### DOI: 10.1111/isj.12307

WILEY

## A paradoxical perspective on technology renewal in digital transformation

# Henrik Wimelius<sup>1</sup> | Lars Mathiassen<sup>2</sup> | Jonny Holmström<sup>1</sup> | Mark Keil<sup>2</sup>

<sup>1</sup>Department of Informatics, Umeå University, Umeå, Sweden

<sup>2</sup>Department of Computer Information Systems, Georgia State University, Atlanta, Georgia

#### Correspondence

Henrik Wimelius, Department of Informatics, Umeå University, 901 87 Umeå, Sweden. Email: henrik.wimelius@umu.se

Funding information This research is partly funded by the Marianne and Marcus Wallenberg Foundation.

### Abstract

To realize their strategic goals and maintain a competitive advantage in the digital era, organizations must periodically renew their digital platforms and infrastructures. However, knowledge about such technology renewal is scattered across diverse research streams, so insights into the process are both limited and fragmented. In this article, we consolidate insights from previous research to conceptualize technology renewal as an inherently paradoxical digital transformation process that requires organizations to simultaneously remove their technological foundation and build on the practices that depend on it to implement a new technological foundation. Previous research suggests that technology renewal initiatives are driven by three paradoxical tensions: (a) established vs renewed technology usage, (b) deliberate vs emergent renewal practices and (c) inner vs outer renewal contexts. We apply this framing to a longitudinal case study in which we analyse and explain how an organization's responses to manifestations of these tensions eventually led to a vicious cycle of continued investments into two overlapping and largely incompatible digital platforms over a 9-year period. Based on these conceptual and empirical insights, we theorize technology renewal as a

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited. © 2020 The Authors. Information Systems Journal published by John Wiley & Sons Ltd. paradoxical, and increasingly critical, digital transformation process that forces managers to make decisions in complex and ambiguous choice situations.

#### KEYWORDS

digital platforms and infrastructures, digital transformation, paradox, responses, technology renewal, tensions

### 1 | INTRODUCTION

In recent decades, digital technologies have come to fundamentally transform how organizations operate and compete (Galliers & Sutherland, 1991; Tilson, Lyytinen, & Sørensen, 2010). As a result, organizations must not only continuously develop and implement new digital capabilities and applications vis-à-vis their existing technology stacks, they must also periodically renew their underlying digital platforms and infrastructures based on technology advances in order to stay competitive (Hanseth & Lyytinen, 2010; Nambisan, Lyytinen, Majchrzak, & Song, 2017; Yoo, Henfridsson, & Lyytinen, 2010). In both the general strategy literature (eg, Agarwal & Helfat, 2009; Crossan & Berdrow, 2003; Floyd & Lane, 2000; Huff, Huff, & Thomas, 1992) and calls to reframe IS strategy research (Peppard, Lambert, & Edwards, 2000; Tanriverdi, Rai, & Venkatraman, 2010), renewal is seen as a process of change that involves "*replacement of attributes of an organization that has the potential to substantially affect its long-term prospects*" (Agarwal & Helfat, 2009, p. 282). Accordingly, we define technology renewal as the activity through which organizations seek to replace their core digital platforms and infrastructures in order to realize their strategic goals.

We posit technology renewal to be of critical importance on both a practical and a theoretical level. Nevertheless, no IS research stream is exclusively focused on understanding how to replace the technological backbone of an organization's operations. Instead, technology renewal themes are scattered across different IS research streams. This unfortunate dispersal contributes to several challenges. First, current knowledge is limited and incoherent, offering few insights into the specific characteristics of technology renewal. Second, changes to deeply rooted organizational structures, processes and cultures (Hanseth & Lyytinen, 2010; Liang, Saraf, Hu, & Xue, 2007; Wand & Weber, 1995) inevitably make renewal initiatives prone to failure. We, therefore, need concrete knowledge about the mechanisms that drive risks and their resolution during renewal initiatives. Third, without concepts and frameworks dedicated to technology renewal, we cannot establish a cumulative tradition (Walsham, 1995) in which researchers can consolidate new empirical findings and advance theory.

