue internet use.</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Furneaux &amp; Wade (2010)</td>
<td>Replacement</td>
<td>Conceptual</td>
<td>Technology-organization-environment framework</td>
<td>Organizational information systems</td>
<td>The authors propose a conceptual model to explain organizational IS discontinuance.</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Whitten et al. (2010)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Switching costs</td>
<td>Organizational IT operations</td>
<td>Different types of switching costs shape how IT operations are outsourced.</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Hand et al. (2009)</td>
<td>Quitting</td>
<td>Mixed</td>
<td>Diffusion of innovations, literature on adoption and situational factors</td>
<td>Online grocery shopping</td>
<td>Some users seem to discontinue online grocery shopping once the initial trigger, that made them to adopt it, has disappeared or they have experienced a problem with the service. The triggers relate to life-events such as having a baby or developing health problems.</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Miller et al. (2009)</td>
<td>Rejection, Quitting</td>
<td>Qualitative</td>
<td>Diffusion of innovations, technology acceptance model</td>
<td>CAD in construction</td>
<td>Low perception of value, benefit and usability cause rejection, discontinued use or neglect.</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Geri &amp; Naor-Elaiza (2008)</td>
<td>Quitting, Temporary discontinuance</td>
<td>Quantitative</td>
<td>Technology acceptance model, diffusion of innovations</td>
<td>Online Assignment Submission System</td>
<td>Four most frequent reasons for abandoning the system were: system is not offered on the courses (41.4%), not compatible with needs (27.4%), not consistent with teachers’ guidelines i.e. does not allow late submission although teacher would give extra time (8.9%), complexity (8.3%), not mandatory to use (7.0%).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Authors (Year)</td>
<td>Category</td>
<td>Methodology</td>
<td>Subject</td>
<td>Notes</td>
<td>Rating</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>41</td>
<td>Kim et al. (2008)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Technology acceptance model, diffusion of innovations</td>
<td>Mobile data services use. The study compares the effect of factors that determine behavioral intention by running a multigroup analysis between continuers and discontinuers.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Spiller et al. (2007)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Expectation-confirmation theory, diffusion of innovations</td>
<td>ISP. Reliability of the service, payment options, and cost affect discontinuance of ISP service. Demographic factors had no effect.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Gokhale &amp; Narayanaswamy (2006)</td>
<td>Quitting, Replacement</td>
<td>Conceptual</td>
<td>Literature on innovation use experience</td>
<td>IT applications. Satisfaction and compatibility determine discontinuance intentions.</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Ye et al. (2006)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Diffusion of innovations, technology acceptance model, unified theory of acceptance and use of technology literature in switching</td>
<td>Web browser switching. User satisfaction and breadth of use of the incumbent browser had a negative effect on switching behavior, while perceived ease of use, relative advantage and perceived security of the substitute (as compared to the incumbent) had a positive impact.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Cerfetelli (2004)</td>
<td>Rejection</td>
<td>Conceptual</td>
<td>Use enablers and inhibitors</td>
<td>Not specified. Inhibiting and enablers perceptions of technology use are qualitatively different from each other, independent, and can coexist.</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Hogan et al. (2003)</td>
<td>Quitting, Replacement</td>
<td>Quantitative</td>
<td>Diffusion of innovations</td>
<td>Not specified. The impact of a lost customer on the profitability of the firm depends on whether the customer defects to a competitor firm or disadops the technology altogether, and on whether the customer is early or late adopter.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Pollard (2003)</td>
<td>Quitting, Temporary discontinuance</td>
<td>Qualitative</td>
<td>Diffusion of innovations</td>
<td>Organizational Group Support System. Low complexity, low reliability and poor task-technology fit were found to cause discontinuance, while institutional support such as accessibility of a champion prevented it.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Danaher (2002)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Price and attrition elasticities</td>
<td>Telecommunication service. Changes in access price and usage price cause some consumers to drop a service.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>#</td>
<td>Author(s)</td>
<td>Behavior</td>
<td>Methodology</td>
<td>Topic</td>
<td>Context</td>
<td>Reference</td>
<td></td>
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</tr>
<tr>
<td>49</td>
<td>Lemon et al. (2002)</td>
<td>Quitting, Replacement</td>
<td>Quantitative</td>
<td>Literature on keep/drop decisions</td>
<td>Interactive television entertainment service / online grocery store delivery service</td>
<td>2:4</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Zhu &amp; He (2002)</td>
<td>Rejection, Quitting, Temporary discontinuance</td>
<td>Quantitative</td>
<td>Diffusion of innovations, uses and gratifications</td>
<td>Adoption and use of the Internet found to be two distinct processes that are influenced by different forces. Perceived popularity and perceived characteristics of Internet were found to determine its adoption, while perceived need for Internet impacted its continued use.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Hoxmeier &amp; DiCesare (2000)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Prior research on system response time</td>
<td>Browser-based software application</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Parthasarathy &amp; Bhattacharjee (1998)</td>
<td>Quitting, Replacement</td>
<td>Quantitative</td>
<td>Diffusion of innovations</td>
<td>Online service</td>
<td>2:4</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Prendergast &amp; Marr (1995)</td>
<td>Quitting</td>
<td>Quantitative</td>
<td>Diffusion of innovations</td>
<td>Self-service banking (ATMs, etc.)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Cooper (1991)</td>
<td>Replacement</td>
<td>Quantitative</td>
<td>Diffusion of innovations</td>
<td>Organizational office tool (IBM PROFS)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: General overview

Table C1 shows that altogether 41 of the studies in our sample have been published in peer-reviewed journals, and 12 in conference proceedings. Especially the leading IS journals appear to show explicit interest in the topic. The rest of the journal papers are distributed between various outlets, of which some operate in the IS domain but others are specialized in related fields such as marketing, operations, communications, and social science. When it comes to methodology (Table C2), a majority of 31 papers use quantitative analysis; 8 are qualitative enquiries; and 11 apply mixed methodology. Altogether four papers are conceptual theory development papers (Cenfetelli 2004; Furneaux and Wade 2010; Gokhale and Narayanaswamy 2006; Lu and Gallupe 2016). While most of the papers rely on empirical evidence gathered by the authors, some apply statistical modeling to secondary survey data (Kim 2011) or customer data (Danaher 2002; Hogan et al. 2003; Khan et al. 2015), and one even applies simulation (Chesney and Lawson 2013). Finally, Table C3 outlines the data collection methods utilized in the 49 empirical studies. While a notable number of studies draw their data from multiple sources, the research paradigm is heavily dominated by survey-based research.

<table>
<thead>
<tr>
<th>Journal</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information &amp; Management</td>
<td>4</td>
</tr>
<tr>
<td>Information Systems Research</td>
<td>3</td>
</tr>
<tr>
<td>European Journal of Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>MIS Quarterly</td>
<td>2</td>
</tr>
<tr>
<td>Journal of Strategic Information Systems</td>
<td>2</td>
</tr>
<tr>
<td>Information Systems Journal</td>
<td>2</td>
</tr>
<tr>
<td>Others*</td>
<td>26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Conference</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMCIS</td>
<td>3</td>
</tr>
<tr>
<td>ICIS</td>
<td>2</td>
</tr>
<tr>
<td>ECIS</td>
<td>2</td>
</tr>
<tr>
<td>Others*</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

*Note: *Only one relevant publication per journal/conference

Table C1. Outlets of the studies
### Table C2. Methodology applied in studies

<table>
<thead>
<tr>
<th>Methodology</th>
<th>No of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative</td>
<td>31</td>
</tr>
<tr>
<td>Mixed</td>
<td>11</td>
</tr>
<tr>
<td>Qualitative</td>
<td>8</td>
</tr>
<tr>
<td>Conceptual</td>
<td>4</td>
</tr>
</tbody>
</table>

### Table C3. Data collection methods

<table>
<thead>
<tr>
<th>Data collection method</th>
<th>No of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>27</td>
</tr>
<tr>
<td>Various methods (survey, interviews, observations, etc.)</td>
<td>13</td>
</tr>
<tr>
<td>Interviews</td>
<td>5</td>
</tr>
<tr>
<td>User data</td>
<td>3</td>
</tr>
<tr>
<td>Virtual ethnography</td>
<td>1</td>
</tr>
</tbody>
</table>

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Caught in between: How an Organization Became a Prisoner of Its Legacy System after IS Change

Completed Research Paper

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Abstract

Replacing a legacy system is a complex information system (IS) change project and represents severe economic and operational risks for an organization. Due to this, legacy systems are hard to get rid of and thus they sometimes continue to live alongside their intended replacement systems, forming complex IS architectures. To understand how this happens, I conducted an in-depth case study of a factory that failed to kill its legacy system despite executing two massive IS implementations. Interviews with key stakeholders reveal that the factory has gotten caught in between old and new system architectures. Leveraging the punctuated socio-technical information system change (PSIC) model as a theoretical sensitizing device, I provide a process explanation for this outcome. Moreover, I propose extensions to the PSIC model to better capture the nuances of complex IS change. My findings help managers to make more informed decisions when engaging into complex IS change projects.

Keywords: legacy system, IS discontinuance, organizational IS change, process theorizing, PSIC model

Introduction

“…so, you have this particular idea that ‘okay, when we implement the new system, we’ll migrate the whole legacy data from the old system’ and so on, and when we proceed with that, we realize that ‘okay, in addition to this core project we have these things and those things’, that are also important. Then they consume all our resources, and in the end, we state that ‘we don’t have the capacity [to migrate the rest of the legacy data], let’s do it later’. And the later never comes.” (Manager at EngineShop)

Explaining organizational information system (IS) change has long been a core interest of the IS research community (Ahmad et al. 2011; Lytyinen 1987), often focused on studying the implementation of new systems or replacement of existing ones. While replacing old systems with more advanced ones can yield significant business benefits, conducting such a change with success is no walk in a park. Replacement represents an especially perilous challenge in the case of legacy systems, i.e., information systems in place
that embody organization’s incumbent business model (Kelly et al. 1999). Although legacy systems are often based on old or outdated technologies, they tend to run mission-critical back-end processes which makes them notoriously difficult to replace (Bisbal et al. 1999; Brodie and Stonebraker 1995). The development of legacy systems has traditionally been introspective, with little conscious design of system architecture (i.e., the organization and interrelations between hardware, software, networks, data, and work processes, Kelly et al. 1999). As such, legacy system development tends to follow the logic of evolutionary design where new features are being added and integrated on top of the existing system, potentially allowing high levels of customization and integration but resulting in monolithic, silo-like systems (Bannister 2001). Thus, the sheer size and complexity of many old systems make engaging into such projects a serious endeavor.

Recent trends in IS development emphasize organizational flexibility and agility through the adoption of service-oriented architectures consisting of externally maintained commercial systems (Serrano et al. 2014). However, since out-of-the-box systems tend to come highly standardized, they can rarely offer corresponding functionality, which can result in critical performance gaps between legacy system and new IS architecture (Wagner 2010). On top of that, high failure rates of new system implementations (Fruhling and Wallum 2017; Kepes 2013) further discourage organizations to engage in risky projects that could be critical for their long-term survival but may not carry significant immediate benefits (Lyytinen and Robey 1999). If the replacement fails and causes disruptions that materialize to customers, the business implications can be devastating. Thus, the apparent economic and operational risks make replacing large legacy systems difficult to justify, causing many businesses to persist on maintaining their aged IS architectures (Furneaux and Wade 2017; Kelly et al. 1999; Schneider 2013). For instance, several banks still operate with decades-old systems due to the aforementioned challenges (Hemon-Laurens 2016).

Still, managing legacy systems’ end-of-life is becoming an increasingly current issue in many industries (Gauger et al. 2017) since eventually most ISs become obsolete (Furneaux and Wade 2017; Swanson and Dans 2000). Systems become technically obsolete as superior IT solutions with better performance enter the markets and become widely adopted. Moreover, old systems suffer from increasing or hidden maintenance costs (Gangadharan et al. 2013), security risks (Straub and Welke 1998), and the disappearance of critical system maintenance skills as employees retire or switch jobs (Sandborn and Prabhakar 2015). Furthermore, changing business needs render aging systems functionally obsolete if they cannot support organizations’ new strategic directions (Kelly et al. 1999). Indeed, obsolete systems can become a burden on an organization if they cease to provide business benefits or start costing business opportunities (Schneider 2013). This calls for a better understanding of how legacy systems are replaced in the IS change process.

While understanding organizational IS discontinuance is arguably important, most studies tend to focus on new system implementations and neglect the discontinuance perspective (Furneaux and Wade 2011). Those that specifically focus on discontinuance (e.g., Furneaux and Wade 2011, 2017) usually apply positivist factor models that close-box the change process as being unknown and ignore the socio-technical context in which the systems reside. Regarding IS implementation outcomes, research on IS change typically discusses IS successes (Lyytinen et al. 2009) and IS failures (Arvidsson et al. 2014; Sarker and Lee 1999). However, complex and deeply integrated legacy systems add their own twist to the dilemma: it is surprisingly common that legacy systems remain active in some form even after their intended replacements have been implemented, resulting in IS architectures with duplicate systems (CRN 2012). If an organization succeeds to implement a new system but fails to discontinue the old system, has the IS change succeeded? Current literature is lacking understanding of such grey area.

Against the above backdrop, I set out to investigate the following question: how does an organization get caught in between old and new system architectures when conducting IS change? To this end, I conducted a case study at a factory of a multinational manufacturing group through a series of in-depth interviews with key stakeholders. Legacy system implemented at the factory was deemed outdated and unfit for the strategic needs of the company, and thus a decision was taken to replace it with multiple modern commercial systems. This was followed by two implementation projects aimed to dismantle the old system, starting by replacing its product data management (PDM) and enterprise resource planning (ERP) functions. While for the most part the factory was able to migrate these functions into the care of commercial systems, today significant entities of the old system remain operational. Understanding the factors and events that led to the current situation requires examining various path dependencies and interactions in the change process at different levels of analysis. The punctuated socio-technical
information system change (PSIC) model (Lyytinen and Newman 2008) allows one to conduct such multifaceted process analysis. Thus, leveraging the PSIC model, I uncover why the original intention to discontinue the legacy system in its entirety has not realized and what this means for the organization. This article contributes to the IS change literature by providing a richer understanding of complex IS change processes and their outcomes, as well as by extending the PSIC model. This article is structured as follows. Next, I discuss relevant background literature of this study, and move on to describing my research approach. Then, I describe the case organization and disclose my data collection and analysis processes. Finally, I report my findings and discuss the implications of this study.

**Legacy System Replacement as a Socio-Technical Change Process**

Replacing a legacy system is arguably a compelling challenge for an organization as it requires executing bold organizational changes. Due to the complex structures and evident mission-criticality of legacy systems, killing them requires accounting for various interactions and externalities that emerge during and after such projects. The extant literature on legacy system replacement is scarce and mostly addresses the technical aspects of the topic from the software engineering perspective, proposing methodologies and best practices for migrating away from legacy systems or for extending their lifespan (e.g., Almonaies et al. 2010; Bisbal et al. 1999; Gangadharan et al. 2013; Ning et al. 1994; Stephen Adolph 1996). At the same time, empirical accounts of legacy system replacement as a part of organizational transformation are lacking. Overall, accounting for the wider organizational context and implications of system replacement is crucially important when explaining IS change (Averou 2001; Besson and Rowe 2012). This is true especially with legacy systems as they tend to be deeply intertwined in their organizations’ structures, processes, strategy, and culture (Kelly et al. 1999, p. 9). Indeed, highlighting the business dimension of legacy systems, Kelly et al. (1999) argue that “legacy systems cannot be defined solely as a technical problem” (p. 23) since they embody the strategic vision of their organization from the time the system was developed. Moreover, legacy systems are embedded into the daily routines of organizational actors and encompass their values, norms, and role expectations (Lyytinen and Newman 2008, p. 596-597). This makes legacy system replacement a significant socio-cognitive problem as well. Omitting contextual and socio-cognitive aspects could limit our understanding of the phenomenon.

Moreover, while the broader organizational IS change literature (e.g., Lyytinen et al. 2009; Lyytinen and Newman 2008) has acknowledged the importance of studying IS change in its larger socio-technical context, it has largely neglected the discontinuance perspective by predominantly focusing on the implementation of new IS. It has been noted that by focusing solely on adoption, one tends confound the lifecycle of an incumbent system with that of its replacement (Furneaux and Wade 2011, 2017). Such approach gives only limited insight on complex change processes that involve the discontinuance of incumbent systems, and thus on the outcomes of the IS change. Overall, the IS research field has been criticized for having pro-adopter bias: technology discontinuers are typically understudied (Rogers 2003), resulting in a lack of understanding of IS discontinuance as a phenomenon. Recent research (Power and Gruner 2015; Rinta-Kahila et al. 2018) has shown that studying IS discontinuance can shed new light on organizational IS change. The IS change research often implicitly assumes that implementing new systems automatically leads to the termination of old ones, but as practice has shown (CRN 2012; Hennon-Laurens 2016; Schneider 2013), this is not always the case. In this sense, some systems prevail far beyond their expected expiry dates, sometimes continuing to live alongside their intended replacements. This notion points to the possibility of high organizational intentions to discontinue a system coexisting with high intentions to keep maintaining it. Overall, both research and practice indicate that considering the discontinuance perspective can significantly inform the academic inquiry of complex system replacement processes – as well as their outcomes.

The discussion above points to the importance of understanding legacy system replacement as an organization’s socio-technical transformation where discontinuing the incumbent system plays a key role. Often a complex change is best understood through investigating its process, i.e., a series of events and interactions that occur in a time-ordered sequence. Process theories are emergent in nature as they explain how things develop and change over time (Markus and Robey 1988). Process theorizing allows one to capture the events and their interactions within their context, which can help to explain how an organization shifts from one state of being to another. Indeed, process thinking has enhanced our understanding of complex IS change (Ahmad et al. 2011). Thus, process theorizing can be a useful approach for uncovering
how organizations navigate through a difficult and time-consuming change that involves discontinuing legacy architectures and replacing them with a set of standardized systems.

Lyttinen and Newman (2008) have developed the PSIC model as an analytical tool for understanding IS change processes. The PSIC model captures multiple analytical levels of IS change, including the work system (WS) level (i.e., the incumbent organizational work processes), the building system (BS) level (i.e., resources and activities assembled for an IS change project), and the contextual levels of organization (e.g., top management) and its environment (e.g., customers, economy, legislation). The model views IS change simultaneously as technical and social change, that can be both incremental and punctuated, i.e., the change oscillates between periods of stability and moments of radical upheavals. At the core of the model is the socio-technical theory (Leavitt 1964), which suggests that socio-technical systems consist of four components: tasks, actors, structure, and technology. Tasks describe the goals and deliverables of daily work (WS) or change projects (BS). Actors include the people in the organization who are involved in work processes (WS) or change projects (BS), such as users, managers, and developers. Structure refers to the systems set up for communication, authority, and workflow in everyday work (WS) or in a project organization (BS). Finally, technology covers software or hardware-based tools for conducting everyday operations (WS) or for developing or implementing an IS (BS).

Balances and imbalances in work and building systems are embodied in connections and gaps between those four main components. For instance, a building system imbalance may occur through a gap between task and actors if project employees assigned to implement a new IS are found to lack the skills to do that. Then again, if the organization fails to grant sufficient resources for the implementation project, a gap between structure and task emerges. Discovering an incumbent IS as technically inadequate for supporting work processes is an example of a gap between technology and task in the work system. Finally, a misalignment between employee work roles and organizational policies would indicate a gap between actors and structure. The PSIC model allows one to adopt both horizontal and vertical modes of analysis: analyzing the consecutive balances and imbalances in socio-technical systems helps to understand the temporal dynamics of change, and a simultaneous consideration of different levels of analysis shed light on vertical interactions from the organizational and environmental context that also shape the change process. Finally, the model takes into account the history as a baseline for the IS change by including its antecedent conditions on each level of analysis.

In sum, the current literature on legacy system replacement has mostly concentrated on developing technically oriented prescriptions for transiting away from legacy architectures. However, the wider socio-technical processes and implications of discontinuing legacy systems have not received sufficient empirical attention. Moreover, we lack understanding of IS change outcomes where old systems remain existing on the side of new ones, forming complex IS architectures with duplicate systems. To fill this gap, I leverage the PSIC model as I investigate organizational legacy system replacement as a socio-technical change process that involves an attempt to discontinue the incumbent system while implementing its replacement.

Research Method

Case Study

Yin (2009) identifies case study as a capable method for empirically studying a complex phenomenon that is tightly embedded into its context. Thus, to investigate a process of complex system change, I conducted an in-depth case study at EngineShop\(^1\), a factory of a multinational manufacturing corporation EngineGroup. The group has more than 130,000 employees worldwide and its manufacturing business focuses mainly on robotics, heavy electrical equipment, and automation technologies. EngineShop is located in Finland, employs almost 1000 people, and is one of the leading production sites of the global organization, concentrating mostly on motors and generators. In the beginning of 2000s, EngineGroup undertook strategic initiatives to transform their traditional geo-centric operating model into a global matrix organization. This change entailed adopting unified IS architectures to replace the traditional

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\(^1\) To protect the anonymity of the case organization, I use pseudonyms of the organizational units discussed in this study. Thus, EngineShop and EngineGroup are aliases for real organizations. However, the information systems are referred to with their real names (DG, SAP, Teamcenter).
country and factory-specific legacy systems. For EngineShop, this meant running down their decade-old legacy system dubbed as Driving Glove (DG) and replacing it with commercial IS solutions. Change programs resulted in implementing modern systems for EngineShop’s product data management (PDM) and enterprise resource planning (ERP) processes. However, killing the remaining parts of the legacy system proved surprisingly difficult, and thus DG remains operational today, despite the persisting intentions to discontinue it. For the factory, this means increased complexity in their IS architecture, potential hidden costs, and the inability to fully exploit the possibilities of the new global ISs. I was fortunate to gain a generous access to the research site and interview key stakeholders of the IS change. This enabled me to collect a rich dataset that provides a very detailed picture of EngineShop’s IS architecture and the IS implementation processes.

**Data Collection**

The data collection progressed in three stages (see Table 1) and followed a realist approach as I attempted to gather all possible accounts of people that could explain the IS change outcomes at the factory. In Stage I, I conducted a preliminary group interview where my contact person, the Application Manager at EngineShop, had invited the most relevant stakeholders of the factory’s IS architecture. The interview participants represented various aspects and levels of EngineShop’s IS management. For instance, while the Factory Business Engagement Manager oversaw the overall IS architecture by acting as the intermediary between the factory and the global EngineGroup organization, Teamcenter Application Owner was working closely with the system end-users and was responsible for the local development of the factory’s PDM system. The goal at this stage was to gain an overall understanding of the situation at the factory and to identify a research question and possible approaches. This interview followed a loosely structured protocol and gave me a good overall understanding of the current situation at EngineShop. Based on this understanding I formulated a research proposal where I described the premise of the study, laid out preliminary research questions, and a suggested research approach. This proposal was evaluated by the factory’s IS management to ensure that I had acquired an adequate understanding of the situation.

Stage II involved a series of semi-structured interviews with all the participants of the group interview as well as several other key personnel identified by those participants. Considering that the question of killing DG was perceived as a somewhat divisive issue in the organization, and that many of the related events had occurred in the past, I triangulated my findings in line with Klein and Myers (1999) and Huber and Power (1985). Specifically, I requested to interview people who were somehow connected or invested into the legacy system environment and could bring relevant perspectives on the research problem. Furthermore, I requested such people who would be especially knowledgeable about the topic and who had been or were currently in relevant positions regarding the events of interest. To offset the effect of potential biases of informants, I asked to interview people who had contrasting perspectives or who knew about different aspects of the topic. Moreover, I requested for informants with various levels of emotional involvement to the topic. Regarding data elicitation, I attempted to motivate the informants to co-operate with me and remove potential disincentives to responding by explaining the purpose of the research and informing them that while we had a specific amount of time reserved for the interview, the interview would continue only as long as they were available and comfortable with. Further, I ensured the informants the anonymity and confidentiality of the interviews and that I would not disclose any information they did not wish to be recorded or reported.

Thus, using earlier literature on organizational IS change, IS discontinuance, and legacy systems as a sensitizing device, I formulated a semi-structured interview protocol to be used as data collection instrument for capturing the IS change process. The guiding themes at this stage related to previously reported issues with legacy systems (Kelly et al. 1999), factors that affect organizational IS discontinuance decisions (Besson and Rowe 2012; Furneaux and Wade 2011, 2017), and the socio-technical theory (Leavitt 1964; Lyttinen and Newman 2008). The significance of these factors was discussed regarding different temporal stages, i.e., before the IS change, during the change, and after the change. To this end, I inquired about issues such as the informants’ perception of and relationship with the legacy system and the implemented replacement systems, their view on the decision to replace the legacy system, complexities experienced in the transition, how the transition affected their work, and their assessment on why the legacy system persists on existing. The initial sample of informants consisted of eight managers and employees who were identified as relevant stakeholders in the first stage. While I attempted to cover the themes outlined in the protocol, I allowed the interviews to deviate from the script whenever needed. Moreover, I
made notes during the interviews and I allowed the informants to illustrate the process and system architectures on paper or a flipchart. I utilized snowball sampling as in the end of each interview I inquired whether the informant is aware of anyone else in the organization who could shed light on the topics of interest. This led to the identification of four additional informants for subsequent interviews in the second stage. The first round of interviews gave me a good overall understanding of EngineShop’s IS change process and their current IS architecture.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time</th>
<th>Title</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGE I: Initiation with a group interview</td>
<td>November 2017</td>
<td>Application Manager; Application Specialist; Factory Business Engagement Manager; Head of Engineering Applications; Teamcenter Application Owner</td>
<td>40 min</td>
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<tr>
<td>STAGE II: Individual interviews</td>
<td>December 2017</td>
<td>Business Unit Manager</td>
<td>54 min</td>
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<td></td>
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<td>Head of Engineering Applications</td>
<td>58 min</td>
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<td>Product Group Engineering Tools and Processes Manager</td>
<td>63 min</td>
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<td>Teamcenter Application Owner</td>
<td>64 min</td>
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<td>Country IS Manager</td>
<td>60 min</td>
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<td>Product Group Product Development Manager</td>
<td>27 min</td>
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<td>Factory Business Engagement Manager</td>
<td>45 min</td>
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<td>Application Specialist</td>
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<td>Purchasing Manager</td>
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<td>Business Unit Product Manager</td>
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<td>Factory Production Manager</td>
<td>52 min</td>
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<td>STAGE III: Follow-up interviews</td>
<td>March 2018</td>
<td>Product Group Product Manager</td>
<td>100 min</td>
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<td>Country IS Manager</td>
<td>81 min</td>
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<td>Project Manager</td>
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<td></td>
<td>Factory Business Engagement Manager</td>
<td>78 min</td>
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Table 1. Stages of Data Collection

In Stage III, I took a more detailed look on the events that led to the present situation at EngineShop. To this end, I conducted follow-up interviews with the Country IS Manager and the Factory Business Engagement Manager as the previous interviews had revealed that they possessed the most comprehensive knowledge about the two IS implementations. Moreover, I conducted two additional interviews with new informants: Project Manager, who had been closely involved with the ERP implementation and could inform me about its specifics, and Product Group Product Manager, who was expected to bring additional perspectives to the current IS architecture due to his focal role in the organization’s global IS development. Again, I produced an interview protocol guided by the levels of analysis and socio-technical components of the PSIC model, including in-depth questions about specific events and aspects. This time the interview protocol was more detailed and extensive than the previous one, resulting in longer interviews. Applying the logic of temporal bracketing (Langley 1999), I organized the protocol based on three periods: the antecedent conditions at the time the change was initiated (~2000–2005), the PDM and ERP implementations, their interactions, and surrounding conditions (2006–2010), and subsequent system development work and new replacement initiatives (2011–2018). This stage resulted in gaining additional perspectives to the IS change at EngineShop and filling of the missing pieces regarding the relevant events. Altogether, the three data collection stages resulted in 147 pages of transcribed interview data, 8 pages of fieldnotes, and various physical and digital exhibits.
**Data Analysis**

All interviews were recorded and transcribed. In addition, some informants provided me with illustrations of their IT processes, as well as physical and digital materials about the IS implementation projects. Studying these materials along with the interview transcriptions helped me to gain a better understanding of the overall process. My goal was to build a process model of IS change at EngineShop that would accurately describe how a strategic IS replacement project led the factory from using an all-encompassing legacy system into a state of being caught in between old and new IS architectures. Thus, I conducted a PSIC process analysis using Atlas.ti software and following the operational steps outlined by Lytinen and Newman (2008). First, I familiarized myself with the data by reading the transcriptions and making notes. This was followed by building an overall narrative of EngineShop’s IS change, where I gave codes to individual statements and paragraphs in the data that indicated critical events. These events were used to build a more structured change description through distinguishing the building system and work system narratives, in which I identified gaps and balances between the components of Leavitt’s (1964) socio-technical model. Specifically, I coded the critical events according to which socio-technical components they involved: task (T), actors (A), structure (S), or technology (Te). Then I examined interrelationships between the components and judged them either as balanced or having gaps that could emerge from incremental developments or punctuations. For instance, the following quote represents a gap between technology and task in the new PDM work system, emerging from a punctuation (i.e., the launch of the new system): “It could crash at any moment. It could be that when you were working on a task, it lost the connection and you were not able to save your work.” A gap or gaps between any of the four components indicated an imbalanced system, whereas a lack of gaps indicated a balanced system. Moreover, I investigated whether the subsequent gradual and punctual developments succeeded in filling the gaps or led to persisting or new imbalances. Then, I identified vertical interactions in the change process by connecting organizational and environmental events and conditions to the work and building system events. I also analyzed the antecedent conditions of the change by examining the circumstances prior to the IS change program on each level of analysis. This resulted in connecting each identified event to its antecedents and consequences at each level of analysis of the IS change process. In the final step, I composed a visual map of the IS change process.

The coding process was messy and iterative as I kept returning to the data after reflecting on and writing up the findings. Each event was validated and its impact assessed through comparing and evaluating the informants’ reports (Lytinen and Newman 2008). Certain degree of interpretive analysis (Klein and Myers 1999) was required as the informants’ views were occasionally in sharp contrast. The coding scheme could not be included in this paper due to space limitations but is available from the author upon request. The occurrence of contrasting opinions and perspectives on the IS change together with the wide coverage of organizational functions represented in the sample indicates that the sample is relatively free from bias.

**Findings**

In this section, I report the main findings of the case study. I begin by describing the antecedent conditions for the change. Then, I examine the critical events that initiated the change projects and the structure and process of those projects. Finally, I address the research question by analyzing the current state of the factory which can be characterized as ‘caught in between two IS architectures’.

**Antecedent Conditions**

Understanding the IS change at EngineShop requires accounting for its history, i.e., the antecedent conditions for the critical events. Thus, this section outlines the background of the IS change on four levels of analysis: work system, building system, and organizational and environmental context. Regarding work system, EngineShop had been utilizing DG for a decade. DG covered virtually every organizational function, including ERP, PDM, design, configuration, accounting, sales, and purchasing, among others. The Country IS Manager described the level of automation and integration in DG being “world class” during the system’s golden years in 1997–2005: “It was so tailored, fit-for-purpose, and made precisely for these operations. You could not find corresponding functionality from any commercial system or their combinations.” Data would flow automatically from one part of the system to another, and further outwards to other environments. Thus, the name Driving Glove – it fit into the hand like one. This level of integration resulted in high efficiency, which translated into high user satisfaction with the work system. Concerning building
system, while DG’s development started with a relatively narrow scope, the system was soon expanded to cover almost all the organizational functions, including design, configuration, accounting, sales, and purchasing. After five years of development, DG was launched. As legacy systems often are, DG was developed in an evolutionary manner. Users’ specific requests could be implemented rapidly and accurately into the system. This resulted in a highly complex system architecture as new functions were built on top of existing ones and additional features and functionalities integrated into the DG corpus. Such a flexible building system also contributed to users’ high satisfaction with DG. However, the golden days of DG were coming to their end due to changes in organizational and environmental context. A prominent trend in the business had long been a geography-centric model where factories operated independently from each other and answered to the global management. This was also the case with EngineGroup. However, the industry started moving toward models of global collaboration by operating in internationally networked matrix organizations. Moreover, emergence of new commercial IT solutions enabled companies to focus on their core competences by outsourcing their IT development and maintenance, creating further competitive pressures.

The IS Change Process

Overall, both implementations followed a punctuated pattern where the process advanced through the interplay of implementation project activities and environmental and organizational factors. Thus, the change patterns involved oscillation between work and building system balances and imbalances. In addition, the implementation projects interacted, affecting each other’s socio-technical balances. The process is illustrated in Figure 1. In line with Lyytinen and Newman (2008), the bidirectional arrows within the socio-technical work system (WS) and building system (BS) illustrations indicate the interrelationships between different socio-technical components (A, T, S, Te). Solid arrows and components’ white background indicate a balanced relationship, whereas dotted arrows between components with grey background indicate gaps. For instance, a gap between technology and task in the work system may occur if an incumbent information system is found to be incapable to support employees’ work tasks; such an imbalanced system would be denoted as “WS gap: T-Te”. The emergence of additional gaps between the same socio-technical components or deepening of existing gaps is illustrated with a darker shade of grey. Unidirectional arrows between socio-technical systems indicate punctuations. Socio-technical systems are enumerated based on (a) which implementation project they refer to (PDM 1-12; ERP 13-22), and (b) their temporal occurrence in the following process narrative. This helps the reader to connect events described in the text to the socio-technical (im)balances illustrated in Figure 1. The years denoted on the horizontal axis indicate the temporal occurrence of events across different levels of analysis.

Critical Events That Initiated Change

EngineGroup’s old management structures were obliterated as it transformed into a multi-level matrix organization with a more globally-oriented business strategy. The chains of responsibility would no longer lie linearly on single top-down axis, but they would extend to both local and global directions that were separately governed. Strategic IS changes were a natural follow-up to the newly defined business strategy. Regarding the engineering and manufacturing of products, the new global structure created operational needs for seamless collaboration between business units across geographical borders. For instance, an Indian factory should be able to assemble products of which components are designed in Finland and Estonia. DG’s legacy architecture was not designed for such global use and thus did not support this strategy. To the global organization, this represented an imbalance in the work system (i.e., incumbent socio-technical system for conducting organizational operations), essentially stemming from a gap between technology and structure as the old legacy technology did not support the new organizational structure (WS1 gap: S-Te) and the new ways of operating (i.e., changing tasks) it entailed (WS1 gap: T-Te). Regarding resource planning, the need to harmonize ERP systems across EngineGroup had been acknowledged already in the early 2000s: at that time the global organization was running more than 800 different ERP systems. This inhibited efficient global ERP coordination, representing gaps between technology, work tasks, and structure in the incumbent ERP working system (WS13 gap: S-Te; T-Te). Thus, two change programs were put forth by the global management. First, the need for global operability led to initiating a project to harmonize PDM systems within EngineShop’s business unit, and EngineShop was selected as the pilot site for the change due to the high system development expertise at the factory. At the same time, a
Caught in between Old and New IS Architectures

Figure 1. IS Change Process at EngineShop

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global organization wide initiative to harmonize all ERP systems was put forth. SAP® was selected as the ERP system and the transition was facilitated with an ERP-focused change program dubbed as ‘One Simple EngineGroup’ (OSE). From the local perspective of EngineShop factory, although their DG was effectively serving as both a PDM and ERP system, the management was also concerned that soon the old code behind DG would run into incompatibility issues (WS1/WS13 gap: S-Te). Moreover, since the development of DG had been in the hands of very few, the expertise required to maintain it was feared to disappear as these people would eventually retire, ultimately creating a gap between actors and technology (WS1/WS13 gap: A-Te). “This kind of [system] that is completely in our own hands, a fully tailored system based on a technology that is rotting away from below. That is a risk for business continuity too. If an unpredictable technical discontinuity occurs with some technology that is associated to that [system]. Then the bill could be astronomical, what we have to pay to secure the continuity and operability of its business logic in that environment. In the end, we have to remember that these kinds of risks exist when talking about legacy systems.” (Country IS Manager)

Against this background, when the two global change initiatives were communicated to EngineShop, it became clear that it was time to let go of DG. However, since the system had grown into an all-encompassing “monolith” that was integrated into every process at the factory, it was apparent that it could not be taken down all at once. Thus, in line with the global initiatives, the management started by focusing on the PDM and ERP functions. Whereas at this point it was already clear that SAP would be the new ERP system of the global organization, EngineShop had to find an apt PDM system. Since the intention was to get rid of DG entirely, the initial plan was to split the monolith into two parts: engineering processes (incl. product data and configurator) would be transited to the new PDM system and ERP processes (incl. order-fulfillment, document mediation) to SAP.

IS Change Narratives: PDM and ERP Implementations

During 2006, EngineShop conducted an extensive pre-evaluation of the current IS architecture and the potential new PDM solutions. Contrary to the initial intentions, these evaluations revealed that their incumbent DG-based product configurator was too complex and integrated to be discontinued within the scope of the PDM project without disrupting factory’s ongoing operations. This indicated an imbalance in the building system (i.e., the project organization set up to erect a new system), as the structures set up to execute the change (i.e., scope and resources) were found insufficient for the original purpose of replacing both PDM and product configurator (BS2 gap: S-T). Thus, it was decided that the new PDM would be integrated into the remaining body of DG, including its product configurator, so that the factory could keep on operating as before. The configurator would be replaced with a more modern system later. A system known as Teamcenter® was selected to replace DG’s PDM function and its implementation was initiated in 2007. This decision to narrow the project scope resulted in balancing the building system as the task was adjusted to correspond the structure through aligning project scope with its resources (BS3). However, new gaps between the building system’s actors, task, and structure emerged when it was discovered that, contrary to the vendor’s initial promises, Teamcenter could not support the complex requirements of EngineShop’s processes without heavy customization. Resources allocated for the project, especially in terms of time and work hours, were found insufficient for the task of implementing it (BS4 gap: S-T). “We did get an understanding of DG’s complexity during the pre-investigations in 2006. But that the new system did not bend as much [as was expected] and that modifying it was so difficult, that was a bigger surprise in my opinion.” (Country IS Manager) Despite the significant pre-evaluations, project employees and managers had neither possessed an adequate understanding of the complex integrations between DG and engineering processes nor the capabilities of Teamcenter to bend into those processes (BS4 gap: A-T).

These gaps deepened later when product data was being migrated from DG to Teamcenter: a significant portion of the data got corrupted in the migration (e.g., some component lists broke down) and the factory lacked available human resources to repair it (BS5 gap: S-T, A-T). Balancing them required punctuations: more work hours were spent for tailoring Teamcenter to fit EngineShop’s processes; and additional labor was hired to fix the corrupted legacy data (BS6). Due to these punctuations, Teamcenter implementation

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3 https://www.sap.com/index.html

was significantly delayed. However, this was not a major problem as DG was still effectively serving as the current PDM system and the project had no fixed deadline. In 2009, Teamcenter was launched into use as it replaced DG as the PDM system. However, Teamcenter turned out to be in many aspects far inferior to its predecessor: the system was unstable as it kept crashing, and its performance was frustratingly slow, increasing lead times prohibitively (WS7 gap: T-Te). Although the system had been tailored to the incumbent IS architecture (i.e., structure), similar levels of integration as before could not be achieved, resulting in more manual work where the same data needed to be recorded in multiple fields (WS7 gap: S-Te). Thus, engineers (i.e., actors) exhibited change resistance and vocal dissatisfaction with the system (WS7 gap: A-Te), especially when contrasted to the satisfying performance of DG. Nevertheless, from the global managerial perspective, the system was working well enough to be replicated in other factories within the business unit.

Although the management assured that Teamcenter would receive rapid improvements, the spotlight had already moved elsewhere as the OSE program had shifted to Finland. Preparations for SAP implementation had already been started in the fall of 2008, and now in 2009 when Teamcenter was working well enough to keep the operations running, SAP implementation project was put forth (BS14). Unlike the PDM transition that had been given a flexible schedule, the ERP change had a strict deadline “written in stone” by the global management. Just like in the Teamcenter implementation, significant building system imbalances emerged through the revelation that SAP in its vanilla form was not flexible enough to support the current ways of working at EngineShop. This would require significant process re-engineering, something that the factory had not anticipated when planning the implementation (BS15 gap: S-T) since project management and employees had not been entirely aware of the magnitude of the change required (BS15 gap: A-T). Thus, a choice had to be made between re-engineering the processes to fit SAP and tailoring SAP to support the existing process. This BS imbalance led to the deepening of the gap between actors and task when the project management could not reach an agreement on the matter (BS16 gap: A-T). While two managers wanted to tailor SAP to ensure the continuity of operations, one manager felt that the processes should be re-engineered to harness the full potential of SAP. This disagreement was escalated up to the factory management, and it was resolved by management’s decision to favor the former perspective, i.e., SAP tailoring (BS17). Finally, SAP was integrated to Teamcenter (WS7-BS17) and launched into use (WS18). Due to the strict schedule and the sheer immensity of the project, SAP implementation had absorbed most of available resources from Teamcenter development (BS17-BS8).

Post-Implementation Development

Teamcenter’s performance problems required significant development efforts but these had to wait due to the vertical effects of global management prioritizing between the projects (BS8 gap: S-T): “Engineering times increased, I think as much as by 50%... [...] we thought that it [Teamcenter] would get improvements straight away. But then the SAP implementation came and took all the development resources from Teamcenter. [...] Then two years passed without any developments.” (Teamcenter Application Owner). Moreover, the integration between Teamcenter and SAP altered work processes to include more stages than before (WS9 gap: T-Te). These factors led to increased dissatisfaction among the engineers and thus deepened the gap between actors and technology (WS9 gap: A-Te). However, eventually Teamcenter got improvements (BS10). First, these occurred in a more punctuated manner when major updates and reconfigurations helped to bring the system onto a more usable level, and later the development followed a more incremental path when the system received regular but less radical improvements. Still, despite the performance improvements, the user dissatisfaction prevailed (WS11 gap: A-Te): “The decrease in integration [still] causes a lot of dissatisfaction in users.” (Country IS Manager) “...Teamcenter has improved but it is still not on the level of DG in terms of performance.” (Teamcenter Application Owner). Interestingly, it seems that the initial shock of performance drops had lasting psychological impacts regarding how engineers evaluate Teamcenter, resulting in a persistently deep gap between actors and technology (WS12 gap: A-Te): “I’m not sure if today the actual grade [evaluation of Teamcenter in work satisfaction survey] is really that bad anymore or whether people just give it [a low grade] due to old habits based on the fact that it did not work ten years ago.” (Teamcenter Application Owner). SAP required significant post-implementation development too: a few weeks after its launch, rashly executed integration of SAP’s purchasing function caused some purchases to delay (WS19 gap: T-Te). The situation was resolved by manually ordering the purchases and ultimately fixing the integration (BS20). In some respects, the factory went backwards in their IS implementation: since SAP could not bend
to EngineShop’s complex requirements for the document mediation (DM) process (WS19 gap: T-Te), they needed to develop a replacement for DG’s highly automated and customized DM application that had been discontinued (BS20). Compared to the previous DM application that was carefully tailored around the work processes, the newly developed replacement had to be integrated to both DG and SAP, and in terms of functionality was a step backwards. Moreover, later one department found themselves doing a significant part of previously ERP-integrated work manually in Excel (WS19 gap: T-Te). This resulted in building additional functionalities to SAP (BS21), resulting in a better-functioning work system (BS22).

**Caught in between**

“We got a good funding for that so we could start building it. [...] But after engaging to the actual projects, we came to realize exactly how far thought the business logic of DG was. How hard it was to replace it with generic commercial systems. ... [now we are IS] architecture wise pretty much in the same situation as we were after these projects in 2010. Still.” (Country IS Manager)

Since killing DG altogether was found infeasible within the project scopes of the time, the new systems needed extensive integrations and add-ons that connected them into the remaining legacy corpus. Yet, their performance and integration did not reach the same level that DG used to have. Since data did not flow as fluently between different systems as it had done in ‘the monolith’, the amount of manual work increased as users now had to record the same data into numerous places. Certain entire functions remained tightly in the old DG environment, most notable ones being product configurator and document mediation. To this day, there is still no clear vision how these functions would be modernized. Thus, EngineShop is caught in between two IS architectures: old legacy systems and modern applications. To address the research question (i.e., how does an organization get caught in between old and new system architectures?), I explain the occurrence of this outcome through analyzing the horizontal (i.e., temporal path dependencies) and vertical interactions (i.e., effects across multiple levels of analysis).

**Horizontal Interactions**

Horizontal interactions shaped the outcome of the system implementations, as the decisions made prior and during the projects determined the emergence of gaps in work and building systems, both during and after the implementations. The reasons for the difficulties in these implementations can be traced down to the choices made regarding process re-engineering, as the factory strived to balance between maintaining their existing operability and achieving new strategic goals. The Business Unit Manager exhibited a strategic, process re-engineering-oriented view on IS change: “When thinking about future competitiveness, if we have certain cemented boundary conditions that come somewhere from the shadows of our history, they cut the degrees of freedom in developing our operations. A concrete example: we have a certain way of measuring our electric engines, which is based on our specific ways to work on steel plates at the factory, which determines how we measure windings. And the whole [system] logic is built on top of that.” (Business Unit Manager) Yet, some informants felt that the process re-engineering potential of the IS change was not utilized. From the socio-technical perspective, gaps between actors, structure, and task were critical sources of imbalance in both implementations: people conducting the IS change were not sufficiently aware of the extent of change required to implement the new systems, and thus the initial structures assembled for the projects were found insufficient. Balancing these gaps was a matter of choosing between heavy process re-engineering and significant system customization – to modify either task or technology of the upcoming work system. While some extent of process re-engineering was conducted, it was mainly technology that had to bend in front of the processes that were still mainly based on the old factory-centric logic, instead of transforming them to fully align with the new global structure.