At least four streams of IS literature touch upon the challenges associated with technology renewal. Scholars of implementation research have found that the organizational implementation of complex technologies is challenging due to impediments such as knowledge barriers (Attewell, 1992) and socio-psychological barriers (Orlikowski, 1992). Meanwhile, infrastructure research has demonstrated that changes to organizational use of technology can be difficult because of the inertia generated by the installed base (Hanseth & Lyytinen, 2010). Enterprise systems research has shown that integrating new digital platforms into organizational practices can be a prolonged process with uncertain outcomes (Liang et al., 2007; Öbrand, Augustsson, Mathiassen, & Holmström, 2019; Rolland, Mathiassen, & Rai, 2018). Finally, digital transformation research is an emerging line of research that seeks to capture the different ways in which incumbent organizations leverage various forms of digital technologies to improve or change their strategic positioning and operations (Vial, 2019; Wessel, Baiyere, Ologeanu-Taddei, Cha, & Jensen, 2020). Interestingly for this study, Gregory, Keil, Muntermann, and Mähring (2015) outline six areas of digital transformation, one of which is architectural change with choices between integration and replacement of digital technologies. While none of these research streams provide a theoretical base for understanding the unique challenges in technology renewal, together they suggest that such initiatives involve complex changes with orthogonal trajectories that

generate arrays of strategic and operational tensions. We, therefore, conceptualize technology renewal as a paradoxical digital transformation process in which organizations must *simultaneously remove their technological foundation and build on the practices that depend on it to implement a new technological foundation*.

By adopting a paradox perspective, we advance knowledge of the dynamic interplay between the contradictory yet interrelated elements of technology renewal *"that seem logical in isolation but absurd and irrational when appearing simultaneously*" (Lewis, 2000, p. 760). IS and management researchers have adopted the notion of a paradox to study the phenomena in which competing demands must be met (Cameron, 1986; Poole & Van de Ven, 1989). This has also helped reveal how interrelated tensions may persist over time and trigger on-going organizational responses (Calabretta, Gemser, & Wijnberg, 2017; Jay, 2013; Lewis, 2000; Smith & Lewis, 2011). For example, Cuganesan (2017) details six types of strategic responses to tensions that may contribute to virtuous or vicious cycles in on-going management of the identity paradox in organizations. Similarly, Wareham, Fox, and Cano Giner (2014) investigate viable governance mechanisms to address tensions pertinent to the stability-evolvability paradox in digital ecosystems. While researchers conceptualize these tensions in various ways (Farjoun, 2010; Sheep, Fairhurst, & Khazanchi, 2017), we follow this general line of paradox research to articulate the paradoxical nature of technology renewal and to investigate how consequential tensions and organizational responses shape such an initiative's trajectory.

To apply and further develop a paradoxical perspective on technology renewal, we draw on a longitudinal qualitative case study (Yin, 2013) of a renewal initiative at the Headquarters office of HealthOrg, a large, distributed Swedish health services provider. Based on staff member concerns and a governmental decree to improve and restructure all public services through digital transformation, HealthOrg managers conducted comprehensive analyses and identified fundamental information management problems at the organization's Headquarters. As a result, in 2002, HealthOrg made a strategic decision to acquire a new enterprise content management (ECM) system to replace its ageing digital platform. Over the following 9-year period, the organization carried out dedicated and extensive efforts aimed at simultaneously replacing its legacy platform and building on its existing use patterns to support implementation of the new platform. Despite these efforts, however, the renewal initiative only exacerbated the original information management problems as use of the two overlapping and largely incompatible platforms persisted.

Based on these considerations, our paper addresses the following research question: *How and why do paradoxical tensions affect the trajectory of initiatives to renew an organization's foundational digital technology*? To address this question, we reviewed existing research streams and consolidated them into three tensions related to the paradoxical nature of technology renewal: (a) established vs renewed technology usage, (b) deliberate vs emergent renewal practices and (c) inner vs outer renewal contexts. Given unfettered access to rich data from HealthOrg's renewal initiative, we applied this framing to investigate how, and with what impacts, the organization responded to manifestations of these tensions at critical junctures. We then draw on these conceptual and empirical insights to offer a theoretical perspective on technology renewal as a paradoxical and increasingly critical digital transformation process, one that forces managers to make decisions about the many complex and ambiguous choice situations that arise during these initiatives.

### 2 | PARADOXICAL TENSIONS IN TECHNOLOGY RENEWAL

Hanseth and Lyytinen (2010) distinguish between digital capabilities, applications, platforms and infrastructures, and they suggest that transformation of these present organizations with increasing degrees of complexity. *Digital capabilities* let users edit text, search for information, manage contacts and perform other distinct actions. *Digital applications* combine digital capabilities into systems that support specific tasks, such as patient billing, staff scheduling or quality monitoring. *Digital platforms* are networked collections of digital capabilities and applications; examples include ECM, electronic medical record (EMR) systems and enterprise resource planning (ERP)

WILEY-

systems. Finally, *digital infrastructures* are portfolios of interconnected socio-technical systems that are shared, open, unbounded and evolving, and may comprise several digital platforms, applications and capabilities. Given these definitions, *technology renewal* entails replacing a digital platform or key parts of the digital infrastructure upon which an organization bases its operations and competitive positioning (Hanseth & Lyytinen, 2010; Liang et al., 2007).

Given that technology renewal initiatives play a critical role in shaping how an organization digitizes its operations, as well as shaping its overall strategic trajectories, it is not surprising that such initiatives are driven by tensions. Indeed, organizational and technological change processes generally entail numerous tensions, including, for example, between opposite poles of exploration and exploitation (Benner & Tushman, 2003; March, 1991), stability and evolvability (Tilson et al., 2010; Wareham et al., 2014), and cohesiveness and diversity (Jarvenpaa & Wernick, 2011). As Smith and Lewis (2011) note, prior research investigated tensions through two perspectives: As socially constructed and experienced by actors in situ during a specific change episode; and as abstract notions that apply, in general, across a change context without being directly observable by the involved actors. Smith and Lewis demonstrate how to theorize tensions by combining these two perspectives, such that salient tensions are experienced by organizational actors in specific situations as expressions of underlying, latent tensions in the broader change context (ibid. p. 388). Thus, in adopting a duality perspective (Farjoun, 2010; Sheep et al., 2017), we conceptualize technology renewal as a specific type of paradoxical digital transformation process that triggers related tensions (Cyert & March, 1963; Sabherwal & Newman, 2003) at specific junctures and make them salient to organizational actors (Hargrave & Van de Ven, 2017), which in turn provokes organizational responses. In what follows, we draw on the extant literature on IT-related change to conceptualize three tensions related to the paradoxical nature of technology renewal, and, to further advance our theorizing, we investigate how these paradoxical tensions manifested at HealthOrg, how actors responded to the manifestations, and how those responses impacted the renewal initiative.

### 2.1 | Tension between established and renewed technology usage

Because it replaces the digital platforms and infrastructures that organizations rely on for day-to-day operations, technology renewal involves changing not only technologies but also, and more importantly, their use. Implementing complex technologies inevitably impacts organizational structures, processes and cultures (Fichman & Kemerer, 1997; Gregory et al., 2015; Lyytinen & Damsgaard, 2001; Robey, Ross, & Boudreau, 2002); as a result, it may be thwarted by user resistance fuelled by a desire to continue using familiar structures and technologies (Polites & Karahanna, 2012). Knowledge barriers can also make implementing new technology difficult (Attewell, 1992), and users may address such barriers by constructing workarounds (Alter, 2014; Azad & King, 2008; Gasser, 1986), devising shadow systems (Behrens, 2009; Furstenau, Rothe, & Sandner, 2017; Strong & Volkoff, 2004), and engaging in reinvention (Boudreau & Robey, 2005) to preserve established use patterns. Polites and Karahanna (2012) further note that user resistance may continue despite their perception of a new technology's relative advantages, expressing a status quo bias in which they "disproportionally make decisions to continue an incumbent course of action, rather than switching to a new (potentially superior) course of action" (Polites & Karahanna, 2012, p. 23). User resistance may also arise due to a perception of high switching costs (Kim & Kankanhalli, 2009) and to the inertia generated by the installed base in digital infrastructures (Hanseth & Lyytinen, 2010). Such observations emphasize how existing technology use may adversely affect implementation of complex networked technologies, such as digital platforms and infrastructures (Gregory et al., 2015; Lyytinen & Damsgaard, 2001). Given the technology renewal paradox, we, therefore, expect an amplification of tensions between the established use patterns of existing technologies and the emerging requirements related to using new technologies across individual, group and organizational levels.