The Head of Engineering Applications criticized the factory’s IS development practices, arguing that some of the difficulties in replacing the old legacy architecture stem largely from the general lack of process re-engineering-oriented thinking at EngineShop: “...instead of rethinking our processes, it has been more about identifying inefficiencies and then developing the system to decrease the lead times. So, if an engineer does not have certain data and has to spend a long time to retrieve it, instead of thinking whether s/he even needs that data, we have just developed DG... [...] ...a new report or a new database linkage or a new ‘IF formula’ on top of existing IF formulas. So, instead of thinking what the engineer should do, we have just coded those new IF formulas.” This refers to the history of IS development (i.e., antecedent conditions) at EngineShop: the evolutionary development practices of DG’s golden era appeared to
influence also the new system implementations: when it was discovered that the new systems could not support the existing processes, the systems were tailored. Ultimately, this resulted in the factory continuing the trend of piling new applications on top of the existing ones, further complexifying their IS architecture. Trying to accommodate the existing architecture led into socio-technical system imbalances as the commercial systems did not fully bend to the factory’s challenging process requirements, causing further socio-technical gaps during and after the implementations. Considering that the implementations were heavier than expected, it was no surprise that some extent of ‘combat fatigue’ seemed to inhibit giving the project a full closure. Extending the replacement efforts to other functions was not on top of anyone’s agenda right after two demanding transitions, in which the factory was still struggling with achieving similar levels of performance as with the previous system architecture.

**Vertical Interactions**

Organizational context exerted significant vertical effects on IS change as the priorities and schedules set by both factory and global management shaped the extent of change. At the factory level, the management’s resolution to the quandary about SAP customization reflects a vertical effect that contributed into creating a gap between task and technology in the upcoming SAP work system. At the global level, the policy to direct post-implementation development resources from Teamcenter to SAP caused the emergence and deepening of several gaps in Teamcenter work system. Such vertical effects were significant also after the PDM and ERP implementations. The global management did not allow EngineShop to go forward with discontinuing the rest of DG but prioritized other more burning issues, such as implementing Teamcenter in other factories. During 2011-2017, several discontinuance initiatives were regularly brought up at EngineShop (e.g., “Kill DG’s configurator”) but those would always get blocked by the lack of top management approval, pushing the ultimate discontinuance to somewhere in the future. Indeed, in the eyes of the global management discontinuing the old legacy architecture represents a bad business case – it incurs significant costs but produces little immediate benefits. The Factory Business Engagement Manager explained that both the global matrix organization and the long lifecycles of EngineShop’s products make it difficult to drive through such initiatives: “There are many of those who can say ‘no’ to any given proposition and if any one of them does, the proposition goes no further. [...] We are stuck in the eternal cycle where we don’t get rid of the old [systems] since we don’t have anything new to build on, and the old one still exists and functions. Since our products have decades of usable lifetime, even delivery times can be as much as 10 or 20 years. [...] ...it’s a big thing and when we have ‘supposedly’ more urgent and important projects that consume money, it’s a question of prioritizing.” In addition, it is possible that the economic climate after the 2008 financial crisis has affected IS change budgets: “...the world after 2008 has been quite different than the world before 2008. [...] ...projects that take more than a year, you don’t have those anymore because you don’t get funding for several years. [...] And you don’t kill these large systems within one year.” (Application Manager) Hence, also factors related to EngineShop’s business environment impede discontinuing DG.

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**Figure 2. Different Socio-Technical Perspectives to EngineShop’s PDM System Change**
Different perspectives to socio-technical systems shed additional light on how vertical interactions shaped the IS change outcomes at EngineShop. The overall process model (Figure 1) gives an aggregate view on work system imbalances by drawing from the perspectives of the factory management and global management while ignoring the views of end-users. As this undermines the significance of such vertical misalignments, I extend the PSIC model by opening up the different perspectives to socio-technical systems, exemplified in Figure 2. Regarding the PDM work system, the IS change was put forth by the global management who saw that the incumbent local legacy systems did not support EngineGroup's strategy, as they were not aligned with the new organizational structure (WS gap: S-Te) and manner of operating (WS gap: T-Te). In addition to these concerns, EngineShop’s IS management was worried about DG’s end-of-life issues, namely, the future compatibility and maintainability of the aging technology (WS gap: S-Te) and the disappearance of expertise (WS gap: A-Te). Still, from the engineers’ and certain managers’ perspective, DG was a highly efficient and functional system that was serving their work task impeccably and could be developed and maintained in the future, representing a balanced work system. Similarly, when Teamcenter had been successfully implemented, the global management deemed the work system to be balanced (enough) and did not grant additional development resources for the time being. By contrast, engineers at EngineShop were struggling with poor performance (WS gap: T-Te), low integration (WS gap: S-Te), and change resistance (WS gap: A-Te).

**Discussion**

In a pursuit of increased agility and globalization, businesses are shifting from the traditional location-bound legacy systems toward modular, service-oriented IS architectures (Serrano et al. 2014). These shifts entail complex and risky IS changes, which are prone to fail. Against this backdrop, I set out to investigate the following question: *how does an organization get caught in between old and new system architectures when conducting IS change?* This in-depth case study comes with contributions to both theory and practice.

First, I contribute to the IS change literature by reaching beyond the traditional dichotomy of IS successes and failures by exploring an outcome of IS change where an organization gets caught or stuck in between two IS architectures. Although corresponding outcomes appear to be surprisingly common in practice (CRN 2012; Schneider 2013), they have not received adequate attention in the literature. While the current situation is far from optimal, and the factory intends to change it, it is also not completely unsustainable, and some informants even argued for maintaining the current status quo. While the primary goals of the IS change were achieved, the persisting legacy architecture restricts EngineShop’s organizational agility (Leonhardt et al. 2016) as it inhibits harnessing the full potential of modern IS environments.

Second, as a response to the research question, I disentangle the process that led to the caught-in-between state. Applying the PSIC model allowed me to systematically examine the emergence of socio-technical gaps and the consequent organizational responses aimed at balancing them. The inability to align EngineShop’s processes with the new organizational structures may relate to the bounded rationality and cognitive entrenchment of actors at the factory, materializing as tendencies to maintain current operations and to continue the long tradition of system customization. Whereas achieving the strategic objectives of the change would have required EngineShop to change the task, structure, and actors of the upcoming work system, it was technology that changed the most. Embracing the true extent of change needed to transform organizational operations is arguably challenging in the middle of daily work especially when talking about complex organizations with complex IS architectures. When implementing new IS, changing technology by tailoring it is easier and attractive on the short term but may cause problems in the long run due to increased IS complexity. After the two implementations, EngineShop's ability to change the implemented technology was limited due to the initial misalignment between technology, structure, and task. Thus, the other socio-technical components had to bend in order to achieve a functioning work system. The faithfulness to incumbent processes reflects organizations’ inert tendencies to implement new ISs to merely automate or accommodate the existing processes (Arvidsson et al. 2014; Hammer 1990; Lyytinen and Robey 1999), possibly exhibiting some extent of strategic blindness (i.e., the failure to realize strategic intentions of IS implementation in organizational practices, Arvidsson et al. 2014). In a sense, the factory failed to properly unfreeze (Schein 1996) its practices when initiating the change, resulting in a more superficial change where the deep process structures remained the same. Surprisingly, refreezing after the change was not complete either: due to Teamcenter’s poor performance, many engineers still kept using the remaining functions of DG for certain tasks, although those tasks were intended to be moved to Teamcenter. Vertical interactions
from the organizational context were salient as the top management prioritized between multiple projects by moderating resources and marginalizing the end-users (Lyttinen and Newman 2015). Another crucial factor relates to the tension between local efficiency and global operability of ISs in multinational organizations (Rolland and Monteiro 2002; Williams and Karahanna 2013). In EngineShop’s case, balancing the global and local needs presented the factory with difficult trade-offs that ultimately led to compromises in IS implementations. Finally, the environmental context regarding the nature of EngineShop’s business and the economic climate of the time shaped the change outcome as well.

Third, this study demonstrates how the PSIC model can be leveraged to capture important but often neglected aspects in a major IS change. Whereas previous work has considered the successful launch of a functioning work system as the ultimate outcome of IS change process (e.g., Lyttinen et al. 2009), I show how the PSIC model can be leveraged to understand how post-implementation processes shape the organizational outcomes. With both implementations, certain gaps in the new work systems were spotted only when the systems had been in active use for some time, suggesting that endeavors to understand IS implementation success should not be limited to treating a successful system launch as the ultimate outcome. Finally, I extend the PSIC model to capture contradicting perceptions of socio-technical systems by showing how the interpretation of their stability may depend on the level of analysis (Figure 2). Accounting for this helped to understand how the organization ended up being caught in between two IS architectures: when actors’ perspectives and agendas are not vertically aligned, conducting bold changes with success becomes difficult (Arvidsson et al. 2014). Hence, I suggest the future research on complex IS change processes, when appropriate, to account for different interpretations of socio-technical balances and their implications.

From the managerial point of view, this case sheds light on dilemmas managers face when engaging in complex IS change. Telling a detailed story of how events and their interactions shaped the outcome of a complex IS change process can inform managers about relevant considerations associated to such change (Ramlill and Pentland 2009). In essence, it can help managers to grasp a variety of possible trade-offs and complexities associated to change, resulting in better-informed decisions. This case highlights the importance of understanding of the extent of integration of old systems and the capabilities of their intended replacements. While pre-evaluations were conducted at EngineShop, such complexities and limitations still came as a surprise to the factory. Another key lesson is that striving to maintain ongoing operations and product support may cost an organization the opportunity for significant process re-engineering that could give them competitive edge on the long term. Thus, managers should be willing to look beyond the incumbent processes and reshape their operations to be aligned with the overall strategy.

This study comes with a few limitations that must be acknowledged. Most events reported in this study occurred in the past and are captured from the informants’ retrospective accounts. Thus, it is possible the informants did not recall all significant events that shaped the process and its outcomes. Moreover, it is possible that some exhibited personal biases regarding recollecting and interpreting the events. However, I made significant efforts to offset such potential sources of bias by interviewing various stakeholders with different positions and varying perspectives to the IS change. I was also able to verify some events by studying documents retrieved from the informants’ archives. Moreover, the complex matrix structure of the multinational EngineGroup organization and the complicated IT architecture at EngineShop made distinguishing and interpreting some of the interactions between project events and contextual factors challenging. Thus, it is possible that I have missed some relevant considerations and nuances when making sense of this complexity. However, throughout the research project I actively consulted the factory management and staff to ensure I have an adequate understanding of their socio-technical environment.

To conclude, legacy systems are notoriously difficult to modernize, and their replacement presents organizations with severe economic and operational risks. While this issue is widely acknowledged across industries, the complexities of this dilemma have not been fully captured in the current IS literature. I conducted an in-depth case study at a factory that has been trying to kill its legacy system for years with limited success: the implemented replacement systems have not been able to take over certain critical processes, and this has caused the organization to get caught in between two system architectures. Applying the PSIC model, I identify the events and processes that led to this outcome. Moreover, I extend the PSIC model by accounting for different perspectives to socio-technical balances. My findings help to understand why discontinuing legacy systems tends to be difficult and provide managers with essential considerations to be taken into account when engaging into such projects.
References


Paper III


Unpublished manuscript.
When the Black Box Disappears:

The Surfacing of Latent Deskilling after IS Automation

Abstract

While knowledge work automation offers higher efficiency and lower costs, its potentially adverse effects on workers’ skills are also a perpetual concern. One of them is the fear that relying on such automation may deteriorate workers’ professional abilities, deskilling them. To better understand the conditions leading to deskilling and its implications on organizations, we investigate two research questions: 1) how does organizational automation implementation lead to deskilling of knowledge workers?; and 2) how may an organization cope with deskilling? We conducted a revelatory case study about an IT service firm that had been actively using a fixed assets management (FAM) software for many years and found that deskilling resulted from workers handing off the mindful control of the task to the software. Environmental, organizational, and cognitive factors facilitated this process. Our case company discovered this outcome only after having already discontinued using the FAM software. This resulted in struggle to cope with the lack of skills to rapidly regain them. Our findings thus indicate that deskilling may occur latently – unacknowledged by workers and managers – and surface only when automation is discontinued, and manual skills are needed again. The lack of skills then disrupts organizational processes and necessitates various coping strategies on worker and company level, such as modifications of work routines and procedures as well as relearning the forgotten skills and knowledge. Based on these insights, we provide theoretical and managerial implications.

Keywords: automation, deskilling, knowledge work, accounting, case study
INTRODUCTION

“When you have it automated, you don’t really start to contemplate the deep origin of things.”

- Accountant at AccComp

Virtually all companies implement information systems (ISs) as a form of office automation (McLeod Jr. and Jones 1987) to increase the productivity and performance of their knowledge workers. With automation, functions previously carried by human operator are fully or partially replaced by technology (Parasuraman 1997). Automation facilitates work processes and frees workers’ time and attention to other tasks. Evidently, IS-enabled automation delivers concrete operational, managerial, and strategic benefits that directly contribute to firm’s bottom line (Shang and Seddon 2002), and may even enhance employee welfare by taking care of repetitive and mechanical tasks (Millman and Hartwick 1987). However, the long-term consequences of automation on employee skills are still a subject of debate. While automation can produce significant advantages to its implementers, it also tends to force them to question the need to develop and maintain employee expertise and knowledge (Orlikowski 1991). In fact, inappropriate reliance on automation may lead to counter-productive partnerships between automation and its operators, such as misuse and disuse of automation (Lee and See 2004; Parasuraman 1997). Thus, questions about ethics of automation have become an important concern: “What should be automated?” (Tedre 2006, 2014).
Besides facilitating knowledge work, IS automation alters work processes (Millman and Hartwick 1987) and can even disrupt them (Davis and Hufnagel 2007; Drummond 2008). One of the most often raised concerns of IS automation’s adverse effects is work force deskilling\footnote{The term deskilling has been used to refer to two parallel but distinct phenomena (Orlikowski 1991): an occupation or industry requiring less skills than before (e.g., due to the introduction of technology, resulting in cost savings from hiring less skilled labor; Braverman 1974) and a person becoming less skilled (e.g., due to overreliance on technology; Arnold and Sutton 1998). Thus, from an organization’s perspective, the former effect is often an intended one, while the latter effect tends to be an unintended side-effect. In this article, we refer to the latter meaning of the word.}: when automation is implemented as a ‘black box’ that masks the work procedures, the workers may gradually lose the essential process knowledge of those tasks (Davis and Hufnagel 2007; Murphy 1991). Carr’s business bestseller (2015) suggests that automation makes us complacent: it causes us to lose the fundamental understanding of the logic and mechanics behind the automated processes and renders the professionals who previously were in charge of performing the operations manually as mere external observers or assistants of technology. This may result in a loss of hands-on know-how, inability to diagnose and remedy problems in processes, and ultimately decreased process control. In this scenario, automation transforms the hard-earned expert knowledge into a black box that conjures results and brings to mind the pessimistic view of technology becoming “the master while [hu]man is relegated to the slave” (Hirschheim and Newman 1991, p. 39).

While the effects of automation on knowledge work have been actively studied (e.g., Arnold et al. 2006; Davis and Hufnagel 2007; Dowling and Leech 2007; McCall et al. 2008; Murphy 1991), we still lack understanding of how deskilling develops in an organizational knowledge work environment. Although prior research suggests that reliance on automation can cause deskilling in
the long term (Arnold and Sutton 1998; Dowling et al. 2008; McCall et al. 2008), empirical investigations of the matter are few (McCall et al. 2008; Triki and Weisner 2014). Moreover, we know little about the strategies that workers and their organization may leverage to cope with the potentially adverse consequences of deskilling. Thus, we focus on two questions: 1) how does organizational automation implementation lead to deskilling of knowledge workers (RQ1) and 2) how may an organization cope with deskilling (RQ2).

To this end, we conducted a case study in an IT service firm, focusing on accountants – a worker group whose performance is of utmost importance to any company but whose competence has become increasingly precarious through automation of digital payments and reporting process. Since accountants can be held legally responsible for tax reporting, mistakes due to deskilling can lead to sanctions such as tax increases, fines, and even sentences for financial officers and executives. that had discontinued using their accounting automation software.

We draw on theoretical constructs discussed in seminal automation literature (Arnold and Sutton 1998; Parasuraman and Manzey 2010; Zuboff 1988) when exploring the first question. Regarding the second question, we apply the lens of coping theory (Beaudry and Pinsonneault 2005; Lazarus and Folkman 1984) as it has been found suitable for explaining coping with disruptive IT events, which the effects of deskilling may very well be.

Based on our analysis of in-depth interviews, we show that automation’s negative effects on knowledge may remain latent, or unacknowledged, due to continuing reliance on automation. Latent deskilling may suddenly surface when automation’s discontinuation reveals deficiencies in employees’ skill repertoire. We synthesize these findings in a deskilling process model and provide managerial implications that help avoid and recover from disruptions. We also discuss how
automation can be designed and managed so that the systemic risks from handing process knowledge to automation can be mitigated.

THEORETICAL REVIEW

Studies on deskilling’s potentially severe consequences often draw from the theory of technology dominance (TTD, Arnold and Sutton 1998) which suggests that “there is a positive relationship between continued use of an intelligent decision aid and the de-skilling of auditors’ abilities for the domain in which the aid is used” (p. 189). TTD’s propositions are largely premised on the notion that deskilling results from reliance on automation. While TTD’s hypotheses on the formation of reliance have received empirical support (Hampton 2005), only few papers have investigated its deskilling proposition reiterated above – or the relationship with automation and deskilling in general (Triki and Weisner 2014). These few studies (Axelsen 2012; Dowling et al. 2008; Galletta et al. 2005; Jones and Wright 2010; Mascha and Smedley 2007) have provide mostly preliminary evidence about IS automation causing deskilling (Triki and Weisner 2014, p. 66). Moreover, since most of them are cross-sectional studies that apply quantitative field experiment methodology, they give very little insight on the process that results in deskilling. This leaves open the question of how deskilling happens over time in organizations.

Others have found that IS automation may prevent the formation of new skills in the first place (e.g., Murphy 1991; Orlikowski 1991). Then again, automation has been found to result in a number of other adverse consequences such as disrupting professional identity (Davis and Hufnagel 2007) and causing problems in service processes (Drummond 2008). Such consequences seem to stem from an altered task governance between workers and automation, where human
workers’ tasks change from those requiring higher level cognitive effort into tasks involving mindless “pushing of buttons”.

However, deskilling is not necessarily process automation’s inevitable outcome (Millman and Hartwick 1987; Sayed 2006; Zuboff 1988). If novel kind of mental work is simultaneously introduced, the workers’ skillset may in fact expand (Attewell and Rule 1984; Gallie 1991; Willcocks 2004; Zuboff 1988). Moreover, workers have an agency – they can actively mitigate the uninvited effects of automation (Orlikowski and Barley 2001). For instance, workers can inhibit IS automation’s deskilling effects by actively redefining and developing their expertise (Sayed 2006). Also, sometimes implementing IS merely alters or even increases workers’ skill requirements instead of diminishing them (Orellana 2015; Schuppan 2014). These findings reflect the more optimistic scenario in which technology is portrayed as a “tool” and the end user as the “craftsman” who is skilled enough to decide when and how to use the tool to her or his advantage (Hirschheim and Newman 1991). As Arnold (2016) puts it: “you need smart users to use smart technologies” (p. 5).

**Roots of Deskilling**

While automation is typically expected to free its operator from mundane tasks, it also takes over such detail work that fosters the development and maintenance of expertise (Arnold and Sutton 1998; Mascha and Smedley 2007; Rochlin 1997). In addition, deskilling is often attributed to the structural restrictiveness of IS, which, while reducing the cognitive load, forces its operator into a restricted frame of thinking and operating (Arnold 2016; Carr 2015). Furthermore, Carr (2015) argues that automation complacency plays a key role in the degradation of skills. Cambridge Dictionary (2018) defines complacency as a “feeling of calm satisfaction with your own abilities
or situation that prevents you from trying harder”. Thus, automation complacency generally reflects a sense of security that the automated system will work flawlessly, causing its operators’ attention to drift and rendering them overly reliant on automation (Parasuraman and Manzey 2010). A closely related concept, automation bias, occurs when the operator gives undue weight to the information provided by the system, ignoring other sources of information, such as environmental cues that the automation cannot detect. These concepts are usually connected to automation’s effect on its operator’s situational awareness and performance, typically in contexts where mistakes may carry grave consequences, such as in aviation (Parasuraman et al. 1993) and driving (Strand et al. 2014). Parasuraman and Manzey’s (2010) integrated model of complacency and automation bias suggests that reliably functioning automation makes the automation’s operator compliant, which leads to attentional bias, further resulting in the loss of situational awareness and blind reliance on automation. If no negative performance consequences occur, a positive feedback loop of “learned carelessness” is formed, where reliably functioning automation increases its operator’s automation complacency. Automation’s reliability tends to increase its operator’s trust in it, creating an overreliance on automation that may result in undesired performance consequences (Parasuraman et al. 1993).

In contrast to compromised situational performance, deskillling refers to the decrease or entire disappearance of skills, relating to the long-term implications of automation (Arnold and Sutton 1998). Complacency, bias, and overreliance could be expected to shed light on deskillling too: when they keep on occurring, the operator’s know-how erodes over time, ultimately leading to a decreased skill repertoire.
Coping with Deskilling

Workers may need to cope with deskilling when the lost skills are needed again, for instance, when organizational IS is replaced (Furneaux and Wade 2011, 2017), IT implementation is decreased (Power and Gruner 2015), or work tasks and roles are transformed (Davis and Hufnagel 2007; Orlikowski 1991). They may need to find ways to work around the tasks without the IS and the skills (Ferneley and Sobreperez 2006) or to relearn the lost skills anew. No research prior to this paper, to our knowledge, discusses knowledge workers’ coping with deskilling caused by organizational automation implementation. Nevertheless, literature on coping with stress (Lazarus and Folkman 1984) and its extensions to technology implementation contexts (Beaudry and Pinsonneault 2005) give some indication of how this could happen.

The coping model of user adaptation (CMUA; Beaudry and Pinsonneault 2005; Elie-Dit-Cosaque and Straub 2011) posits that awareness of an IT event (such as an event of IS’s discontinuation) is followed by users’ evaluation of the event’s potential consequences, starting with primary appraisal where the event is interpreted either as an opportunity or a threat. In a secondary appraisal, users assess the extent of influence they have over the event regarding three components: work, self, and technology. These assessments precede workers’ evaluations of potential coping strategies, such as benefits maximizing and benefits satisficing (under opportunity appraisal) and disturbance handling and self-preservation (under threat appraisal). The strategies entail both problem-focused and emotion-focused acts. The former ones aim to manage the disruptive issue itself by changing the environment (e.g., altering organizational practices) or changing oneself (e.g., learning new skills or restoring forgotten skills). The latter ones aim to reduce the emotional
distress caused by the disruption, e.g., by maintaining hope and optimism, submitting into passive acceptance, avoiding, or venting anger.

Thus, CMUA predicts that a discovery of deskilling will trigger either disturbance handling or self-preservation strategies depending on the extent of influence the worker has over the components and the event’s evaluation as a threat or an opportunity. If users adopt the disturbance handling strategy, they will engage in re-learning the lost skills and educate themselves to master new tools that required. On the other hand, if they adopt the self-preserving strategy, their coping will consist of emotion-focused coping, such as active user resistance (Kim and Kankanhalli 2009; Lapointe and Rivard 2005) or passive resistance through technology misuse (Marakas and Hornik 1996).

Summing the review of research overall, literature indicates that IS automation can have negative effects of knowledge workers’ cognitive capabilities. However, the research attention has been mainly on short-term knowledge losses, which has left automation’s deskilling effects virtually unaddressed, especially concerning the question of how deskilling happens. Moreover, while workers might encounter situations that require coping with deskilling, prior literature offers only starting points for the theorizing on how such coping may happen.

**EMPIRICAL STUDY**

**Research Approach**

Research on the effects of automation on knowledge work skills involves an empirical challenge of finding a method that enables observation of a negative change in workers’ cognitive skillsets. The task is challenging because skills and their changes are not readily perceivable. In addition, deskilling can usually be recognized only retrospectively. One way to work around the challenge
is to tap into a case organization where a long-term automation implementation has been discontinued and where workers are required to carry out their tasks manually again. Interviews with the employees can then ascertain that deskilling has occurred and also retrospectively reveal the process that led to this situation.

Following this approach, we conducted a case study in a company that had discontinued its previously implemented automation. Conducting a case study using a single-case research design can be valuable if the case is “revelatory”: if it provides the researcher with an access to a phenomenon previously inaccessible to scientific inquiry (Yin 2009). We were fortunate to gain access to our case organization during the time of disruption resulting from knowledge work automation getting discontinued and recovery resulting from a relearning process that followed. Our approach was inductive and data-driven. However, we did not enter the field with an “empty mind”; rather with an “open mind” (Siggelkow 2007). We utilized existing literature as a frame of reference and a sensitizing device both in the preparation of interviews as well as in the analysis of the data. We gathered qualitative data, and when doing that we interleaved our data collection and analysis, consistent with the guidelines of conducting revelatory exploratory case studies (Yin 2009).

Due to the above-mentioned empirical challenge, hypotheses on deskilling are challenging to test using “a traditional scientific method” (Arnold and Sutton 1998, p. 192). To understand how cognitive changes unfolded in our case organization, we take a process theorizing approach (Markus and Robey 1988) and apply a multi-level process analysis to build a narrative of events that explains how and why deskilling occurred. This narrative is then used to produce a process theory of the phenomenon of interest (Pentland 1999). Consistent with the logic of temporal
bracketing (Langley 1999), we limit our data collection and analysis to concern specific time periods: time before automation, automation introduction and implementation, its subsequent discontinuance and the following disruption, and coping and recovery that followed. In reporting our empirical study and its results, we apply visual mapping (Langley 1999) to illustrate the sequence of emergent events over time on different levels of analysis.

**Case Organization**

The organization, called AccComp², in which process automation and related events took place was a Finland-based but internationally operating medium-sized IT firm with a personnel count of almost 1000 employees. AccComp operates in the field of IT services, specializing in the development of digital business solutions and financial processes, including accounting outsourcing. For a decade, AccComp had been utilizing FamSyst, a software specifically designed for fixed assets management (FAM), along with their main accounting system, OldSyst. In essence, FamSyst was an office automation system designed to facilitate a very specific but complex part of accountant work. While some companies choose to conduct FAM manually, FAM automation, such as FamSyst, is an attractive option when the amount of fixed assets is large. Since not every organization automates their FAM process, FamSyst can be considered as an automation that performs functions that are also executed manually by humans, rather than a pure machine operation (Parasuraman 1997).

At AccComp, accountants had specified the preferred depreciation methods in FamSyst and fed the acquisition prices of the company’s fixed assets (e.g., IT tools, cars, buildings, or machinery)

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² To ensure the anonymity of the companies and systems central to this study, we refer to them by using pseudonyms. Thus, AccComp, FamSyst, FamComp, OldSyst, and ConsoSyst are all aliases for real companies and systems.
into the system. FamSyst then automatically calculated their depreciations and produced reports for accounting and taxation. The depreciation data typically flowed from FamSyst to the company’s main accounting system via a linkage that connected the two systems.

However, in 2015 AccComp decided to discontinue both OldSyst and FamSyst, and replace them with, ConsoSyst, which is a consolidated system for managing a large variety of accounting-related processes. For accountants involved in FAM, this transition was a step toward more manual work, especially that for the duration FamSyst had been in use, manual work required for the FAM process had been minimal. By contrast, the ConsoSyst package did not include specific FAM automation. Therefore, all fixed assets depreciations and related procedures had to be calculated manually, typically using a spreadsheet application such as Microsoft Excel.

Data Collection

We conducted altogether 19 interviews with 17 participants between November 2016 and June 2017 (see Table 1). This process consisted of three distinct stages that each shed light on the events that took place between 2005 and 2017 (see Figure 1).

Table 1. The stages in data collection

<table>
<thead>
<tr>
<th>Stage</th>
<th>Company</th>
<th>Interviewees</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AccComp</td>
<td>13 accountants (incl. accountants 1 &amp; 2)</td>
<td>45-90 min per interview</td>
</tr>
<tr>
<td>2</td>
<td>FamComp</td>
<td>Sales Manager</td>
<td>30 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CEO/Owner</td>
<td>25 min</td>
</tr>
<tr>
<td>3</td>
<td>AccComp</td>
<td>Accountant 1</td>
<td>55 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accountant 2</td>
<td>51 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accounting Manager</td>
<td>48 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Head of FPS</td>
<td>46 min</td>
</tr>
</tbody>
</table>
Figure 1. The timeline of topics, themes, and IT studied in each stage of data collection

Accountant Interviews

In Stage 1, we conducted thirteen initial interviews with accountants at AccComp to gain an overall understanding of their accounting processes, how automation had affected them, and how the accountants had perceived automation and its effect on their skills and knowledge. Our semi-structured interview protocol was based on prior literature on accounting and automation, and focused particularly on the content of accountant work and how accountants perceived automation technologies. We allowed the discussions to flow naturally and to deviate from the script if it seemed that we could encourage the informants to elaborate interesting issues. Indeed, one such issue did emerge in this stage and led to the identification of our research topic: to the phenomena around a downgrading of an IS from a fully automated system to a semi-manual one. The previously used fully automated FAM system was mentioned by three informants, and two of these employees had been directly involved in the company’s FAM. They expressed a strong discontent
with the discontinuance decision as it had brought a significant amount of cumbersome manual procedures into their daily work. This transition had also led to uncertainties in their work routines as the complex tasks that had been previously carried out automatically by FamSyst now had to be done manually. The likelihood of making mistakes was perceived high by the informants. The transcribed interview data from this stage encompassed 200 pages.

**IS Provider Interviews**

Stage 2 aimed at gaining a better understanding of the environmental context, i.e., FAM and related tax reporting processes, as well as of the type of automation, i.e., the functionality of the FamSyst software. Thus, following a semi-structured interview protocol (see Appendix A), we interviewed managers at FamComp – the IT solution provider that sells FamSyst and related FAM services. FamComp is a Finnish IT consultancy company, who is not a mere software provider but offers a full service that along with the software license includes service support and consultation related to both the software functionality and FAM process in general. We interviewed both the product manager and the founder-CEO. We wanted to particularly understand a) what exactly makes FAM processes so complicated that there is a market demand for software specifically designed to automate them, and b) how FamSyst automates these processes. These interviews gave us a good understanding of the complexities in Finnish FAM and tax reporting, and how FamSyst addresses them. This stage resulted in 11 pages of transcribed interviews.

**Accountant Follow-Up Interviews**

Stage 3 consisted of follow-up interviews at AccComp among employees who had used both FamSyst and ConsoSyst. Only two such employees were identified by the company management. Based on the outcomes of the first two data collection stages and the existing literature on
automation and deskilling, our semi-structured interviews in this stage (see Appendix B) addressed topics related deskilling and automation, organized into three logical steps (3a–3b; see Table 2). Finally, in the end of each interview, we inquired whether these informants could identify any other current or former employees who would fit our informant criteria. We subsequently interviewed a third employee, a superior of the two previously interviewed accountants. Finally, to gain managerial perspective on the events, we interviewed the company’s Head of Finance Process Services (FPS). This final stage resulted in 38 pages of transcribed interview data.

Table 2. The temporal stages and concepts of interest in Stage 3

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Data analysis

The data collection and analysis were iterative and overlapping throughout the stages, so that an earlier stage informed the subsequent stage. We used open thematic analysis (Boyatzis 1998) to examine the core concepts. Using Atlas.ti software, we first familiarized ourselves with the data by reading through the interviews and making notes about occurring patterns. We then generated initial codes by systematically going through the data and inductively assigning codes to the parts in the data that related to our research questions, i.e., automation, deskilling, complacency,
disruption from automation discontinuance, coping, and reskilling. The coding was an iterative process where we kept returning to the data and the codes after reflecting on the emerging themes and their relationships. We added new relevant codes, combined existing codes into more appropriate ones that were discovered, and split existing ones that were found to have more than one dimension or meaning. For instance, following coping theory, we broke the initial code ‘coping’ into emotion and problem-focused coping techniques, and those further into specific coping acts.

During this analysis process, we identified key temporal stages in the data, such as the stages of ‘manual FAM’ (the time before implementing FamSyst), ‘automation introduction’ (when FamSyst was implemented), and ‘automation discontinuance and disruption’ (the decision to discontinue FamSyst and the consequences that followed). We identified the salient themes in each stage and investigated their temporal path dependencies. Finally, we re-examined the interview data to ensure that the final themes accurately represented the accounts of our informants. Our coding scheme is included in Appendix C. We concluded the analysis by writing a narrative of the events and translated it into a graphical process chart (Langley 1999) illustrated in Figure 2. In line with previous process research (e.g., Lyttinen et al. 2009; Lyttinen and Newman 2008), we examined temporally progressing events simultaneously with their interactions across different levels of analysis.

**FINDINGS**

In this section, we present our findings by first establishing that deskilling had indeed occurred in our case organization. Then, we discuss the significance of task governance between human workers and automation, concentrating on two focal concepts: control and execution of the task.
Finally, we move on to address our two research questions. As a response to RQ1 (how does organizational automation implementation lead to deskilling of knowledge workers?), we present the process of deskilling. We address RQ2 (how may an organization cope with deskilling?) by analyzing coping strategies leveraged in our case organization.

The Surfacing of Latent Deskilling

The detrimental effects of automation’s discontinuation at AccComp emerged gradually. AccComp made the strategic decision to simplify their IS architecture after seven years of FAM automation. It discontinued both OldSyst and FamSyst and implemented one organization-wide accounting system, ConsoSyst. When the implementation team was preparing for the transition, the accountants tried to communicate which features they wished to include in the new system – much in line with what they had gotten used to in working with FamSyst. However, this did not produce the desired effect, partly because these requests were not considered and partly because the accountants could not always even articulate what features to request. It turned out that while FamSyst had been executing a range of procedures, the accountants had forgotten that some of them needed to be done. Thus, several months passed from the transition, after which unanticipated process malfunctions started to occur. The accountants realized that numbers in balance sheet did not match, and the reason for that was that depreciation differentials had not been allocated (as they should) for the fixed assets for two years; this was something that FamSyst had done automatically.

The Head of FPS reported feeling surprised when discovering the accountants’ lack of FAM know-how during the transition: “When I asked accountants that where do some particular numbers in the tax report come from, they would say ‘well they come from the FamSyst’s report’ [laughs]…
“[...] that is completely against my principles...” “Of course everyone had some conception of how to do it but maybe there was no sufficient understanding of how FamSyst used to do it...as said, the skills had eroded...” (Accounting Manager). Deskilling was manifested as losses in accountants’ declarative knowledge, i.e., they lacked the understanding of ‘what needs to be done’ (Anderson 1983); and decreases in their procedural FAM knowledge, as they had lost the understanding of ‘how to do it’ (ibid.). However, the accountants were not immediately aware that significant deskilling had occurred, rather they thought that the new system was inadequate or defective. Deskilling had happened latently and surfaced when automation was discontinued, and accountants were once again required to master FAM.

**Control and Execution of the Task**

When examining changes on a work-task level, we find that the concepts of control and execution of the task provide a crucial explanation for how the FAM automation led to deskilling. While control has traditionally been discussed in terms of supervising workers’ performance (Anderson and Oliver 1987; Challagalla and Shervani 1996), we find it as a suitable analytical tool for examining how workers govern their own work tasks. Control reflects the supervisory part of workflow. Different types of control include activity control that refers to the specification and monitoring of work-task activities, capability control that deals with maintaining and developing one’s skills and abilities, and output control that relates to monitoring the output quality (Challagalla and Shervani 1996). Execution, on the other hand, reflects carrying out the work task – the concrete execution of its procedures. Without control, it is impossible to conduct a work task, as one would not what activities it involves, which abilities it requires, and what are its desired outputs.
In the time before FamSyst, control and execution were tightly coupled in the hands of human workers who needed to understand the necessary steps in the workflow, execute them, and verify the output. The accountants’ task control manifested in mastering and understanding the procedures required for execution (activity control), maintaining and developing those skills (capability control), and verifying reports for accounting and tax reporting (output control). Especially tax reports needed high-level scrutiny before sending them out to the Tax Office.

The implementation of FamSyst allowed AccComp to separate the control and execution, essentially through offloading the task execution to the care of the automation, while leaving human workers the supervisory control of the work task. The accountants fed the relevant fixed assets data into the system and inspected and sent out the resulting reports for accounting and tax office. FamSyst took care of task execution, i.e., calculations on depreciated amounts, allocations of depreciations to correct categories, and compilation and production of tax reports. Although human workers were supposed to stay in control of the task, gradually they started surrendering the control too to the automation.

It started with giving up activity control. As FamSyst was found highly capable in executing the FAM procedure, the accountants no longer felt the need to understand what FamSyst was doing:

“It produced a form, which is exactly like the Tax Office one, precisely the same numbers, so you didn’t have to think about anything at all… [...]...everything came out readily prepared.” (A1);

“You did not always realize what the old system did automatically...we kind of did not even know it, that oh, FamSyst did this and that this is something that should be done.” (A2) Due to FamSyst’s consistently solid performance and FamComp’s encompassing service, the accountants started to hand over their capability control to the automation and its provider. Since any legislative changes
would be coded into FamSyst anyway, the accountants had little incentive to maintain and develop their FAM skills: “Surely you give up thinking about things by yourself, you don’t need to when they are already thought out behind the software” (A2). Finally, since FamSyst’s main outputs, the tax reports, were consistently found as flawless, also output control loosened: “We had extremely solid trust in it [FamSyst] and it was pretty much the case that if the software showed that this is how you need to report it, then we would not start to question that, we had a firm trust in it.” (Accounting Manager) The lack of output control became even more apparent after FamSyst discontinuance, when incorrect tax reports got sent to the Tax Office.

Next, we expand our analysis by incorporating both horizontal and vertical dimensions (Lyytinen and Newman 2008) of the events into a process model (Figure 2). The horizontal axis represents temporal stages: the time before automation when FAM was conducted manually; automation’s introduction; continued automation implementation; automation discontinuance and resulting disruption; and the period of coping and relearning. The vertical axis, in turn, captures the levels of analysis: the environment (FAM legislation; FamComp); the organization (decisions and practices at AccComp); and the worker cognition (individual worker perspective). Changes in the control and execution of the task are presented separately but being dynamically influenced by both organizational and worker cognition levels. Overall, the model describes how deskilling occurred over time from the interplay of the aforementioned factors, and how this caused a disruption in the case organization. It also sheds light on how the disruption was coped with and how the lost knowledge was injected back into the organization.
The Process of Deskilling

We will use Figure 2 as a reference in our deeper analyses that address the research questions. For the first research question (i.e., how does organizational automation implementation lead to deskilling of knowledge workers) we investigate in more detail the interactions between environment, organization, and worker cognition, and how they facilitated relinquishing the mindful control of the work task to the automation that was already executing the mindless procedures (Butler and Gray 2006; Weick et al. 1999). We organize our findings per each level of analysis, i.e., environmental, organizational, and individual worker, and discuss how the control and execution of task were shaped on each level.
Continued automation implementation

Automation discontinuance and resulting disruption

Coping and relearning

FAM legislation is notoriously complex in Finland, especially regarding to tax reporting. This incentivizes companies to find automated solutions to facilitate FAM.

FAM conducted manually, requires both control and execution of the task.

FAM conducted by workers; learning about FAM legislation changes in training.

Manual FAM

Automation introduction

Automation discontinuance

Coping and relearning

Figure 2. The process of deskilling and recovery

Environment

Organization

Worker cognition

Worker cognition shapes control and execution of the task

Control and execution tightly coupled, mastered by workers

Workers possess control over the process that they execute. They maintain their FAM skills through hands-on work.

Perception of FamSyst's reliability and high cognitive fit

Workers are taught about FamSyst and its functionality; workers have a deep trust in the automation.

Workers experience frustration and increased work burden.

Workers and their team leverage emotional and problem-focused coping strategies to overcome the situation. They start regaining control of the task.

Ultimately, the control is largely given up to automation.

Automation discontinued; having previously given task control to automation; workers lack skills to execute the FAM process.

Workers start to relinquish the control as they grow to rely on automation.

Perception of FamSyst's reliability and high cognitive fit

Workers increasingly rely on FamSyst and feel competent; they no longer attempt to accumulate and retain their FAM knowledge; the control increasingly shifted to automation.

Workers experience frustration and increased work burden.

Workers and their team leverage emotional and problem-focused coping strategies to overcome the situation. They start regaining control of the task.

Automation discontinued; having previously given task control to automation; workers lack skills to execute the FAM process.

Workers start to relinquish the control as they grow to rely on automation.

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Workers experience frustration and increased work burden.

Workers and their team leverage emotional and problem-focused coping strategies to overcome the situation. They start regaining control of the task.
Environmental Context

Two factors in the environmental context (i.e., external to AccComp) set the stage for deskilling to occur in our case company. First, the complex legislation regarding FAM and tax reporting incentivized AccComp to look for means to automate FAM. Second, FamComp provided an advanced and reliable FAM automation service that efficiently provided a means to do that.

The interviews with FamComp’s managers in the second data-collection stage revealed a close connection between tax legislation and the practicalities of FAM and tax reporting. In Finland, where we conducted our study, the FAM process is notoriously complex due to the differing reporting practices in accounting and taxation. Tax reporting involves several tax forms whose filling-in logic varies depending on the case. Yet the legislation and tax office regulations provide very little practical advice on how to fill out the depreciations in the tax reporting forms and how to match them with accounting reports. The CEO of FamComp explained: “...there are not that many laws and regulations [regarding them], they are not written anywhere. They come through experience – you have to deduce them, but you cannot read directly from laws and regulations that ‘this is how it should be’, there is no one manual where you could see that ‘okay, this is how it’s done’.” Due to these complexities, the depreciated sums in company’s accounting and tax reporting can differ. When such differences accumulate over the years without being adjusted, a company may face a significant accounting mismatch that will be hard to trace back if its rectification is attempted.

These challenges have created a market niche for FAM automation: “An accountant can usually handle tax reporting and accounting separately, but it is at the matching of the two where problems arise, from the differences between the two.” (CEO of FamComp). FamSyst automates several
critical procedures in fixed assets depreciation reporting, relieving the user only to input the key data, while the system takes care of the execution, i.e., computing depreciations and producing reports for tax office and accounting. FamSyst inhibits the mismatches between accounting and tax reporting, as elaborated by the company’s Sales Manager: “It [FamSyst] automates the depreciation-counting for accounting and taxation and it keeps track on their differences.” FamSyst can also anticipate problematic cases and thus it can produce required amendments on accounting reports, saving the accountants the trouble of figuring them out and fixing them. Indeed, the software produces readily filled out documents that are identical with the ones used by the tax office. These features make FamSyst a hazard to the declarative and procedural knowledge of its users. This danger to capability control does not only concern skill maintenance but also skill development: whenever legislation regarding tax reporting changes, FamComp updates the software functionality accordingly. On top of this, FamComp provides extensive technical and procedural support and consultancy for using FamSyst and conducting FAM in general.

When applied in a context of high complexities, such an advanced automation service can incentivize workers to offload the mindful control of the task to the automation, which could result in deskilling on the long term. Regarding this possibility, the Sales Manager noted that “*since the basic use is pretty simple and you can count on the software [being correct], it might be the case that someone would use it without really understanding much of what is happening*”, further mentioning that “*the software makes it possible that one could use it even with quite limited [FAM] knowledge.*” This indicates that skilled professionals would not necessarily need to use their skills when operating FamSyst. However, the Sales Manager also highlighted that FamSyst has an integrated, Wiki-based user support function that provides its users with background information of the procedures and functions in the program and describes their underlying logic: “*So hopefully*
there is also the other side of things, that it teaches and develops the user... this of course requires that the user is interested in such learning... [...] but yeah, it is a two-sided issue.” This indicates that while such automation may invite deskilling, it can also be applied in a manner that maintains workers’ control over the task and inhibits skill deterioration. However, it is up to the organization and its workers to implement automation in such manner.

**Organizational Activities**

We find that the automation implementation practices adopted at AccComp contributed in the realization of the deskilling potential set by the environmental context. In short, the organization adopted potentially deskilling knowledge-distribution and -sharing practices by concentrating FAM knowledge on one individual only, allowed workers’ relinquishment of task control to the automation become institutionalized, and took no measures to prevent skill deterioration.