 $\perp$ Wiley-

202

### 2.2 | Tension between deliberate and emergent renewal practices

Enterprise systems research has shown that implementing digital platforms requires organizations to simultaneously redesign technology, structures, processes and skills (Robey et al., 2002). Consequently, these implementations are associated with long-term commitments and large economic costs; both factors make the implementations prone to failure and also make trajectories difficult to reverse once the projects are initiated (Barker & Frolick, 2003). Similarly, research has demonstrated that implementing new technology is often a slow and painful process (Lyytinen & Damsgaard, 2001; Wessel et al., 2020). Furthermore, because the technologies are subject to interpretive flexibility, the requisite intertwining of technologies with human agency and use contexts produces unpredictable discrepancies between intended and actual practices (Orlikowski, 1992). Successfully implementing complex digital technologies, therefore, requires dedicated implementation strategies, top management support and clear communication channels (Nah & Delgado, 2006). Managers are further advised to assume leadership of change by "orchestrating and coordinating the efforts of multiple change leaders throughout the organization" to effectively facilitate employees' behavioural change (Martin & Hug, 2007, p. 136). While undoubtedly important, such deliberate leadership must contend with and adapt to strongly confounding factors as organizational actors engage in local innovation, opportunistic structural shifts and emergent improvisations in response to unanticipated events (McGann & Lyytinen, 2005; Orlikowski, 1996, 2000). In a similar vein, researchers have argued that organizational changes do not always follow rational models based on clear goals, strategies and stable configurations of participants (Eisenhardt & Zbaracki, 1992; Gregory et al., 2015); instead, many organizations may follow ambiguous processes characterized by fluid participation, problematic preferences and unclear digital technology (Cohen, March, & Olsen, 1972). We draw on these insights to posit that technology renewal fosters tensions between deliberate and emergent renewal practices as actors engage to support or resist organizational efforts to replace existing digital platforms and infrastructures with new ones.

### 2.3 | Tension between inner and outer renewal contexts

Research on implementing complex technologies demonstrates that external pressures can also shape agendas and motives for technological change (Liang et al., 2007; Teo, Wei, & Benbasat, 2003). Among these external pressures are technology standardizations (Lyytinen & King, 2006), digital platform ecosystems (Rolland et al., 2018), governmental mandates (Brown, Massey, Montoya-Weiss, & Burkman, 2002) and managerial fashions (Wang, 2010). At the same time, organizations are permeated by internal conflicts between organizational entities and levels (Bacharach, Bamberger, & Sonnenstuhl, 1996; Gregory et al., 2015), within which situated agendas and cultures may flourish, establishing their own rationales, practices and implications for technology renewal (Hoffman & Klepper, 2000). Such internal cultures may be at odds with external renewal agendas for rationalization and standardization (Hanseth, Jacucci, Grisot, & Aanestad, 2006). We, therefore, submit that the technology renewal paradox fosters tensions between inner and outer contexts, where inner contexts incorporate the culture of an organizational entity (including social norms, strategic objectives and management structures), while outer contexts incorporate the environment that the organization operates in (including social, competitive, economic and political factors) (Pettigrew, 1987).