The initial implementation of FamSyst can be seen as an organizational response to the complexities of the FAM process. Since FamSyst offered an advanced automation capability, it was taken into full use and the FAM execution was handed over to it. One accountant was appointed as a FamSyst key user with a task to maintain the FAM understanding and its developments by participating in training and sharing this knowledge with the rest of the team. While other accountants were encouraged to participate to the same courses, this was not mandated, and thus their participation remained low, as noted by Accountant 1 (hereafter A1): “I took some of those courses, but many did not take any.” As FamSyst repeatedly proved itself reliable and capable, the accountants’ task control started to loosen. As a result, workers’ relinquishing of FAM’s task control to the automation became institutionalized, both at the organizational level and among individual workers. At the time, the organization did not consider
the potential dangers the automation could pose to workers’ skills. Thus, no organizational practices, such as enforcement of FAM training course participation, the use of FamSyst’s user support function, or other measures of skill maintenance, were introduced to prevent deskilling.

**Worker Cognition**

At the individual worker level, we find that cognitive changes occurred through the workers’ deep trust in FamSyst, which translated into a vicious cycle of reliance and complacency where they treated FamSyst as a ‘black box’ and unreflectively let deskilling to occur. Given the complexity of FAM legislation, the high level of automation provided by FamSyst, and organizational practices that enabled giving the task control to automation, it was not surprising that the accountants spoke very highly of FamSyst: they had a firm trust in it. This notion of solid trust is rooted in the perceived reliability of FamSyst, which we could attribute to the interaction between FamSyst and the external legislative environment. First, the system’s performance received positive external validation as there were hardly any complaints from the tax office or auditors regarding FamSyst’s reports. However, occasionally the tax officials had to request certain additional information. FamSyst’s ability to address such requests left a deep impression on the accountants: “...so we just read that, ‘okay, the tax office is asking about this special case, which is already opened up for us in the FamSyst output’...” (A2) Finally, the informants found FamComp’s extensive support service reassuring: even if a problem would somehow occur, there were FAM specialists who they could turn to. Hence, the accountants felt safe about handing the task control increasingly over to FamSyst and FamComp. While changes in tax legislation were communicated in training courses, the accountants rarely participated in them, and even when they did, they did not get much out of the courses. This was due to the accountants’ awareness that the
changes would be integrated in FamSyst anyway. Overall, the accountants felt that the trainings concerned the software rather than themselves, and as such, they were not perceived as relevant. “Unfortunately, nowadays you are so busy...that you don’t really start to find out about things unless you really have to.” (Accountant 2, hereafter A2)

However, the potential danger of relying too much on FamSyst did not occur to the accountants: “…there was no danger [in not understanding what the software does], since it worked. It worked!” (A1); “No, I was not [concerned], no worries of whatsoever.” (A2). This signals of automation complacency (Carr 2015; Parasuraman and Manzey 2010), manifested as a state of feeling relaxed and not needing to give much thought on what is happening beyond the software interface: “You could trust the software doing things right even though you would not always understand everything...[...]...you can be more relaxed when you know that you don’t really have to examine if you are doing it correctly” (A1). Although FamSyst has an integrated user support function that enables the user to maintain one’s activity and capability control, the accountants rarely utilized this feature, as they did not perceive much practical value in it. When asked whether they used the feature, they replied “Not really...the software was so perfect [humoristic tone] ...I did not really need to think about such things...” (A2); “We should have used it more...” (Accounting Manager).

Reliance fueled complacency, and ultimately this developed into a self-reinforcing a cycle. “It could be so [that skills eroded] [...] When everything is so clear, you don’t have to think about those things.” (A1) The Accounting Manager was convinced that the long-term reliance on FamSyst had caused deskilling: “the trust in the system was so strong and it was so deeply automated for FAM that I guess it did eat away the related know-how, maybe not the basic know-
how but that of special cases, because the system did so much automatically. [...] ...you easily relied on the system to take care of the tasks. And when several years pass, it starts to erode the level of know-how in some ways”. Overall, the accountants experienced that their need to understand the nuances of the FAM process and exercise control over it was minimal during the years of using FamSyst. Deskilling manifested later as their inability to calculate and report depreciations and make the sums match. AccComp’s Head of FPS explained: “when the know-how about making legal interpretations has been readily embedded in the software, then it [know-how] has totally disappeared along the use, at least with some people.” Reliance and complacency also inhibited the development of new skills when tax regulations changed: “…of course we studied some of those things, regarding taxation...but they went pretty much over my head, I didn’t really get wind of them or familiarize myself with them anyway...” (A2). Interestingly, at the time of the interviews the occurrence of deskilling was recognized more by the managers than the accountants themselves, which, along with the accountants’ own narratives, suggests that accountants and their managers had contrasting perspectives on the governance of work between humans and automation.

To answer how deskilling occurred (i.e., RQ1), we find that environmental and organizational factors set the stage for workers to hand off the control of the work task to automation, resulting in deskilling. Specifically, high task complexity in a dynamically changing legislative environment made it attractive to relinquish the task control to automation. The reliable and extensive performance of the automation along with insufficient knowledge-sharing among workers contributed to his process. In the absence of adequate organizational measures to prevent deskilling, the resulting positive experiences developed into reliance and complacency without accountants’ conscious awareness. Rather, they embraced the fact that automation was taking care
of inconvenient operations and dismissed any emerging opportunities to maintain or develop their expertise. This state of being caused their skills to gradually erode, up to the point where they could no longer master the FAM process.

**Overcoming Deskilling**

Discontinuing FamSyst caused a shock among accountants as it increased their work burden and disrupted the overall accounting processes. Next, we move on to discuss the second research question (i.e., how may an organization cope with deskilling?) as we shed light on the coping strategies (Beaudry and Pinsonneault 2005; Lazarus and Folkman 1984) that the accountants and the organization leveraged to navigate through the disruption and to retain their freshly recovered skills in the future.

**Coping Process**

Since the accountants had expected that the new system would offer similar automation as the old one, their initial appraisals were neutral or even favorable: “*All I could anticipate was that maybe the next [system] would be even better [than the current one]*” (A2). Thus, no significant coping occurred prior to the transition, since neither the accountants nor the organization were expecting any disruption or major changes to occur. The first signs of threat-oriented (instead of opportunity-oriented) appraisals occurred in the impact period (i.e., during the transition) and led to problem-focused acts: the accountants made specific requests for features in the new system, in the perception that they would possess significant influence over the technology. However, the perceptions changed again when the requests were not implemented. Finally, in the post-impact period (i.e., after the transition), both the accountants and their managers realized that the new
system architecture no longer automated FAM like before, which turned the accountants’ appraisal conclusively into perceiving the IT transition as a threat that needed to be significantly coped with.

In the early stages of the transition, the Accounting Manager acted as the champion of the change, reassuring the accountants that “this will be a good thing once they get it working” (as reported by A2), reflecting emotion-focused coping where one aims to maintain hope and optimism.

Although the accountants later became dissatisfied with the situation and complained about it, they accepted the facts stoically: “We didn’t really [resist], we are already dispirited enough, so why waste energy at barricades since it doesn’t help anyway. [...] ...we complained among each other but you know what that is good for...” (A2). Thus, they exhibited emotion-focused coping too by venting frustration but still submitting to passive acceptance of the situation. While the accountants lacked the ability to change the technology, they could still alter the work and the self, albeit to a limited extent. This, fortunately, preserved the possibility for active disturbance handling through problem-focused coping acts.

Multi-Level Coping Strategies

The coping occurred at different organizational levels: among individual accountants, their teams, and in the organization. At the individual level, the accountants adapted their work by modifying procedures and routines. This was done by reverse-engineering FamSyst’s automation logic: the accountants copied its readymade tax report form into an Excel spreadsheet so that it would be easier to execute the procedure manually. Moreover, they also used the previously installed and still available FamSyst interface to view historical customer data, compare that with new calculations, and draw conclusions from the existing cases to similar new cases: “…if it wasn’t there, we adapted: we thought that okay, now when in that [other] group it [depreciation] was
allocated there, then there must be an equivalent one also in this group” (A2). Another mean of adapting the work related to a drastic change in how much time the accountants used for different work tasks. This was brought up by A1 who used to do mainly basic accounting with some FAM on the side prior to the discontinuance. However, during the disruption most of her time was consumed by FAM, which she perceived as a negative change. Finally, the accountants adapted their self by relearning FAM procedures, which included studying the FamSyst manual and existing literature and regulations regarding the reporting of fixed assets depreciations. “I guess now I know more than before when I had to read all these, to study how it goes. And I have been reading FamSyst manual again, although we don’t have FamSyst anymore but everything is explained in such great detail in that manual” (A1). This adaptation represents individual-level attempts to regain task control.

Also, at a team level the accountants strived to solve the emergent issues by adapting their work and their self. They shared information and worked together to tackle the issues that emerged. One method was collective brainstorming to find practical solutions: “...we tried to figure these things out together, there is always someone who knows something, fortunately. [...] ...we have asked [help] from everyone who could have the knowledge, so it could be said that it [collegial information exchange] has increased.” (A2) This resulted in an increased alignment between the technology and user environment and further regaining of task control.

At the organizational level the management applied problem-focused coping during the transition by arranging one workshop day intended to equip the accountants with skills to master the new system. However, this measure proved inadequate when problems started to occur: “We had one day of training in a workshop, and [later] we always referred to how something was explained at
the workshop, but it still didn’t work out as was explained” (A1). While the accountants initially tried to lean on ConsoSyst’s provider of, it turned out that the provider did not possess the required expertise in FAM. Thus, in the post-impact period, AccComp applied problem-focused coping by buying consultancy services from FamComp, as they knew that FamComp had extensive FAM competence regarding and was already familiar with AccComp’s accounting. Later on, the accountants were sent to formal trainings arranged by the Chamber of Commerce. Another new development was a change in how teams share knowledge: “...and [we] changed the way of operating so that the team leader’s role is not to be always there telling ‘this is right and that is wrong and this is how it is done’ – rather, the team leader should be the last link that can help if someone cannot manage, but the know-how should come from within the team, that is the goal.” (Head of FPS)

To address RQ2, we find that workers engaged in active problem-focused coping in the impact period when system transition was happening. This did not yield expected results and changed their appraisal of the transition from opportunity to threat, leading the workers to exhibit emotion-focused coping by venting frustration in the post-impact period. However, unable to change the technology, they adopted a disturbance handling oriented coping strategy that included problem-focused coping, such as work procedure modification, relearning of lost skills, and learning of new skills. Similarly, problem-focused coping was put forth at the team and organizational levels. Therefore, FAM was again mastered in the organization only after repeated problem-focused coping in all three organizational levels.
DISCUSSION

In this paper, we set out to answer two research questions, namely, 1) how does organizational automation implementation lead to deskilling of knowledge workers?; and 2) how may an organization cope with deskilling? To this end, we have analyzed a process where automation contributed to the deskilling of knowledge workers and where discontinuing that automation caused an organizational disruption, requiring coping. We find that deskilling occurred through changes in the task governance between human worker and automation. The primary reason lied in workers not only offloading the execution of FAM operations to automation but also relinquishing their control over them. This resulted in decreasing the workers’ understanding about FAM, but it happened without any problems in the organization’s operations. The lack of warning signals contributed to changes in worker cognition through cycles of trust, reliance, and complacency, and ultimately resulted in deskilling the workers. Environmental and organizational factors contributed into this process through the complexity of FAM legislation and lack of organizational attention to skill maintenance, respectively. When the deskilling was discovered, our case organization and its workers leveraged various problem-focused coping strategies, including systematic relearning and alteration of knowledge distribution practices, and regained control of the operations.

Based on these findings, we dedicate the following discussion to five central aspects: (1) the process of deskilling; (2) latent development of deskilling; (3) perspectival nature of automation and its impacts; and (4) the practice of informed automation implementation. Moreover, we provide practical implications for managers’ consideration.
**Theoretical implications**

Whereas automation may present a danger on humans’ skills through taking over the repetitive hands-on execution of the work task, even more detrimental effects may be expected if it causes humans to relinquish their control over the task.

Firstly, we elaborate the process of deskillling through automation discontinuance and discover that the division between control and execution of the task provides a useful analytical tool for studying human-automation coupling and its effects of skills. While the effects of automation on worker skills have typically been studied through variance-based experiments (e.g., Dowling et al. 2008; Mascha and Smedley 2007), our analysis has looked at the process of deskillling. Our findings corroborate the TTD (Arnold and Sutton 1998) in the context of FAM automation: if the task is complex and workers feel familiarity and high cognitive fit with the automation, even experienced professionals may end up relying on it too much. We also found strong evidence for the link between reliance on automation and deskillling on the long-term (Arnold and Sutton 1998). Whereas prior applications of supervisory control have been applied in studying the relationship between managers and workers, we extend the concept to concern the relationship between workers and their work task. This provides us an effective and informative way of looking at various phenomena around automation implementation and deskillling. Considering different types of control further enriches such analysis, and such framework could be used in future studies set out to unpack the relationship between automation and its potential undesired effects such as deskillling.

Second, the latent nature of deskillling’s development has not received much attention in the extant literature. This may be due to the earlier studies’ cross-sectional analyses that have directed
attention away from processual characteristics of deskilling. The process of latent deskilling and its consequences, as they happened in our case organization, are shown in Figure 3. When automation was in place, it started latently eroding workers’ knowledge base. This happened through a vicious cycle of reliance and complacency that stemmed from strong trust in a reliable system. The discontinuance of automation caused the latent deskilling to surface to an observable level, resulting in disruption in organizational processes and daily work as the deskillled workers were required to execute the process manually without the needed skills. Finally, the organization and workers navigated through the disruption by leveraging various coping methods as they learned to run the process manually.

Figure 3. The surfacing of latent deskilling through automation discontinuance

We use the term ‘latent deskilling’ to reflect its unobservable, or even, unconscious nature. Similar latent effect has been described in agriculture, where farmers’ skill repertoire may degrade gradually and unnoticed through the increasing implementation of technologies (Stone 2007). A key insight here is that, just like farmers, instead of being responsible of one specific and narrow task, knowledge workers (such as accountants) typically have to execute a certain assortment of
related yet distinct tasks, and thus they need to maintain a corresponding repertoire of skills. Some of these tasks are executed daily while others more rarely, and automation may then slowly degrade some of the more peripheral skills, ultimately resulting in deskill without the worker even noticing it. However, when the automation gets discontinued, the effects of deskill may surface to what we call the apparent level.

The third central aspect we wish to emphasize is the notion that the task division between automation and its users is perceptual (i.e., in the eye of the beholder). Our case study reveals interesting contradictions in the perspectives of different organizational stakeholders (Davis and Hufnagel 2007), and narratives emerging from these contrasts help to explain why automation discontinuance resulted in such a disruption. Accountants 1 and 2 shared a unanimous view that discontinuing FamSyst was a bad decision made by those who do not understand the accountants’ work. Indeed, the accountants felt that automation made their work more enjoyable and meaningful, representing a phenomenon that could be termed as ‘reverse-luddism’, where it is in fact the workers who invite automation to take care of their work tasks. This finding contradicts with widely documented cases of technology resistance that stem from workers’ fear of losing their expert statuses (e.g., Kim and Kankanhalli 2009; Komito 1998; Lapointe and Rivard 2005; Marakas and Hornik 1996; Martinko et al. 1996); here the workers were not concerned at all about automation making their work input redundant. Accounting Manager, the direct superior of Accountant 1 and 2, appeared to side with his employees, strongly criticizing the decision to give up FamSyst and the implications that followed. However, echoing the metaphor of automation as

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3 Luddism is a philosophy that inherently maintains a general skepticism and opposition toward automation, stemming from workers’ fear of losing their jobs (Grint and Woolgar 1997; Jones 2006).
a double-edged sword (McCall et al. 2008), he saw the problems in too heavy reliance on automation, recognized the importance of mindful automation implementation, and also acknowledged the benefits of restoring the knowledge capital by having to learn FAM from scratch. As a team leader, his responsibilities lied in his employees’ performance, and this position possibly gave him a more holistic view on the matter. The Head of FPS brought in yet another perspective, as she expressed her shock toward the extent of deskilling that had occurred during the years of using FamSyst. Her view reflects the concerns of automation causing a loss of relevant skills (Carr 2015), which creates a gap between the work task and the worker (Lyytinen and Newman 2008), ultimately eroding the organization’s knowledge capital. The solution to this would (and did) entail training the workers, i.e., reskilling them.

Finally, our findings point to the concept of informating discussed in Zuboff’s seminal work (1985, 1988, 1991). In short, informating refers to implementing automation mindfully, so that an IT is applied not only to automate a task but to disentangle and represent the logic behind the task in a way that improves its operator’s understanding. Optimally, such implementation would allow workers to gain a deeper comprehension of the work tasks, while giving them a more comprehensive understanding of organizational operations and how the work task relates to them, as workers would no longer be immersed in its manual execution. However, this does not happen by default – the outcome depends on whether the organization chooses to implement the IT in a manner that informates and empowers employees (Olson 1982; Psoinos et al. 2000; Zuboff 1985). This was not the case at AccComp: although FamSyst had an informating capability in the form of a user support function, this functionality was not leveraged effectively. Thus, if an organization neglects informating and purely automates, deskilling would be expected to happen.
AccComp’s relearning process and modification of the horizontal distribution of expertise (Davis and Hufnagel 2007) represent a determination to pave way for informed automation implementation. While informating was recognized as an important consideration with automation already in the 1980s (Zuboff 1985, 1988), it may hold even higher relevance in today’s world where an unprecedented range of tasks is being automated. What was considered as nearly impossible to automate yesterday, may well be executed by algorithms tomorrow. Rapidly advancing automation of knowledge work, especially of tasks that require complex or creative thinking, means that machines and algorithms are entering a territory that has previously been thought as belonging exclusively to humans, ultimately questioning what it means to be a human (Harari 2016). Thus, it is crucial that we remain mindful about the way we implement automation and prevent skill erosion in whatever tasks we wish to master also in the future.

Managerial Implications

Our case demonstrates that IS automation poses a danger of deskilling knowledge workers. This may even occur without either workers or managers realizing it. A clear practical implication of this is that the implementing organization should make efforts to explicitly keep worker competence up through mindful automation implementation. Overall, an IS can be implemented to complement human labor or substitute it entirely (Hitt and Snir 1999). The problem in the case of AccComp appears to have been that automation was implemented as a pure substitute to human labor, instead of leveraging it in a complementary manner. Specifically, the software was perceived as a black box where employees would feed data and the box would then produce readymade reports. Thus, essential process knowledge was lacking between the inputted data and the resulting reports. While automation is typically expected to take care of repetitive routine tasks
and leave complex thinking to humans, the opposite had happened at AccComp: the accountants could still somehow master the most basic tasks but had lost their expertise on the more special and demanding cases, precisely those which require complex reasoning. Such a substitutive manner of automation implementation has a high likelihood of leading to the deskilling of employees and consequently to a degradation of organization’s knowledge capital. Without simplistically considering automation as a problem, we propose managerial solutions to avoid latent deskilling.

Specifically, implementing automation as a tool for facilitating knowledge work should strive for complementarity that ensures that employees stay on top of their tasks. The risk of deskilling could be tackled by placing specific mechanisms through a careful system design, in a way that would ensure that workers maintain an understanding of what is happening ‘under the hood of the black box’. As one informant from AccComp elaborated: “...if it [the automation] is so advanced that people do not understand what the system is doing, how it produces it all. So, it should be modeled somehow, as a process description in the system about what it does. This could be the solution...”

While FamSyst had such user support function, it is possible that it was not visible or visual enough – perhaps too easy to ignore – since the accountants did not end up using it much. This could be countered with forced feedback and feedforward mechanisms (Arnold et al. 2006) that would provide workers with knowledge of the process. Another approach could be collaborative system design where automation is implemented as worker’s electronic colleague whom with the worker shares the work tasks so that task responsibilities alter between human and automation, which could decrease the risk of technology dominance (Arnold and Sutton 1998). Moreover, active managerial efforts, such as enforcing the mindful use of automation might help to counter
deskilling. Thus, organizations should pre-emptively strategize effective approaches to human-autonomy teaming (Endsley 2017).

Limitations and Future Research

This study comes with certain limitations that must be acknowledged. First, regarding the occurrence of deskilling, it was not possible for us to conduct such longitudinal study where we would observe workers’ skill maintenance and development in real time. Thus, we relied on retrospective accounts of informants when reconstructing the narrative of the events. Future research could consider such setting where the worker skills are measured before and during automation implementation. Second, our empirical study is limited to one company only, and it is possible that some of the findings may not be generalizable to other organizations. However, we deem the single-case design appropriate due to the revelatory nature of the empirical setting and our findings, and we also consider our accounting services as a prototypical example of an IT services business from which research findings may be generalizable to other organizations. An interesting extension for this research would be to conduct a comparative case study where one would study the long-term effects on skills in two or more similar organizations that have all used the same automating software. Further, studying the automation implementation practices of such organization could shed light on the matter of automation discontinuance surfacing disruptions in some organization but possibly not in others. Third, we acknowledge that our final sample consists of only three such employees who had been working with both the discontinued and the current system. While these interviews already showed signs of theoretical saturation as the amount of new insights decreased drastically with each interview, it is possible that having access to more informants would have uncovered additional aspects. Fourth, we note that the legislation regarding
tax reporting of fixed assets changes constantly, and thus it is possible that the experienced
disruption was not caused solely by deskilling but also the fact that the accountants were not
keeping up with the legislation changes, since this was done by FamSyst’s developers. However,
since our informants reported consistently that skills the workers used to possess in the past had
eroded during the time FamSyst was implemented, we deem that deskilling played a major role in
explaining the disruption. Finally, while our study concerns individual-level deskilling, we note
that the question of whether IS automation causes unintended deskilling of entire occupations or
industries (i.e., Proposition 8 of TTD, Arnold and Sutton 1998) still calls for inquiry in the
knowledge work context.

CONCLUSION

Our work discussed a dark side of IS phenomenon that has received surprisingly little attention in
the literature, i.e., the unintended deskilling of knowledge workers through IS implementation. We
investigated the phenomenon on multiple levels of analysis (Lyytinen and Newman 2008) and
from various angles, shedding light on the context of occurrence, the nature of negative effects,
and mitigation mechanisms (Tarafdar et al. 2015). We conducted a revelatory case study of an IT
service company that discontinued its fixed assets management (FAM) software, one that is
specifically designed to automate complex accounting and tax reporting tasks. We found that while
the system was extremely efficient and reliable as it was executed FAM work tasks, the workers
ended up offloading also the control of the task to the system and its developers. Such
implementation practice in a context of great task complexity and all-encompassing service from
the automation provider led to adverse cognitive development among workers, i.e., they became
reliant and complacent with the automation, which ultimately resulted in their deskilling. The
empirical data and the analysis helped us identify several concepts and their interrelationships that can sensitize managers to the hidden negative effects of automation, including: reliance, complacency, and latent deskilling.

In particular, the deskilling occurred on a latent level and remained unacknowledged, until the system was discontinued. The discontinuation brought the effects of deskilling to the surface, causing notable disruptions in the accounting processes of the organization. Specifically, the accountants’ work burden increased significantly and accounting processes became disorganized. However, the organization managed to navigate through these issues by leveraging numerous coping methods, such as the use of external consultancy services, effective worker collaboration and information sharing, and work task modification. Ultimately, the organization engaged in a determined relearning process where accountants recovered their understanding about the previously automated process. This resulted in increases in the organization’s knowledge capital.

REFERENCES


Appendix A: Interview Protocol Used in Stage 2

The system
What does FamSyst do?
What kind of data goes in, what comes out?
What exactly does FamSyst automate?

Users
Who are the users of FamSyst?
What skills are required from the users?
How does using FamSyst affect the know-how of its users?

Competitive advantage
Does your software have competing alternatives?
What is the main advantage of FamSyst compared to the old (i.e., non-automated) way of doing FAM?
What is the advantage of FamSyst compared to generic systems such as ConsoSyst?

Customer discontinuing FamSyst
How did the decision by AccComp to discontinue FamSyst appear to you?
How have you consulted the ex-users of FamSyst at AccComp after the discontinuance?
Are there other companies who have made similar decisions to discontinue their FamSyst implementation?
What do you see as the current trend in FAM – more automation or something else?
Appendix B: Interview Protocol Used in Stage 3

Introduction

In the beginning of each interview, we explain the informant:

- Our background and the purpose of conducting the interviews
- The interviews are completely confidential
- We will not report the AccComp management anything the informants do not wish to be disclosed
- The interview will take about one hour
- It is okay to interrupt at any point

Informant’s background

- Personal background, education and work history, current position, typical work tasks

The use of FamSyst

1. When was the first time you used FamSyst?
   - Was it at AccComp or somewhere else?
   - What did you do with FamSyst during the time it was implemented?

2. What did FamSyst do?
   - What kind of information did you feed into the system?
   - How did FamSyst integrate to other systems?
   - How did the data flow between the systems?
   - How did FamSyst process information: what does it do with the information fed to it?

3. What were the positive and negative sides of FamSyst? Please name the most relevant ones.
4. FamSyst has an educational function (by pressing F1 you get additional information about the process) – did you use it? Did other accountants use it?

5. How much did you trust in FamSyst to function reliably?

6. Where did the trust in FamSyst stem from?

**The effect of FamSyst on skills**

7. What was the effect of FamSyst on accounting skills related to FAM?
   - What new things it taught you? Which things it made you forget?
   - Did FamSyst help you to understand FAM better or the other way around?

**The discontinuance of FamSyst**

8. Who decided that FamSyst will be discontinued?

9. How did you perceive the discontinuance decision?
   - Before discontinuance, after discontinuance, and now

10. What kind of feedback did the discontinuance decision stir up?
    - Was there passive or active resistance?
    - Did you try to influence the decision?

11. How is the process that FamSyst used to automated being handled currently?
    - What is the official way?
    - Are there alternative ways?

**Coping and recovery**

12. How did you navigate through the disruption caused by the discontinuance of FamSyst?

13. How did the relearning happen?
    - Were trainings arranged? Did you participate?
14. Did the amount of manual work increase or were you able to automate the process in other ways?
   - E.g. Excel macros?

15. When was external consultation used?
   - Consultants from FamComp?
   - What did they do?

16. What is your current level of FAM know-how?
   - Have you returned on the same level of know-how as before FamSyst?
   - Have you learned something useful?

17. Are there other employees who used FamSyst?
   - Request their contact information
### Appendix C: Coding Scheme

<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Example of code</th>
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<tbody>
<tr>
<td>Automation characteristics</td>
<td>Intelligence</td>
<td>On Intelligence: &quot;and even if [the tax office] did inquire about something, we could easily check it from FamSyst's reports, there might already be a statement waiting for us, so we just read that, 'okay, the tax office is asking about this special case, which is already opened up for us in the FamSyst output', like, what could it be, decrease in an asset value or...these kinds of rare cases...&quot;</td>
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<td></td>
<td>External validation</td>
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<td>Customer support</td>
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<td>Efficiency</td>
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<td>Cognitive fit</td>
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<td>Compatibility with needs</td>
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<td>Reliability</td>
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<td>Capability</td>
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<td></td>
<td>Automation complacency</td>
<td>On Automation complacency: &quot;I cannot name any specific example where we would have made a mistake because of trusting the software. No such examples, but think of it in a way that you can feel more relaxed when you know that it...that you don't really have to check whether you are doing it correctly...&quot;</td>
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<td></td>
<td>Reliance on automation</td>
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<td>Trust in automation</td>
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<td>Black box</td>
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<td>Eroding of knowledge</td>
<td>On Eroding of knowledge: “Of course everyone had some conception of how to do it but maybe there was not sufficient understanding of how FamSyst used to do it...as said, the skills had eroded...”</td>
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<tr>
<td></td>
<td>Cessation of learning</td>
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<td>Accountant skill repertoire</td>
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<td>Process malfunction</td>
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<td>Increased work burden</td>
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<td>Organizational disruption</td>
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<td></td>
<td>Gap between skills and task</td>
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<td></td>
<td>Problem-focused coping</td>
<td>On Problem-focused/post-impact period coping: &quot;We checked if some other company – since we have around ten companies – we can check the fixed assets of each one, so we went to check whether there exist a corresponding entry profile that we need for the company of which [tax reporting] went wrong. So, like this; plus another thing was that if it wasn’t there, we adapted: we thought that okay, now when in that [other] group it [depreciation] was allocated there, then there must be an equivalent one also in this group, we had a separate chart of accounts”</td>
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<td>Emotion-focused coping</td>
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<td>Impact period coping</td>
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<td>Post-impact period coping</td>
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<td>Threat appraisal</td>
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<td>Opportunity appraisal</td>
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<td>Individual coping</td>
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<td>Group-level coping</td>
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### Organizational coping

<table>
<thead>
<tr>
<th>Recovering the knowledge capital</th>
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<tr>
<td><strong>Training</strong></td>
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<td>On Training: “Now, having wised-up from the previous experience, this year every accountant went through a tax report training course, that discussed specifically those special cases and the most difficult area, which concern the management of movable fixed assets. So that was one [way to bridge the gap between skills and task requirements], and people had been asking for that kind of training, so this is how the know-how accumulates”</td>
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<td><strong>Composing of manuals</strong></td>
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<td><strong>Changes in knowledge distribution practices</strong></td>
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<td><strong>Organizational learning</strong></td>
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Paper IV


Unpublished manuscript.
The Effects of Self-Checkout Service Discontinuance on Customer Response: Evidence from a Natural Field Experiment

ABSTRACT

In retail servicescape, the use of technologies is often confronted with the debate between automation and human touch. Thus, while many retailers are upgrading their customers’ checkout experience with self-checkout (SCO) services, some end up discontinuing their previously implemented SCOs. In this study, we investigate the effects of SCO service discontinuance on two dimensions of customer response: purchase behavior and service evaluation. We conduct a natural field experiment where we measure the purchase behavior and service evaluation both pre- and post-SCO discontinuance for two groups of customers, the treatment group (who experienced SCO discontinuance) and the control group (those who did not experience SCO discontinuance). Leveraging difference-in-differences analyses, we find that SCO service discontinuance results in 7% reduction in basket size and 3% decrease in customer satisfaction. These findings are substantiated through supplementary analyses. This study contributes to the literature by showing how service discontinuance disrupts customers’ purchase behavior and causes them to adjust their service evaluation downwards. From the managerial perspective, we demonstrate that service discontinuance may come with indirect costs that managers should consider.
INTRODUCTION

The importance of service has become increasingly pronounced in various contexts, as economies are dominated by the service sector that encompasses transportation, healthcare, retailing, and other non-manufacturing industries (Buera and Kaboski 2012). This development has raised the prominence of effective management of the customer experience and the servicescape, i.e., the physical surroundings of the service delivery environment (Bitner 1992). While ‘service’ in general has been traditionally connected to the interaction between humans, recent decades have witnessed the rise of self-service technology (SST) that has become an indispensable part of the servicescape (Lemon and Verhoef 2016). Accordingly, varying human-technology configurations in service design and their effect on customer outcomes have been identified as one focal priority for service research (Ostrom et al. 2010).

Servicescape management through upgrading and remodeling is especially common in retailing (Dagger and Danaher 2014). In retail servicescape, checkout services hold a notably central role in shaping the customer experience, as they concern and involve every customer frequenting a retail store. Also in this service context, the traditional human-delivered checkout services have been complemented and sometimes even substituted by technology-based alternative known as self-checkout (SCO1) services, which have become an important part of retail customer experience (Verhoef et al. 2009). A growing number of retailers have introduced such services in their stores: the number of SCO units has been estimated to reach 325,000 by 2021, an increase of 44% from the year 2016 (IHL Consulting 2007; Retail Banking Research 2016, 2015). Besides cutting operations costs, retailers can leverage SSTs in building more attractive and flexible servicescapes: customers report increased convenience as one of their main reasons to use SSTs (Blut, Wang,

1 SCO is an acronym for self-checkout used widely in the industry (e.g., Walter, Morrison, and Lin 2006), also used by the world’s leading self-checkout manufacturer NCR (NCR 2016).
and Schoefer 2016; Collier and Kimes 2012; Kimes and Collier 2015). Service convenience is becoming more important than ever in today’s retail business, as demonstrated by Amazon that chomps an impressive 43% of US retail sales today (Business Insider 2017; Investopedia 2017). Thus, the importance of SSTs is paramount in managing customer experience, as illustrated recently by Zara that introduced SCO services effectively in its stores (eConsultancy 2016).

Still, some retailers choose to discontinue their existing SCO services and replace them with staffed checkouts. Such decisions can be motivated by customer feedback (Telegraph 2015), low usage levels (CNBC 2011), operational reasons (Business Insider 2013), or concerns of “shrink” or lost inventory due to factors ranging from theft to accidental failure to scan an item at SCO (Beck and Hopkins 2015; IBM 2008). As many retailers are weighing the pros and cons of continuing or discontinuing their implemented SCO services, it is important to understand the effect of such service discontinuance on customer response. In fact, the existing discourse on technology implementation in several domains has been criticized to suffer from pro-adopter bias where most studies are focused on technology adoption and use, while discontinuance of technology and its effect on user behavior lack attention (Power and Gruner 2015; Rogers 2003).

Past studies (see Table 1) have found that upgrading servicescape increases sales, enhances customers’ service evaluation, and even attracts new customers (Brüggen, Foubert, and Gremler 2011; Dagger and Danaher 2014). May retailers upgrade their servicescape by implementing SSTs. While several studies have investigated customers’ SST adoption and use (see Blut et al. 2016 for a review), some have also established that SST implementation has positive effects on customers’ purchase behavior (Weijters et al. 2007) and service evaluation (Orel and Kara 2014). However, discontinuing traditional, human-delivered service and forcing customers to use SSTs may hurt customer satisfaction and decrease customer spending, if such changes are perceived negatively
by customers (Reinders, Dabholkar, and Frambach 2008; White, Breazeale, and Collier 2012). Similarly, prior research on other negatively perceived service changes, such as service disruptions (Bolton 1998; Bolton and Drew 1991), service failures (Forbes 2008; Zhu et al. 2013), and reduced offerings (Boatwright and Nunes 2001; Martin 2004), indicates that such changes have adverse effects on customer relationships which may alienate customers from the service provider. In addition, downsizing of service resources harms customer satisfaction (Habel and Klarmann 2014). Overall, customers want convenience (Collier and Kimes 2012) as well as a choice over the service delivery method (Reinders, Dabholkar, and Frambach 2008; Scherer, Wünderlich, and Wangenheim 2015).

Against the above background, we set out to investigate the following research question: What are the effects of retail SCO service discontinuance on customer response? SCOs being an integral part of the SST servicescape, they can be seen as a complete self-service (or customer only) environment, highlighting the relevance of studying customer reactions to changes in that environment (Bitner 1992). We focus on the following two dimensions of customer response: purchase behavior and service evaluation. Drawing on service convenience literature and the belief-adjustment model (Hogarth and Einhorn 1992), we hypothesize that the decreased service convenience due to SST discontinuance has adverse effects on purchase behavior and that customers adjust their service evaluation by comparing the downgraded servicescape with their beliefs that were formed before the discontinuance of SCOs. In line with previous findings (Bolton 1998; Gijsenberg, Van Heerde, and Verhoef 2015), we posit that customers weigh negative service experiences (i.e., losses) more than positive ones (i.e., gains), highlighting the importance of understanding the potentially disruptive effects of SST discontinuance.
To empirically investigate the effect of SST discontinuance, we rely on a novel field experimental setting. We collaborated with two national retail chains and collected data about their customers’ behavior and service experience. Whereas one of the retail chains discontinued its previously implemented SCOs, the other continued having the service. We measure the customer responses pre- and post-SCO discontinuance of two distinct groups of customers, the treatment group (who experienced SCO discontinuance) and the control group (who did not experience SCO discontinuance). Thus, since our unique dataset comprises the same panel of customers pre- and post-intervention, following recent studies (e.g., Huang et al. 2012), we cast our analysis in the difference-in-differences based modeling framework. We triangulate our findings by investigating qualitative customer data and interviewing the manager of the store that discontinued the SCO service. Our empirical results indicate that discontinuance of SCO has significant adverse effects on customers’ basket size (a drop of 7%) and customer satisfaction (a drop of 3.4%).

The study is organized as follows. In the next sections, we discuss our theoretical framework and present hypotheses. After this, we describe our method and empirical-qualitative results. The final sections are dedicated to robustness checks, discussion, and conclusion respectively.

THEORETICAL BACKGROUND

Altering the retailing servicescape affects customers’ purchase behavior and service evaluation (Brüggen, Foubert, and Gremler 2011; Dagger and Danaher 2014). Therefore, service convenience from SST implementation shapes customers’ purchase behavior and they update their beliefs about the service by contrasting it with the previous service experience. Discontinuance of SST can be seen as a servicescape-altering event that may affect such customer responses.
**Service Convenience**

SSTs provide increased service convenience (Berry, Seiders, and Grewal 2002) by reducing waiting times, increasing accessibility and privacy, and bringing hedonic aspects to service encounter (Collier and Sherrell 2010). Prior research has found that such enhanced convenience may stimulate customers’ spending behavior, incentivizing or triggering customers to buy more (Evanschitzky et al. 2015; Koufaris 2002; Pemberton 2004). However, discontinuing the SST strips the servicescape from this convenience, potentially causing a negative impact on customers’ purchase behavior. On the other hand, the increased convenience enabled by SST may encourage customers to come for spontaneous store visits for buying just a few items (Wang, Harris, and Patterson 2012). SCO discontinuance may then discourage such visits and incentivize customers to come by only when they need to purchase a larger number of items. Moreover, also payment mechanisms influence purchasing behavior through increased convenience: using contemporary payment mechanisms like credit cards incites consumers to spend more than when using cash (Soman 2001; Thomas, Desai, and Seenivasan 2011), and SSTs are often designed to have high compatibility with tech-based payment modes, potentially nudging customers to favor them.

**The Belief-Adjustment Model**

To explain how service discontinuance impacts customers’ service evaluation, we turn to the belief-adjustment model (Hogarth and Einhorn 1992). The model has been successfully utilized in service research when studying how consumers form opinions of services based on their current beliefs and new information, e.g., in investigation of the link between service attributes and customer satisfaction (Vanhoof et al. 2005), and the effects of servicescape remodeling on customer response (Dagger and Danaher 2014).
The belief-adjustment model posits that people update their beliefs by adding new information to their existing knowledge through a sequential anchoring and adjusting process, where the current belief or perception is seen as an anchor that is subsequently adjusted via exposure to the new information. As such, customers’ judgments about a service do not form in a vacuum but are highly affected by their initial anchoring beliefs. In practice, this would mean that when implementing service changes, customers evaluate the new servicescape against to their anchor beliefs, i.e., their beliefs about service quality before the change. These initial beliefs are then adjusted according to customer’s perception of the change. Discontinuing an SST can be seen as a downgrading of the servicescape, and therefore customers’ new perceptions may drop below their anchor values, making their overall evaluation less favorable than before.

**HYPOTHESES DEVELOPMENT**

In Figure 1, we provide conceptual framework that outlines the effects of SST discontinuance on customer responses, categorized into two dimensions: *purchase behavior* and *service evaluation*. Purchase behavior captures the practical aspects of customer response: a) basket size, which is a relevant and frequently cited measure of purchase behavior (Bell and Lattin 1998; Liu 2007) directly connected to retail performance, and b) preference for cash payment (Hirschman 1979), which affects spending behavior. Service evaluation reflects customers’ overall experience and relational outcomes of SST use through a) customer satisfaction with the service (Meuter et al. 2000), and b) customers’ shopping enjoyment (Dabholkar and Bagozzi 2002; Koufaris 2002).

**Purchase Behavior**

In the retailing context, basket size is one of the most relevant measures of shopping behavior due to its direct relation with purchase incidence (Bell and Lattin 1998, p. 68), and the profitability
Basket size refers to the average number of products a customer would purchase on a normal shopping trip (Desai and Talukdar 2003, p. 910). However, we know very little about the effect of service downgrading on basket size, which can be complex as the effect can be expected to unfold in two alternative ways. On the one hand, the adoption of service technologies like SCO can stimulate customers’ purchases through both utilitarian and hedonic mechanisms (Evanschitzky et al. 2015). First, customers may increase their spending as the increased convenience, especially in the form of reduced waiting time to service (Meuter et al. 2000; Wang, Harris, and Patterson 2012), can trigger them to buy more. For instance, Weijters et al. (2007) show how SCO users translate the perceived time savings and increased control of the checkout process into a increased purchases. Moreover, the fast-food giant McDonalds has found that their self-service kiosk using customers spend 30% more than the ones who choose traditional service, most likely due to the convenience, privacy, and control provided by the SST (CBC News 2016). Furthermore, hedonic aspects of system use stemming from the high involvement and empowerment during self-scanning could trigger customers to buy more too. Overall, getting used to a certain level of convenience can make customers more sensitive to decreases in convenience, and thus SCO discontinuance may exert a negative impact on customers’ basket size. Thus:

\[ H_{1a}: \text{Discontinuance of SCO service decreases customer’s basket size.} \]

On the contrary, shoppers may tend to choose SCOs especially when they are buying a small number of items and turn to traditional tills when checking out larger baskets (Wang, Harris, and Patterson 2012). Thus, it is possible that customers’ basket size could increase as a result of SCO discontinuance: after losing the convenience benefits of SCOs, they may have a lower incentive to check out only a small number of items since they will be forced to use the traditional service anyway. Hence, as an alternative hypothesis to \( H_{1a} \) we propose the following:
H1b: Discontinuance of SCO service increases customer’s basket size.

As modern payment technologies, such as cards, online payments, and NFC (Near Field Communication), are gaining omnipresence, cash becomes increasingly inefficient and expensive mode of payment with declining usage rates (Leinonen 2008). However, cash still remains a significant tender that has a distinct effect on spending behavior: paying with cash has been found to discourage spending through increasing customers’ self-regulation, an effect that appears to stem from the perceived pleasure of owning concrete cash money (Khan, Belk, and Craig-Lees 2015) and the psychological pain of giving it up (Prelec and Loewenstein 1998). On the other hand, payment cards have been shown to reduce this pain by facilitating the payment process and increasing customers’ impulsive purchases (Chatterjee and Rose 2012; Hirschman 1979; Thomas, Desai, and Seenivasan 2011). Thus, retailers have incentives to encourage their customers to adopt and favor contemporary payment technologies. In fact, some retailers offer such SCOs that accept only card payments as they come with a lower cost, smaller size, and better efficiency than the ones accepting both card and cash (The Grocer 2014). Customers’ exposure to SST and the subsequently accumulating use experience can decrease their preference of more conventional means of service (Prendergast and Marr 1995), and thus also a conventional mode of payment, while simultaneously facilitating the adoption of more advanced payment technologies (i.e., making card a more attractive mode of payment). Thus, while SCO availability is likely to cause the prominence of cash to decline, SCO discontinuance may disrupt this trajectory as the ‘cards-only’ service option is no longer there to induce cash using customers out of their old habits. Thus:

H2: Discontinuance of SCO service increases customer’s preference for cash payment.
Service Evaluation

Prior literature suggests that effective implementation of SST in retail servicescape can contribute to higher customer satisfaction (Orel and Kara 2014; Scherer, Wünderlich, and Wangenheim 2015) and a better customer experience (Scherer, Wünderlich, and Wangenheim 2015; Verhoef et al. 2009). This happens mainly through providing speedier checkout and shorter queues (Kimes and Collier 2015; Meuter et al. 2000; Wang, Harris, and Patterson 2012), enabling customers to choose the service delivery method (Cranage and Sujan 2004; Kimes and Collier 2015), and giving them a high perceived control over the service process (Ba and Johansson 2008). A situation where a retailer offers an SCO option along with traditional checkouts serves as the anchoring point where customers attach their initial beliefs, and these beliefs are then adjusted and updated by the new information, i.e., SCO discontinuance. Discontinuing a service component such as SCO is likely to be interpreted as a loss by customers (Bolton 1998), as it strips the servicescape from the abovementioned benefits, leading to diminished customer experience. Since the anchoring belief is based on more comprehensive service experience, SCO discontinuance is expected to reduce the overall satisfaction. This contrast may further amplify if competing retailers retain their SCO services (Yim, Chan, and Hung 2007), emphasizing its disruptive impact. Thus, we propose that SCO discontinuance will be interpreted as negative information that results in lower satisfaction as the downgraded servicescape is contrasted with the initial anchoring beliefs:

\[ H_3: \text{Discontinuance of SCO service decreases customer satisfaction.} \]

Understanding customers’ shopping enjoyment is critical as it has been found as one key determinant of customer retention (Koufaris 2002). Enjoyment plays a significant role in the use of SSTs (Dabholkar 1996; Orel and Kara 2014), and people who like to interact with machines might prefer self-service options for the mere enjoyment of using technology (Langeard et al.
1981). Even strongly utilitarian technologies (such as retail SCOs) can have a significant positive effect on the hedonic aspects of service experience. Likewise, SCOs may amplify the hedonic dimension of shopping (Babin et al. 1994) through the active participation in self-scanning. This is supported by prior research on online shopping, where high interactivity in the shopping environment has been found to contribute to shopping enjoyment (Childers et al. 2001). Considering that customers adjust their beliefs about shopping enjoyment in relation to the anchor values formed in a more encompassing servicescape before SCO discontinuance, we expect perceived enjoyment to decrease because of SCO discontinuance. Thus, we propose:

\[ H4: \text{Discontinuance of SCO service decreases customer's shopping enjoyment.} \]

\[ \text{--------- Insert Figure 1 about here --------} \]

METHODOLOGY

Empirical Setting

The data set for this study comes from two major national retail chains in Finland, which we refer to as Retailer 1, and Retailer 2.\(^2\) Both the retailers operate in the grocery retailing. Moreover, both the retailers hold similar market shares and their product assortments are complementary. In June 2012, Retailer 1 introduced self-checkout (SCO) service in two of its grocery retail stores, one in the capital city and another in a small city. Subsequently, in November 2012, Retailer 2 introduced similar SCO service in one of its grocery retail stores in the small city. These stores of both the retailers are comparable as they are similar in size, product assortment, and target market. Later, after ten months of this service, in August 2013, Retailer 2 discontinued its SCO service from the store, i.e., they reverted to the original service where the only checkout option was

\(^2\) We do not disclose the names of these two retailers to ensure their anonymity.
traditional till delivered by service employees. However, the SCO service in Retailer 1 remained in operation. There were no significant changes in the market environment or market positions of the retailers during the timeline of events.