As Table 1 summarizes, we have identified and conceptualized three distinct yet related tensions pertaining to technology renewal as a paradoxical digital transformation process. We base these tensions on our review of a broad range of extant research on IT-related change. The bulk of the reviewed literature addresses implementation of new technologies into organizations outside the context of renewal initiatives. So, while the insights still apply, we posit that technology renewal adds further complexity because it replaces an organization's *foundational* technologies, thus creating unavoidable functional and operational overlaps between legacy and new technologies. As foundational technologies are business critical, replacing them involves making sure that organizational processes and functions can continue to operate even if the new foundational technology would falter during its early stages. Furthermore, the identified tensions represent composite meta-level concepts that cannot be observed empirically.

Tension	Definition	References
Established vs renewed technology usage	Technology renewal involves tensions between established use patterns of existing technologies and emerging requirements about the use of new technologies across individual, group and organizational levels.	Fichman and Kemerer (1997) Lyytinen and Damsgaard (2001) Robey et al. (2002) Kim and Kankanhalli (2009) Hanseth and Lyytinen (2010) Polites and Karahanna (2012)
Deliberate vs emergent renewal practices	Technology renewal involves tensions between deliberate and emergent practices as actors engage to support or resist efforts to replace existing technologies with new technologies.	Eisenhardt and Zbaracki, 1992) Orlikowski (1992, 1996) Barker and Frolick (2003) McGann and Lyytinen (2005) Orlikowski (1996, 2000) Nah and Delgado (2006) Martin and Huq (2007)
Inner vs outer renewal contexts	Technology renewal involves tensions between the inner contexts of social norms, strategic objectives and management structures, and the outer contexts of social, competitive, economic and political factors.	Teo et al. (2003) Liang et al. (2007) Bacharach et al. (1996) Hoffman and Klepper (2000) Hanseth et al. (2006) Pettigrew (1987)

TABLE 1 Tensions related to the paradoxical nature of technology renewal

Instead, the tensions typically manifest in different situations during the renewal initiative, wherein specific organizational conditions and perceptions render them salient and provoke organizational responses. As such, we posit that it is possible to reveal the generative structure of how and why paradoxical tensions affect the trajectory of renewal initiatives by empirically identifying and analysing how the tensions manifest and how the resulting organizational responses impact the existing course of action.

### 3 | RESEARCH APPROACH

Qualitative research aims to develop in-depth understandings of the phenomena (Garcia & Quek, 1997) by using qualitative data rather than metrics of quantity, amount, intensity or frequency to investigate processes and meanings (Denzin & Lincoln, 1994). Such an approach maps well with our main objective to understand how and why paradoxical tensions affect the trajectory of initiatives to renew an organization's foundational digital technology. Given access to rich data about a failing renewal initiative, we adopted an exploratory qualitative case study design for three specific reasons: We wanted to understand a contemporary phenomenon in a real-life context; we had little to no control over the observed events; and we were interested in how and why the focal process emerged and unfolded as it did (Yin, 2013). Although qualitative case studies have limitations, they do not necessarily lead to merely idiosyncratic explanations. In addition to detailing specific implications and contributing rich insights (Walsham, 1995, 2006), case studies are appropriate instruments for advancing theory (Eisenhardt, 1989) as they may serve as the basis for analytic generalization to develop new concepts and theory (Lee & Baskerville, 2003; Yin, 2013). Moreover, case studies are particularly suitable for investigating processes (Langley, 1999), which fits well with the core interest of our study.

### 3.1 | Data collection

We collected data through two engagements and two follow-ups (Van de Ven, 2007) with HealthOrg. The first engagement took place from August 2005 to May 2006, the second engagement from May 2009 to December

WII FY.