Research Design

The objective of our study is to investigate the causal link between SCO discontinuance and customer response. Therefore, the dataset for our research comes from a natural field experiment described above. In line with these naturally occurring events, we conducted three waves of survey for this study. We conducted a first wave of the survey in January 2013, post introduction of SCO by both the retail chains. This survey was sent to a combined sample of 19395 customers provided by both the retail chains. This sample was selected randomly for those customers who shopped in these stores with their loyalty cards where SCO service had been introduced (two Retailer 1 stores and one Retailer 2 store). We received 3098 responses (yielding a response rate of 16%), of which 2167 and 649 customers indicated Retailer 1 and Retailer 2 as their focal retail chain respectively (the rest indicated another focal retail). We then conducted a second wave of the survey in May 2013 with all those 2595 respondents who gave their consent to sending follow-up surveys. This yielded 1538 responses (a response rate of 59.3%), of which 1125 and 290 responses were from the regular customers of Retailer 1 and Retailer 2, respectively. Then, in October 2013 we conducted a third wave of the survey, post discontinuance of SCO by the Retailer 2 store. The last survey wave gathered 972 responses (a response rate of 63.2%). After removing duplicate responses (some customers had loyalty memberships with both the retailers and had visited both during the sampling period, thus receiving the survey from both the retailers) and respondents who exhibited random or dishonest survey response behavior (e.g., by giving the same value to each
question), we ended up with a usable sample of 719 loyal customers from Retailer 1 and 173 from Retailer 2 who have responded to all three rounds of the survey.

The first wave of the survey identified the focal stores for the sampled customers, as well as their background information. Then, we divided these customers into two groups: treatment group customers who experience the intervention, i.e., SCO discontinuance (i.e., their focal store is the store operated by Retailer 2), and control group customers who do not (i.e., their focal store is from Retailer 1). The second and third waves of survey captured customers’ purchase behavior and service evaluation in pre- and post-periods of SCO discontinuance for both the groups of customers: treatment and control. We used customers’ e-mail addresses to link their responses to each wave of surveys and note that the same set of questions were asked of the respondents in both the second and third waves of the survey. In addition, each survey included a section where the respondents could write informal feedback related to SCOs, the survey, or any topic of their choosing. We summarize the timeline of these events in Figure 2.

--------- Insert Figure 2 about here ---------

The Data

Table 2 provides the summary statistics of our sample used for empirical analysis. The sample consists of 66% of female respondents with an average age of 50 years. The typical household size of an average respondent is between 2-3 inhabitants, with an annual income of 28,776 euros for the respondent. The average length of formal education is almost 12 years, indicating that an average respondent has finished grammar school and either upper secondary school or vocational school. We use respondent addresses to measure their distance to their focal store. Average distance to the store was 4.47 miles (7.2 kilometers). Basket size averages at 14.57 purchases (number of products) on a shopping trip.
We measured the constructs customer satisfaction and shopping enjoyment by using multiple items adapted from the prior literature on technology use and retail SSTs (Bhattacherjee 2001; Lin and Hsieh 2006; Venkatesh, Thong, and Xu 2012; Weijters et al. 2007). In addition, we measured basket size with a single indicator that captures the typical number of products purchased by the customer on a shopping trip. Finally, we composed items for measuring preference for cash payment, as we did not find established item. When composing the items, we acknowledged that at the time of data collection, paying in cash at SCO was not possible in the focal stores as their SCO solutions accepted only card payment. Table 3 provides constructs and their measurement items, reliabilities calculated based on the responses of the second wave of the survey and summary statistics for each construct in the final sample. The reported Cronbach’s alpha values show that the items measure their constructs consistently. For our analysis, we use the means of the items as a composite score for each construct. Correlations of construct means are presented in Table 4.

Following recent literature in retailing and management science (Kumar et al. 2016; Song, Tucker, and Murrell 2015), we use the difference-in-differences (DID) modeling framework to establish the causal effect of SCO discontinuance on customer response. We triangulate our empirical results by supplementing them with a qualitative analysis.

To account for potential respondent self-selection bias, we note that survey response rates were roughly similar between Retailer 1 and Retailer 2 customers in both the second (Retailer 1: 53% vs. Retailer 2: 46%) and the third (Retailer 1: 64% vs. Retailer 2: 60%) wave of survey, indicating that respondent drop-out should not be a cause of concern. However, it is still possible that
respondent self-selection could conflate the results. We control for this possibility by applying propensity score matching techniques.

Model-Free Evidence

In Table 5, we present the “raw” or average DID measures for the response variables (purchase behavior and service evaluation). The comparison of “raw” mean measures of response variables across the two groups of customers and across the two time periods allows us to establish the effect of SCO discontinuance on the treatment group customers in comparison to the control group customers. We find significant differences in basket size (17.54 vs. 18.61) and customer satisfaction (3.49 vs. 3.55) for the treatment group customers between post- and pre-periods with negative consequences (i.e., basket size and customer satisfaction decrease by 1.08 and 0.06 respectively). The overall DID values indicate that SCO discontinuance leads to a decrease in basket size (-1.28, p<0.01) and satisfaction (-0.12, p<0.01). We find no significant overall effect of SCO discontinuance on customers’ preference for cash payment and shopping enjoyment across the two groups. These raw DID results suggest that SCO discontinuance impact customer response.

-------- Insert Table 5 about here --------

Difference-in-Differences (DID) model

We use two-period DID model specification as demonstrated in current literature (Huang et al. 2012; Shi et al. 2017) to capture the causal effect of SCO service discontinuance on the change in customer response of the treatment group. Thus, for customers from both the treatment group and the control group, we model the following:

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3 This reflects an overall drop of 3.38%. Even though this drop may seem meagre in terms of its absolute value, nevertheless it’s a significant drop. According to Anderson, Fornell, and Lehmann (1994) an annual one-point increase in firm’s customer satisfaction index would be worth 11.4% of current ROI or $94 million. According to Anderson and Sullivan (1993) a one-point increase in customer satisfaction leads to 0.0058 increase in repurchase likelihood (on a scale from 0 to 1). Finally, according to Ittner and Larcker (1998), “...a ten-point increase in customer satisfaction index was associated, on average, with a 2% increase in retention, a $194.64 revenue increase, and 3% higher revenue change.”
In Equations 1-4, \( h \) represents customer either from control or treatment group, and \( t \) denotes the time period. \( \text{TreatD}_h \) is a dummy variable that takes value 1 if the customer belongs to the treatment group (i.e., customer of Retailer 2), and \( \text{ScoD}_h \) is a dummy variable that denotes discontinuance of SCO service and takes value 1 and 0 in post- and pre-period respectively for customer \( h \). \( \text{BsktSz}, \text{CashPay}, \text{CustSat}, \) and \( \text{ShopEnjoy} \) are variables corresponding to basket size, preference for cash payment, customer satisfaction, and shopping enjoyment, respectively. Items for these scales and summary statistics are provided in Table 3.\( X_h \) is a vector of customer demographics (age, gender, education, household size, income, and store distance) and \( \alpha, \Theta, \Lambda, \) and \( \Sigma \) are the corresponding coefficients in Equations 1-4, respectively. These variables control for the non-randomness\(^4\) of customers’ selection into the treatment and control group (Shi et al. 2017).

The error term \( E = (e_{BsktSz}, e_{CashPay}, e_{CustSat}, e_{ShopEnjoy})' \) is distributed normally, i.e., \( E \sim N(0, \Sigma) \). The main parameters of interest are \( \alpha_3, \theta_1, \lambda_2, \) and \( \omega_3 \) in Equations 1-4, respectively, as they capture the change in corresponding response of treatment group customers post-SCO discontinuance relative to the response of control group customers whose focal stores did not discontinue SCO service. For example, \( \alpha_3 \) captures the causal effect of SCO discontinuance on basket size of the treatment group customers across the pre- and post- SCO discontinuance periods (as compared to basket size of the control group customers).

\(^4\) The non-randomness comes due to the fact that the retail chains introduced the SCO service selectively in only few of their stores.
RESULTS

We present the parameter estimates of the proposed model in Table 6.

--------- Insert Table 6 about here ---------

**Purchase Behavior**

The impact of SCO discontinuance on customers’ basket size (-1.28; \(p \leq .01\)) is significant and negative. However, we find that SCO discontinuance has no significant effect on customers’ preference for cash payment. Thus, we find support for Hypothesis 1a but not for Hypotheses 1b and 2. We find that age has a negative impact on basket size (-0.07; \(p \leq .01\)) but positive impact on preference for cash payment (0.07; \(p \leq .10\)). Households with a larger family (3.57; \(p \leq .01\)), and higher income (0.0001; \(p \leq .05\)) tend to have larger basket size. Our results suggest that consumers with higher education (-0.03; \(p \leq .05\)) and larger income (-5.9E-06; \(p \leq .01\)) have a lower preference for cash payment option. We find that store distance negatively impacts basket size (-6.1E-06, \(p \leq .10\)), but has a positive effect on cash preference (1.0E-06, \(p \leq .05\)). Finally, we note that the control group customers’ preference of cash use decreases.

**Service Evaluation**

Concerning customers’ responses to service evaluation, our results suggest that SCO discontinuance has a significant negative impact on customer satisfaction (-0.13; \(p \leq .01\)). However, the effect of SCO discontinuance on shopping enjoyment is non-significant. Thus, we find support for Hypothesis 3, but not for Hypothesis 4. Concerning control variables, we find that age and household size both impact satisfaction (-0.01; \(p \leq .01\) and 0.05; \(p \leq .05\)), shopping enjoyment (-0.01; \(p \leq .01\) and 0.14; \(p \leq .01\)). We also find significant effects of gender (0.22, \(p < .01\)) and income (-6.2E-06, \(p < .01\)) on shopping enjoyment.
Finally, we find that preference for cash payment is negatively correlated with basket size (-0.09), customer satisfaction (-0.15), and shopping enjoyment (-0.06). However, shopping enjoyment correlates positively with basket size (0.01) and customer satisfaction (0.68).

SUPPLEMENTARY ANALYSIS

Alternative Model Estimation

The total number of treatment group customers in the main model (Equations 1-4) is small compared to the number of customers in the control group (173 vs. 719). A DID model with few treated subjects may lead to biased estimates due to heteroscedasticity (Bertrand, Duflo, and Mullainathan 2004; Ferman and Pinto 2015). To test whether the proposed model is robust against such a problem, we specify an alternate model where our sample consists of random pairs of control and treatment group customers (see Appendix A for model specification). We find estimates from the alternate model specification similar to the proposed main model.

Robustness Checks

Difference-in-Differences Analysis with Propensity Score Matching. We note that both the retail chains introduced the SCO service selectively in only a few of their stores. Therefore, despite the occurrence of natural events in our context, one can argue that there could be a non-random assignment of consumers (Lee 2008). To address this possibility, we rely on propensity score matching (PSM) techniques (Guo and Frasier 2010; Kumar et al. 2016). The objective of the PSM is to select a treatment group (i.e., customers who experience SCO service discontinuance) and a control group (i.e., customers who do not experience SCO service discontinuance) who are similar to each other in all relevant observable characteristics before the event of interest takes place (in our context, the discontinuance of SCO service). This method allows the creation of statistical
equivalence between the two groups where control group acts as a base case, thereby facilitating comparison of causal effect of the event on treated customers (Rosenbaum and Rubin 1983). Based on prior studies, we use age, gender, education, household size, yearly income, and store distance as observable matching variables for propensity score analysis using a logistic model formulation (Guo and Frasier 2010; Ma, Ailawadi, and Grewal 2013; Wangenheim and Bayón 2007). We discuss these matching variables in Appendix B. We adopt one-to-one nearest neighborhood matching algorithm to obtain the propensity scores for a matched pair of customers from control and treatment groups, and we check the robustness of our results by using additional matching algorithms as well. We provide the parameters of the logistic model and balancing of data before and after matching in Table 8 and Table 9 respectively.

In Table 8, we note that after the matching, the noticeable differences between treatment and control group reduce significantly. We also report the distribution and histogram of propensity scores of matched and unmatched control group customers to compare it against the propensity scores of the treatment group customers in Appendix C. The visual inspection shows that the procedure resulted in a good balance between the treatment and the matched control group. Following PSM, we can match 143 treatment group customers to similar 143 customers from the control group. Thus, we use a sample of 286 customers from both treatment and control groups for our subsequent empirical analysis using the proposed DID method. Similar to the methods expounded in Kumar et al. (2016), we perform DID based analyses on a matched pair of customers from PSM, one from the treatment group and another from the control group. The resulting parameter estimates (Table 9) are similar to the main results. However, we find that basket size of control group customers increases over time, suggesting that continuous SCO availability may
stimulate purchases. Furthermore, we do not find significant effects of customer specific demographic variables since the model is estimated for a matched pair of control and treatment group customers who resemble each other on these variables.

---------- Insert Table 10 about here ----------

Qualitative Analysis of Customer Feedback and Interview with Store Manager. Altogether 346 and 102 respondents from Retailer 1 and Retailer 2 respectively gave informal feedback via an open-ended questionnaire in the third wave of the survey (Table 7). We analyzed their feedback by tabulating the comments in a chart and tagging and inspecting the ones related to respondents’ purchase behavior, perceptions of SCOs, service evaluation, and the SCO discontinuance. This analysis reveals that both retailers have mixed set of customers: those who like SCOs and those who are less excited about them. However, one notable difference between the feedbacks given by Retailer 1 and Retailer 2 customers relates to the latter one’s discontinuance of SCOs. Remarkably, altogether 18% of those Retailer 2 customers who gave informal feedback express their disappointment and frustration of losing the SCO service in their comments, clearly reflecting decreased customer satisfaction due to SCO discontinuance. Some customers even threaten to change their focal store to the competitor’s, which signals of changes in their purchase behavior. This feedback is in line with the findings of our empirical analyses. Interestingly, some customers post-rationalize the discontinuance decision (Table 7, quotes 11-13 and 15), although Retailer 2 did not publicly comment on the decision. This suggests that the customers have adjusted their previous beliefs about both the service and the SCOs as a result of their omission.

---------- Insert Table 7 about here ----------

To gain a better understanding about the background of SCO implementation and discontinuance by Retailer 2, we conducted a 30-minute semi-structured interview with the store’s
manager. We discussed the managerial take on the discontinuance decision and its subsequent consequences. After the interview, we also discussed our empirical results with the manager. Overall, the interview lends support to our analysis, as the store manager reported receiving lots of negative and disappointed feedback from the customers after the SCO discontinuance. The decision came from the retail chain management; thus, the store manager could not influence it. He was not satisfied with the decision as he sees that introducing such a service for customers and then taking it away from them is a bad approach to customer service. The manager noted that customers’ disappointment with the decision came “radically apparent from their feedback.” He described the decision to discontinue SCOs as “pulling the rug from under the feet,” further elaborating: “…the outcome of that decision was extremely bad from my point of view, it honestly acerbated thousands of our customers.” However, there had been no systematic efforts on the store level to investigate the implications of SCO discontinuance: “We have not studied what happened in the end, that how many customers actually switched the store as they promised they would do when we discontinued SCO, or other possible implications. I cannot really say certainly, but the feedback was pretty negatively oriented. I think nothing good came out of that.”

**GENERAL DISCUSSION**

Our study is among the first ones to investigate the effects of SCO discontinuance on customer response. Overall, we find support for two of our hypotheses. First, we show that customers’ basket size decreases due to SCO discontinuance, which may relate to the lower level of service convenience that inhibits their purchase behavior. Second, we find decreases in customer satisfaction, potentially stemming from the process of belief-updating: customers re-evaluate the service by anchoring their new beliefs into those formed when SCO service was still operational,
and this arising contrast causes the evaluation to decrease. To our best knowledge, no other internal or external events than the SCO discontinuance occurred that could have explained the observed changes in customer response. Whereas we could not get access to actual sales data to verify the concrete impact of SCO discontinuance, our supplementary analyses and triangulation lend support to our findings and conclusions. Finally, we show that continued SCO implementation produces a positive customer response as we find increases in customers’ basket size and willingness to choose card over cash.

The context of our study may also help to explain the results. Considering that Finland is a forerunner in technology adoption on several fronts, it is surprising that SCOs have not been in wide usage in grocery retailing until 2012. Since Finnish consumers are used to fast adoption of new technologies in their daily lives, it is probable that they would also adopt SCOs without much effort, and in fact, it is possible that many consumers have already been waiting for the technology to finally shore the stores in Finland. When a significant proportion of shoppers are such technonatives, it is understandable that losing such service incites a negative response. Next, we discuss theoretical and managerial implications based on our results.

**Theoretical Implications**

*SST Discontinuance Inhibits Shopping Behavior.* The significant drop in customers’ purchase behavior is in line with the findings of Weijters et al. (2007) who suggest that users buy more as the perceived time saving from SST use encourages them to stay shopping around in the store longer. This finding highlights the important role of technology in servicescape and its influence on customer response. However, it is also widely established that customer satisfaction is strongly linked to customer retention and purchase behavior (Anderson and Mittal 2000), and one critical explanation may be that customers are buying less due to lower service satisfaction.
**Downgrading Servicescape Affects Customer Satisfaction.** The significant drop in customer satisfaction corroborates SST’s important role in creating a positive customer experience (Verhoef et al. 2009) and indicates that taking the service away deteriorates this experience. By upgrading their servicescape with SST, the retailer sets the bar higher for themselves as well as for their competitors, and consequently, customers adjust their beliefs downwards when faced with a sudden omission of the popular, value-adding service, especially when contrasted to a competing retailer who retains the service. These conclusions resonate with prior research where service inconvenience and availability of more attractive services have been found to decrease customers’ commitment to their current service provider (Keaveney 1995; Yim, Chan, and Hung 2007). Stated evidence from the survey indicates that retailer switching might have happened with some of the customers (Table 7, quote 19). Thus, together with decreasing satisfaction, the attraction of competitors’ services can lead to losing customers to competitors and even to a spread of negative word-of-mouth, both of which may ultimately endanger the retailer’s market position (Hogan, Lemon, and Libai 2003; McDougall and Levesque 2000).

**Creating Better Servicescapes with SSTs.** Our empirical results put offering an SCO service on the side of traditional checkout services in positive limelight as the continuous availability of SCOs was found to stimulate purchases and contribute to favoring card as a mode of payment. Overall, our results lend support to prior work suggesting that offering multiple complementary service delivery options can work in favor of upholding and improving existing customer relationships (Meuter et al. 2000; Scherer, Wünderlich, and Wangenheim 2015). Our implications may apply to contexts outside retailing such as software business, where discontinuance of value-adding services is a prevalent phenomenon (e.g., *The Verge* 2015).
Managerial Implications

Our findings are of critical importance for service providers, such as retail chains, as they show the negative effects of downsizing the service on customer response. Next, we provide relevant implications that can be used as a support for managerial decision-making when it comes to the question of retaining or discontinuing a retail SST.

*Indirect Costs of SST Discontinuance.* The severe practical outcome of SST discontinuance is the significant decrease in customers’ basket size. This possibly stems from the sudden omission service. In any case, such a significant drop in purchases should be interpreted as a warning signal of the risks related to terminating a value-adding service. Moreover, while the observed drop in customer satisfaction is smaller in size, it could persist for a few years after the discontinuance event due to a potential carryover effect (Anderson, Fornell, and Lehmann 1994). This could mean a significant decrease in ROI, especially in the short term. Since the observed decrease in customer satisfaction may, in the worst case, result in customers defecting to competing retailers, managerial decision-making should weigh the possible externality effects on customer relationships against the expected savings and other benefits stemming from SST discontinuance.

*Communicating the Motivations of Service Changes.* An important consideration emerging from our data relates to how a service change should be communicated to the customers. While we find significant negative effects of SCO discontinuance on customer response, we also note that some customers did not like the SCO service and were, in fact, delighted that it was discontinued. Such negative attitudes toward SST appear to stem from the belief that SSTs are applied to reduce personal service and to replace service employees. However, from the retailer’s perspective, SST implementation is often primarily motivated by providing a better and richer servicescape for the customers. As the store manager of Retailer 2 elaborates: “Not everyone
perceives [SCOs] as a positive thing, but see it only as a threat, not in a way that we think - for us it is about customer service, a service mode that customers may use if they want to...we provide alternatives, it is not an ‘either or’ issue...it is an additional service”. The store manager stated that decreasing personnel is neither an objective nor a potential outcome of SST implementation. SCOs can be leveraged to address consumers’ most prominent wishes regarding in-store shopping: achieving increased availability of both free checkouts and knowledgeable sales assistance (Burke 2002). Thus, in line with past research (Homburg, Hoyer, and Koschate 2005) we recommend managers to effectively communicate the motivations of service changes so that customers are not left to make their conclusions, which may be unfavorable toward the service provider.

LIMITATIONS AND FUTURE RESEARCH

It is important to acknowledge that this study comes with certain limitations. Firstly, even though self-service technologies are proliferating (The Economist 2004) giving rise to the self-service economy (Castro, Atkinson, and Ezell 20105), we advise the reader to interpret our findings within the retailing context. Secondly, although we exploit a natural experimental research design, we note that our study is survey-based. Future research can verify the findings by looking at customers’ actual purchase behavior. However, we note that conducting a service discontinuance study in a controlled experimental setting may be costly. Third, although we used a longitudinal design, our findings lack long-term effect of SCO discontinuance. However, considering that we measured the customer response two months after the discontinuance event, we are confident that the observed changes were not mere initial, exaggerated reactions that would fade away shortly after the event. We expect that the effect of discontinuance had stabilized by the time of the post-

5 According to the authors, “…If self-service technology were more widely deployed, the economy would be approximately $130 billion larger annually.”
period survey and thus the discontinuance is likely to have had a lasting effect to some extent. Still, to establish the persistence of these effects, more research should be conducted using even longer time interval. Also, our collaboration with the retailers started only after they had introduced the SCO services in their stores, and thus we did not have a chance to collect data before the introduction of the service. An empirical setting where data is collected prior to implementation, during implementation and post-implementation would make an intriguing research design for exploring the interplaying effects of reference points (Tversky and Kahneman 1991) and service changes on customer response. In addition, that way one could also verify the initial effect of SST introduction on customer response. Finally, we investigate a situation where service provider discontinues the SCO and reverts to the original state before SCO introduction. However, in some cases the service provider has introduced another value-adding service to replace the discontinued SCO, consider for instance Kroger’s move to eliminate their SCOs and add metro checkout service as a part of their store remodeling project (FierceRetail 2011). Looking into such cases could bring invaluable insights into the phenomenon. In spite of these limitations, we contend that the findings of this study have valuable implications for both theory and practice and that our work has successfully opened an avenue for future research of a previously under-explored topic.
REFERENCES


Gijsenberg, Maarten J., Harald J. Van Heerde, and Peter C. Verhoef (2015), “Losses Loom Longer...