### WILEY-

### TABLE 2 Data sources

Data source	Description
Interviews	We conducted nine interviews from August 2005 to May 2006 and 14 interviews from May to December 2009. Each interview lasted 30 to 130 min, and we recorded and transcribed all interviews. All interviews were conducted in Swedish.
Documents	We had access to a vast number of documents on relevant HealthOrg projects, requirements and specifications related to the new digital platform; notes from project meetings; technical specifications of systems and platforms; internal reports; public e-mails; and formal decisions, plans and strategies.
Site visits	We watched demonstrations of each digital platform in action and observed related work practices on three occasions, each lasting between 30 and 120 min.
Qualitative electronic survey	During the first data collection period, we surveyed 148 users with access to both of the digital platforms. We used the web-based survey tool, Questio, and 88 users completed the survey. The survey questions covered issues specifically related to the new platform, such as reasons for use or non-use, perceptions of the platform, frequency of use, and knowledge about who had initiated the implementation process. The survey mostly requested free text answers.
E-mail, phone and informal meetings	We maintained complete records of all e-mails, notes from phone conversations and notes from meetings with members of the organization.
Workshops	We conducted two workshops to present and discuss our research with HealthOrg representatives.
Internal survey	We had access to data obtained from an internal survey aimed at investigating technologies related to document and information management.

2009, and the two follow-ups in 2011 and 2020.<sup>1</sup> During the first engagement, we used an exploratory approach grounded in problems related to the new digital platform as perceived by actors at HealthOrg Headquarters. Our second engagement was more focused and comprehensive, explicitly targeting the continued use of the two over-lapping and largely incompatible digital platforms. Our understanding of how the tensions stemming from technology renewal's paradoxical nature affected the trajectory of the HealthOrg renewal initiative thus developed over several years. To facilitate triangulation, we acquired data from different sources as a way to develop "converging lines of inquiry" (Yin, 2013, p. 120) and corroborate evidence of tensions and consequential responses.<sup>2</sup> Although our primary data sources consisted of interviews and documents, we also used several other sources, including a qualitative survey (see Table 2).

All interviews were semi-structured, open-ended and relied on interview protocols (Kvale, 1997) to ensure a systematic data collection approach (Patton, 2002). For the first engagement, we developed two protocols: One for managers who oversaw the new digital platform's acquisition and implementation, and one for other Headquarters' employees. For the second engagement, we focused on the on-going use of two competing platforms in relation to HealthOrg management, Headquarters employees, and IT department staff. The first author conducted all interviews and tape-recorded, transcribed, and supplemented them with notes taken during the interviews. The selection of interviewees for the two engagements differed to some extent. In the first engagement, a project manager for the new platform helped us select respondents, supplying us with an extensive list of Headquarters employees. From this list, we chose interviewees from each Headquarters department. Given time constraints and the fact that some employees were unable or unwilling to schedule a meeting, we interviewed employees from only five of the seven departments, along with two project managers, in the first engagement. In the second engagement, we attempted to interview all individuals included in the first engagement, as well as representatives from the management board and IT department. However, as Table 3 shows, two interviewees from the first engagements.

#### TABLE 3 Interviewees

Role in the organization	Department	Number of interviews
Project manager 1 (later became manager of the new platform)	Secretariat	3
Project manager 2 (later became IT strategist)	IT department	2
Staff employee	Organizational management	2
Staff employee	Organizational management	2
Staff employee	Secretariat	2
Economist	Finance	1
Staff employee	Secretariat	2
Staff employee	Growth and regional development	1
Staff employee	Secretariat	2
Staff employee	Information	2
IT strategist	Organizational management	1
Head of the IT strategy group (and member of the management board)	Management board	1
Head of the IT department	IT department	1
Manager of legacy platforms	IT department	1
		Total: 23

Having unlimited access to documents helped us develop a broad contextual frame of reference for interpreting interview statements. For the second engagement, we also drew on an internal survey and extensive data from a qualitative survey we conducted during the first engagement. Although case studies typically do not include surveys (Yin, 2013), our qualitative survey provided a broad range of data on use and non-use of the two competing platforms, as well as the respondents' perceptions of the renewal initiative. Most survey questions were open-ended, and we distributed the survey electronically to all Headquarters' employees who had access to both platforms. Finally, the first author confirmed our findings by presenting and discussing our empirical analyses with HealthOrg representatives in two separate workshops and through a final report that we provided to the organization.

### 3.2 | Data analysis

In qualitative process research, time provides a fundamental anchor in explaining why and how event sequences are structured and lead to certain outcomes, such as virtuous and vicious cycles of change (Langley, 2007; Pettigrew, 1992; Van de Ven, 2007). However, the empirical material that is subjected to process analysis is frequently limited to representing what Pentland (1999) refers to as *surface structures*. Such structures are represented by how the interviewed actors and other data sources order the issues, experiences and stories in time. Thus, Pentland (1999, p. 722) argues that *"to describe a process, one needs event sequences. But to explain a process, one needs to identify the generative structures that enable and constrain it."* In a similar vein, Van de Ven and Poole (1995) stress the importance of moving beyond merely sequencing empirically observed events, arguing that process analysis should strive to uncover the generative mechanisms that, based on manifestation of deep structures at particular junctures, drive focal processes. Thus, based on extant research, we adopted a paradoxical perspective as our analytical framing with a priori and theoretically driven assumptions about both the technological renewal's paradoxical tensions (Table 1) and how the dynamics of renewal trajectories may be empirically revealed and subsequently theorized. In the following, we describe the three consequential steps through which we analysed and theorized the rich data.

WILEY

In the first step, we coded the empirical material. To do this, we conducted what Pentland (1999) refers to as descriptive surface structure coding to capture and categorize significant issues, decisions, activities and statements, along with the time at which they occurred. We also applied temporal bracketing (Langley, 1999) to identify and explicate evidence of experienced tensions. We thus considered critical junctures in the temporal data as shifts in dominant tensions. To identify these tensions, we followed Cho, Mathiassen, and Robey (2007), focusing on observed conflicts (Bjerknes, 1991), specific interests, cultural assumptions and institutionalized values (Robey et al., 2002; Robey & Boudreau, 1999), as well as conflicts between different organizational units and levels (Bacharach et al., 1996). Through this process, we identified conflicting requirements to technology, conflicting approaches to change and opposing forces related to different contexts. We initially identified 16 tensions; we then compared and contrasted them to identify similarities and potential overlaps. This resulted in a final explication of six tensions that dominated and shaped the trajectory of HealthOrg's renewal initiative. Thus, although organizational change initiatives inevitably entail a multitude of micro-level activities, conflicts and tensions, our analytical efforts resulted in an aggregated view that revealed six tensions that were crucial in shaping the process. We categorized each tension in terms of the three paradoxical tensions in Table 1. We then mapped out the timeframe during which each tension was in play, identified the associated organizational responses, and traced the impacts of the responses on the overall renewal trajectory. Finally, we framed the duration of each tension as a stage in the overall technological renewal process.

In the second step, we created a process narrative of the technological renewal initiative and how it unfolded within HealthOrg. In addition to explicating the process dynamics within each initiative stage, this approach revealed how the organizational responses at each stage triggered subsequent tensions. This, in turn, illuminated the interplay between tensions and responses as a generative mechanism that, based on manifestations of paradoxical tensions, drove the renewal trajectory over the observed 9-year period. In accordance with Pentland's (1999) recommendations for process narratives, we included (a) a sequence of stages over time; (b) focal actors within HealthOrg; (c) a narrative voice; (d) a clear frame of reference to the impacts of tensions and responses; and (e) other relevant content and context indicators.

Our third and final step combined the empirical account (Table 4) with our upfront conceptualization (Table 1). This allowed us to further theorize the generative mechanisms that drove the change trajectory at HealthOrg Headquarters, as we describe in the "Theory Development" section below and summarize in Table 6. IS theories vary considerably in scope, level of generalization and degree of causality (Gregor, 2006). We focused on mid-range theorizing, as our ambition was to develop a clearly delineated theory of *"bounded relevance and validity"* (Avgerou, 2013, p. 401) that could explain how and why paradoxical tensions affect the trajectory of a technology renewal initiative. To this end, mid-range theory integrates general theory and empirical observations (Merton, 1967), and involves a limited and clearly delineated scope, moderate levels of abstraction and statements related to the particular phenomenon under investigation (Gregor, 2006).