Pemberton, J (2004), “Personal shopping assistant finds favour in German retail market,” *European Retail Digest*, (43), 34–38.


Banking Research.


Table 1: Research Gap and Contributions

<table>
<thead>
<tr>
<th>Type of change</th>
<th>Prior Research</th>
<th>Current Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research on customer reactions to service changes / disruptions</strong></td>
<td>- Service introductions (Orel and Kara 2014; Weijters et al. 2007)</td>
<td>- Service discontinuance</td>
</tr>
<tr>
<td></td>
<td>- Service interruptions (Bolton and Drew 1991)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Service upgrades (Bolton and Drew 1991; Brüggen, Foubert, and Gremler 2011; Dagger and Danaher 2014)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Service separation (Keh and Pang 2010)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Service delays (Taylor 1994)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Service failures (Maxham and Netemeyer 2002; Wangenheim and Bayón 2007; Zhu et al. 2013)</td>
<td></td>
</tr>
<tr>
<td><strong>Research on customer reactions to discontinuance</strong></td>
<td>- Consumer products (Boatwright and Nunes 2001; Martin 2004)</td>
<td>- Self-service technology (e.g., Self-checkouts)</td>
</tr>
<tr>
<td>Subject of discontinuance</td>
<td>- Employee-based service (Reinders et al., 2008; White et al., 2012)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Laying off employees (Habel and Klarmann 2014)</td>
<td></td>
</tr>
<tr>
<td><strong>Research on service technology discontinuance</strong></td>
<td>- Individual user’s decision to discontinue technology (Prendergast and Marr 1995; Hogan, Lemon, and Libai 2003)</td>
<td>- Customer reactions to retailer's decision to discontinue self-service technology</td>
</tr>
<tr>
<td>Focus</td>
<td>- Customer reactions to retailer's decision to discontinue self-service technology</td>
<td></td>
</tr>
<tr>
<td>Methods and data used</td>
<td>- Cross-sectional data (Reinders et al., 2008; White et al., 2012)</td>
<td>- Longitudinal data</td>
</tr>
<tr>
<td></td>
<td>- Treatment created with sample scenarios (Reinders et al., 2008; White et al., 2012)</td>
<td>- Natural experiment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Causal inference</td>
</tr>
</tbody>
</table>

Table 2: Summary of the Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>49.99</td>
<td>13.61</td>
</tr>
<tr>
<td>Formal education (years)</td>
<td>11.90</td>
<td>1.82</td>
</tr>
<tr>
<td>Household size (persons)</td>
<td>2.32</td>
<td>1.17</td>
</tr>
<tr>
<td>Yearly income (€)</td>
<td>28776.22</td>
<td>14725.16</td>
</tr>
<tr>
<td>Distance to focal store (meter)</td>
<td>7220.39</td>
<td>9328.51</td>
</tr>
<tr>
<td>Basket size (# of items)</td>
<td>14.57</td>
<td>10.73</td>
</tr>
</tbody>
</table>
Table 3: Constructs from the Surveys

<table>
<thead>
<tr>
<th>Construct</th>
<th>α</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preference for Cash Payment (^1)</td>
<td>.80</td>
<td>3.03</td>
<td>1.05</td>
</tr>
<tr>
<td>I want SCOs to have the same payment mode than traditional checkouts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A cash payment option would make SCO more useful</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sometimes I prefer to pay my groceries with cash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would be more likely to use SCO if it had a cash payment option</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Satisfaction (^2,3)</td>
<td>.93</td>
<td>3.56</td>
<td>1.07</td>
</tr>
<tr>
<td>I am satisfied with the service of the store that has SCOs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am pleased to frequent a store that has SCOs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCOs improve the service of the store</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The store with SCOs has a positive effect on my shopping experience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shopping Enjoyment (^4,5)</td>
<td>.95</td>
<td>3.02</td>
<td>1.13</td>
</tr>
<tr>
<td>Using SCO is fun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using SCO is entertaining because I can participate in the process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-scanning products is fun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Checkout experience is more enjoyable, when I can do something myself</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Items adapted from \(^1\)Items composed for the purposes of this study; \(^2\)Bhattacherjee (2001); \(^3\)Lin & Hsieh (2006); \(^4\)Weijters et al. (2007); \(^5\)Venkatesh, Thong, & Xu (2012). The items were measured on a 5-point Likert-scale: 1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, and 5. Strongly agree.

Table 4: Correlations of the Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Preference for Cash Payment</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Customer Satisfaction</td>
<td>-.098*</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>(3) Shopping Enjoyment</td>
<td>-.008</td>
<td>.677***</td>
<td>---</td>
</tr>
</tbody>
</table>

*\(p \leq .01\), **\(p \leq .05\), *\(p \leq .10\)

Table 5: Model-Free Evidence

<table>
<thead>
<tr>
<th>Response</th>
<th>Outcome Variable</th>
<th>Group</th>
<th>Pre-Period</th>
<th>Post-Period</th>
<th>Difference</th>
<th>DID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Behavior</td>
<td>Basket Size</td>
<td>Treatment</td>
<td>18.61</td>
<td>17.54</td>
<td>-1.07***</td>
<td>-1.28***</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>13.47</td>
<td>13.69</td>
<td>0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preference for Cash</td>
<td>Treatment</td>
<td>3.08</td>
<td>3.00</td>
<td>-0.08</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>3.00</td>
<td>2.85</td>
<td>-0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Evaluation</td>
<td>Customer Satisfaction</td>
<td>Treatment</td>
<td>3.55</td>
<td>3.49</td>
<td>-0.06**</td>
<td>-0.12***</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>3.61</td>
<td>3.68</td>
<td>0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shopping Enjoyment</td>
<td>Treatment</td>
<td>3.09</td>
<td>2.98</td>
<td>-0.11</td>
<td>-0.12</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>2.97</td>
<td>2.99</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*\(p \leq .01\), **\(p \leq .05\), *\(p \leq .10\)

Note: The table presents the mean values of customer responses (purchase behavior and service evaluation) in pre- and post-period (i.e. before and after of SCO service discontinuance) for both the groups: treatment and control. The “difference” measure is based on the paired-sample \(t\)-test. The DID measure is determined by calculating the difference in the outcome variables between post- and pre-periods and then comparing the means of these differences between the treatment and control groups.
Table 6: Results from the Main DID Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Purchase Behavior</th>
<th>Service Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BsktSz</td>
<td>CashPay</td>
</tr>
<tr>
<td>Intercept</td>
<td>4.4894**</td>
<td>3.6305***</td>
</tr>
<tr>
<td></td>
<td>(1.9641)</td>
<td>(0.2271)</td>
</tr>
<tr>
<td>TreatD</td>
<td>4.8274</td>
<td>0.1498</td>
</tr>
<tr>
<td></td>
<td>(2.9588)</td>
<td>(0.0977)</td>
</tr>
<tr>
<td>ScoD</td>
<td>0.2125</td>
<td>-0.1481***</td>
</tr>
<tr>
<td></td>
<td>(0.4649)</td>
<td>(0.0537)</td>
</tr>
<tr>
<td>TreatD×ScoD</td>
<td>-1.2807***</td>
<td>0.0678</td>
</tr>
<tr>
<td></td>
<td>(0.2556)</td>
<td>(0.1220)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0754***</td>
<td>0.0679***</td>
</tr>
<tr>
<td></td>
<td>(0.0157)</td>
<td>(0.0018)</td>
</tr>
<tr>
<td>Gender</td>
<td>0.9977**</td>
<td>0.0010</td>
</tr>
<tr>
<td></td>
<td>(0.4506)</td>
<td>(0.0521)</td>
</tr>
<tr>
<td>Education</td>
<td>0.1861</td>
<td>-0.034***</td>
</tr>
<tr>
<td></td>
<td>(0.1290)</td>
<td>(0.0149)</td>
</tr>
<tr>
<td>HH Size</td>
<td>3.5738***</td>
<td>0.0193</td>
</tr>
<tr>
<td></td>
<td>(0.1935)</td>
<td>(0.0224)</td>
</tr>
<tr>
<td>Income</td>
<td>0.0001***</td>
<td>-5.9E-06***</td>
</tr>
<tr>
<td></td>
<td>(1.3E-05)</td>
<td>(1.5E-06)</td>
</tr>
<tr>
<td>Store Distance</td>
<td>-6.1E-06*</td>
<td>1.0E-06**</td>
</tr>
<tr>
<td></td>
<td>(3.5E-06)</td>
<td>(4.1E-07)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.2450</td>
<td>0.0761</td>
</tr>
</tbody>
</table>

Correlations

<table>
<thead>
<tr>
<th></th>
<th>BsktSz</th>
<th>CashPay</th>
<th>CustSat</th>
<th>ShopEnjoy</th>
</tr>
</thead>
<tbody>
<tr>
<td>BsktSz</td>
<td>1.0000</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>CashPay</td>
<td>-0.0944</td>
<td>1.0000</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>CustSat</td>
<td>0.0004</td>
<td>-0.1458</td>
<td>1.0000</td>
<td>---</td>
</tr>
<tr>
<td>ShopEnjoy</td>
<td>0.0122</td>
<td>-0.0570</td>
<td>0.6807</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

***p ≤ .01, **p ≤ .05, *p ≤ .10
(Numbers in parentheses are estimated standard errors)
<table>
<thead>
<tr>
<th>No.</th>
<th>Quotes from the feedback section of the third wave of survey *</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>&quot;Currently my focal store ([Retailer 2]) does not have SCOs, they discontinued the implementation, unpleasant.&quot;</td>
</tr>
<tr>
<td>#2</td>
<td>&quot;I am very displeased because [Retailer 2] discontinued their SCO implementation.&quot;</td>
</tr>
<tr>
<td>#3</td>
<td>&quot;I hope SCOs will be brought back to our focal store.&quot;</td>
</tr>
<tr>
<td>#4</td>
<td>&quot;I think SCOs should be brought back.&quot;</td>
</tr>
<tr>
<td>#5</td>
<td>&quot;My focal store has removed SCOs, unfortunately!&quot;</td>
</tr>
<tr>
<td>#6</td>
<td>&quot;Such a terrific invention; I hope they will return as soon as possible! I do not comprehend why they were removed after such a short period of implementation. I was really disappointed. Bring SCOs back and soon!!&quot;</td>
</tr>
<tr>
<td>#7</td>
<td>&quot;It is miserable that although our focal store experimented SCOs, the service is no longer available.&quot;</td>
</tr>
<tr>
<td>#8</td>
<td>&quot;SCOs were such a good thing and I have been regretting that it was just an experimental thing. Please bring back self-scanning and SCOs to [Retailer 2].&quot;</td>
</tr>
<tr>
<td>#9</td>
<td>&quot;My focal store discontinued SCOs in August, and I find that displeasing. I still have not stopped frequenting this store. I would have wished for SCOs to remain in this store.&quot;</td>
</tr>
<tr>
<td>#10</td>
<td>&quot;I like SCOs, because they facilitate grocery shopping. To my nuisance, my nearby grocery store discontinued their SCO implementation. Now it is annoying to go to the store when I have to queue and move groceries back and forth. I used to always choose self-scanning.&quot;</td>
</tr>
<tr>
<td>#11</td>
<td>&quot;Our focal store discontinued SCOs due to low usage, unfortunately. I was very satisfied with SCOs and liked using them.&quot;</td>
</tr>
<tr>
<td>#12</td>
<td>&quot;We are extremely disappointed because the SCOs were recently discontinued, presumably due to lack of interest in them.&quot;</td>
</tr>
<tr>
<td>#13</td>
<td>&quot;It seems that having SCOs did not turn out worthwhile since they were discontinued.&quot;</td>
</tr>
<tr>
<td>#14</td>
<td>&quot;[Retailer 2] ended their SCO implementation. In Ikea the system works really well, they should learn from there.&quot;</td>
</tr>
<tr>
<td>#15</td>
<td>&quot;The store where I was trialing with SCOs discontinued the service due unsuitability with their practices. Although, every time I shopped there I was called for random check. This made SCO use frustrating because I would have gotten out faster using the traditional checkout.&quot;</td>
</tr>
<tr>
<td>#16</td>
<td>&quot;It's a pity that our store discontinued the SCO option. Although I feel that whenever I used SCO, they performed this 'random check' on me, and that slowed down the self-checkout process.&quot;</td>
</tr>
<tr>
<td>#17</td>
<td>&quot;Well, [Retailer 2] had discontinued SCOs so I never got the chance to trial them. And someone really should teach us how use the self-scanner. Maybe they could hold some special training week where staff would come to guide the customers in SCO use. I do not dear to go ask advice myself...&quot;</td>
</tr>
<tr>
<td>#18</td>
<td>&quot;I wish to have more SCOs available! In my town only one store ([Retailer 1]) has them now, [Retailer 2] used to have them but unfortunately discontinued their implementation!&quot;</td>
</tr>
<tr>
<td>#19</td>
<td>&quot;Why did [Retailer 2] remove SCOs? I switched to the neighboring store!!!&quot;</td>
</tr>
</tbody>
</table>

*Translated from Finnish to English*
Table 8: Parameters from Logit Model Used for Matching

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.5151</td>
<td>.8847</td>
</tr>
<tr>
<td>Age</td>
<td>.0262***</td>
<td>.0074</td>
</tr>
<tr>
<td>Gender</td>
<td>.2012</td>
<td>.2195</td>
</tr>
<tr>
<td>Education</td>
<td>-.1844**</td>
<td>.0595</td>
</tr>
<tr>
<td>Household Size</td>
<td>.4261***</td>
<td>.0920</td>
</tr>
<tr>
<td>Income</td>
<td>-3.4E-05***</td>
<td>7.0E-06</td>
</tr>
<tr>
<td>Store Distance</td>
<td>3.0E-05**</td>
<td>1.2E-05</td>
</tr>
</tbody>
</table>

Log likelihood: -408.28

***p ≤ .01, **p ≤ .05, *p ≤ .10

Table 9: Balancing of Data Before and After Matching

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment Group</th>
<th>Control Group</th>
<th>Before matching (b)</th>
<th>After matching (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(T)</td>
<td>(C)</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Age</td>
<td>49.7483</td>
<td>45.0092</td>
<td>4.7391</td>
<td>50.2308</td>
</tr>
<tr>
<td>Gender</td>
<td>.6993</td>
<td>.6110</td>
<td>.0883</td>
<td>.6294</td>
</tr>
<tr>
<td>Education</td>
<td>11.9860</td>
<td>12.9274</td>
<td>-.9414</td>
<td>11.8042</td>
</tr>
<tr>
<td>Household Size</td>
<td>2.3916</td>
<td>2.0518</td>
<td>.3399</td>
<td>2.2448</td>
</tr>
<tr>
<td>Income</td>
<td>28881.1189</td>
<td>38113.5225</td>
<td>-9232.4037</td>
<td>28671.3287</td>
</tr>
<tr>
<td>Store Distance</td>
<td>7003.5664</td>
<td>4837.5927</td>
<td>2165.9738</td>
<td>7437.2168</td>
</tr>
<tr>
<td>Variable</td>
<td>Purchase Behavior</td>
<td></td>
<td>Service Evaluation</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>BsktSz</td>
<td>CashPay</td>
<td>CustSat</td>
<td>ShopEnjoy</td>
</tr>
<tr>
<td>Intercept</td>
<td>2.2242</td>
<td>4.4173***</td>
<td>2.9905***</td>
<td>3.0485***</td>
</tr>
<tr>
<td>TreatD</td>
<td>.6280</td>
<td>-.1766*</td>
<td>-.0455</td>
<td>.1084**</td>
</tr>
<tr>
<td>ScoD</td>
<td>.9354***</td>
<td>.0748</td>
<td>.0163</td>
<td>.1168</td>
</tr>
<tr>
<td>TreatD×ScoD</td>
<td>-3.1399***</td>
<td>.0682</td>
<td>-.0192***</td>
<td>.0437</td>
</tr>
<tr>
<td>Age</td>
<td>-.0018</td>
<td>.0018</td>
<td>-.0044</td>
<td>-.0073*</td>
</tr>
<tr>
<td>Gender</td>
<td>.0323</td>
<td>-.0835</td>
<td>.0988</td>
<td>.1891*</td>
</tr>
<tr>
<td>Education</td>
<td>.0719</td>
<td>-.1056</td>
<td>.0307</td>
<td>-.0052</td>
</tr>
<tr>
<td>HH Size</td>
<td>.5342</td>
<td>.0757</td>
<td>.1007</td>
<td>.1423</td>
</tr>
<tr>
<td>Income</td>
<td>1.2E-05</td>
<td>-1.3E-05</td>
<td>1.7E-06</td>
<td>-4.3E-06</td>
</tr>
<tr>
<td>Store Distance</td>
<td>1.3E-05</td>
<td>-8.6E-07</td>
<td>9.4E-06</td>
<td>1.0E-06</td>
</tr>
<tr>
<td></td>
<td>6.4E-06</td>
<td>(4.9E-06)</td>
<td>(5.1E-06)</td>
<td>(5.3E-06)</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.2034</td>
<td>0.0321</td>
<td>0.0218</td>
<td>0.0241</td>
</tr>
</tbody>
</table>

***p ≤ .01, **p ≤ .05, *p ≤ .10
(Numbers in parentheses are estimated standard errors)
Figure 1: Conceptual Framework

(-) SCO discontinuance will have negative effect
(+) SCO discontinuance will have positive effect
Figure 2: Timeline of SCO Introduction, Discontinuance, and the Three Waves of Survey

- **June 2012**: Retailer 1 launches SCO service
- **November 2012**: Retailer 2 launches SCO service
- **January 2013**: First wave of survey
- **May 2013**: Second wave of survey
- **August 2013**: Retailer 2 discontinues SCO service
- **October 2013**: Third wave of survey

Survey details:
- **June 2012**: Survey sent to find out customers’ background information and their focal retail chain
- **May 2013**: Survey sent to capture the customers’ response behavior
- **October 2013**: Same survey sent to capture same customers’ response behavior
Appendix A: Alternative Model Estimation

For each customer from the treatment group we randomly select a customer from the control group to form a pair. For these random pairs of customers, we model the following:

\[
BsktSz_{ih} = \alpha_0 + \alpha_1 \text{TreatD}_{ih} + \alpha_2 \text{ScoD}_{ih} + \alpha_3 (\text{TreatD}_{ih} \times \text{ScoD}_{ih}) + AX_{ih} + \epsilon_{BsktSz}^{ih}
\]  
(A1)

\[
\text{CashPay}_{ih} = \theta_0 + \theta_1 \text{TreatD}_{ih} + \theta_2 \text{ScoD}_{ih} + \theta_3 (\text{TreatD}_{ih} \times \text{ScoD}_{ih}) + \Theta X_{ih} + \epsilon_{\text{CashPay}}^{ih}
\]  
(A2)

\[
\text{CustSat}_{ih} = \lambda_0 + \lambda_1 \text{TreatD}_{ih} + \lambda_2 \text{ScoD}_{ih} + \lambda_3 (\text{TreatD}_{ih} \times \text{ScoD}_{ih}) + \Omega X_{ih} + \epsilon_{\text{CustSat}}^{ih}
\]  
(A3)

\[
\text{ShopEnjoy}_{ih} = \omega_0 + \omega_1 \text{TreatD}_{ih} + \omega_2 \text{ScoD}_{ih} + \omega_3 (\text{TreatD}_{ih} \times \text{ScoD}_{ih}) + \Omega X_{ih} + \epsilon_{\text{ShopEnjoy}}^{ih}
\]  
(A4)

The subscript \(i\) represents pair of customers, \(h\) represents customer either from control or treatment group, and \(t\) denotes the time period. \(\text{TreatD}_{ih}\) is a dummy variable that takes value 1 if the customer belongs to the treatment group (i.e. customer from Retailer 2), and \(\text{ScoD}_{ih}\) is a dummy variable that denotes discontinuance of SCO service and takes value 1 and 0 in post- and pre-period respectively for customer \(h\) belonging to pair \(i\).

The results from this model are consistent with the proposed model with significant negative consequences of SCO discontinuance on basket size and customer satisfaction.

Appendix B: Matching Variables

In order to discover the possible effects of service discontinuance on customer response, we need make sure that the observed changes occur because of the discontinuance and not because of other factors. Thus, we chose a handful of commonly used matching variables that will be briefly explained here.

**Age.** Some prior research (e.g. Dean 2008) shows that younger customers are more likely to experiment with new SSTs, indicating that the availability of technological solutions is of higher relevance to them.

**Gender.** Prior research has shown that men have greater computer self-efficacy (Durndell and Haag 2002), and higher preference of technological solutions (e.g. online shopping, Van Slyke et al. 2002) than women. Hence, possibly men’s attitudes are affected more by the service discontinuance than women’s.

**Education.** People with higher education tend to be more receptive to technological advances such as SSTs (Weijters et al. 2007). On the other hand, technology experts have been found to report less positive evaluations of new SSTs than technology novices (Reinders, Frambach, and Kleijnen 2015).

**Household size.** Since basket size is highly correlated with the household size, as larger households tend to have larger baskets. It is also possible that large households’ purchasing behavior is less sensitive to service changes such as discontinuance.

**Yearly income.** Higher income has been found to be associated with greater receptiveness of SST due to more frequent exposure and access to technological solutions (Meuter et al. 2005).

**Distance to the focal store.** One important factor to control is the distance between respondent’s home and the preferred store that has/had SCO option. As ‘location’ remains important in retailing context.
Appendix C: Visual Inspection of Propensity Score Distributions

Figure C1: Distributions of Propensity Scores

Note: The figure shows the distribution of propensity score for the treatment group, matched control group, and unmatched control group customers. Before matching, the distributions of unmatched control group and treatment group are quite different. This difference disappears after matching, resulting in similar distribution between matched the control group and the treatment group.

Figure C2: Histograms of Propensity Scores

Note: The figure shows the histograms of propensity scores for the treatment group and both matched and unmatched control group customers. Histograms for unmatched control group and treatment group are significantly different. This difference vanishes after the matching.
Pulling the Plug: The Concept, Process, and Outcomes of Organizational Information System Discontinuance

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