### 4 | TECHNOLOGY RENEWAL AT HEALTHORG

As a large public health care organization with roughly 9000 employees, HealthOrg is governed by politically elected committees and a board of directors, with multiple, distributed clinics that provide health care services and a Headquarters office. Our study focuses on the Headquarters, which supports HealthOrg through its 270 employees in seven departments: secretariat; research, development and education; growth and regional development; management; information; finance; and human resources. Although these departments have various responsibilities, they are all concerned with information production, distribution, access and management. Thus, Headquarters produces and manages a large volume of physical documents and digital information. In 2000, for example, Headquarters' employees produced nearly 400 000 physical copies of various documents and processed information associated with more than 16 000 cases, each of which was defined by a group of related tasks and associated documentation, including economic reports, investigations to support decision-makers and contracts with medical equipment suppliers.<sup>3</sup> Each case typically requires individuals and groups from several departments to cooperate over extended

Stage	Paradoxical tension	Manifestation of tension	Organizational response	Renewal impact
November 2002 to March 2004	Between inner and outer renewal contexts	Inner renewal context: Recognition of existing information management problems, and maintenance of local practices Outer renewal context: Governmental mandate to standardize information management	Board decision to acquire new ECM platform for information management to solve information management problems	Additional digital platform implemented but without explicit articulation of legacy platform's future
April 2004 to February 2006	Between established and renewed technology usage	Established technology usage: The legacy platform met requirements of most employees and departments Renewed technology usage: The new platform afforded information creation and sharing across departments	Secretariat decision to investigate how to ensure that information is created and shared effectively across departments	Co-existence of two diverging user communities with overlapping functionality and partially competing platforms
March 2006 to December 2006	Between deliberate and emergent renewal practices	Emergent renewal practice: Widespread behaviour as if new platform was dedicated to recordkeeping within secretariat Deliberate renewal practice: Secretariat promoted new platform as information management solution for all departments	Board decision to mandate use of new platform without any follow- up procedures to ensure that the mandate was respected	Polarized perspectives on and approaches to the new platform persist
January 2007 to December 2007	Between established and renewed technology usage	Established technology usage: Users had to maintain collaboration with other users who relied on legacy platform Renewed technology usage: Users had to follow general workflow based on new platform	Secretariat sponsored strengthening of new platform by exploiting its capabilities to develop applications	Strengthened strategic position of new platform without resolving workflow issues
January 2008 to June 2009	Between inner and outer renewal contexts	Inner renewal contexts: Interests in supporting idiosyncratic practices within departments Outer renewal context: Increasing push to improve information creation and sharing across the organization	IT department implemented new version of legacy platform, including functions for chat and project management	Increased overlap between capabilities of new and legacy platforms
July 2009 to October 2011	Between deliberate and emergent renewal practices	Emergent renewal practice: Increasing realization of need to coordinate management	Board launched investigation of information	Headquarters continuing to rely on multiple

### TABLE 4 Tensions, responses and impacts in technology renewal at HealthOrg

WILEY

(Continues)

### TABLE 4 (Continued)

⊥WILEY-

Stage	Paradoxical tension	Manifestation of tension	Organizational response	Renewal impact
		of information and technology Deliberate renewal practice: Maintaining disconnected management of information and technology	management practices	overlapping platforms and disconnected management practices

periods of time. Furthermore, as a public service provider, HealthOrg is subject to governmental requirements for formal record-keeping of all case materials, including documents, images and e-mails. If information is lost, the management of that specific process will fail, or fall behind, affecting Headquarters' overall performance and the treatment of specific patients. Headquarters, therefore, expends considerable resources on checking information accuracy, ensuring effective work processes, keeping records of all decisions and minimizing errors.

In early 2000, the secretariat staff raised concerns about the efficiency of information management within Headquarters, where staff members were charged with ensuring that documents were delivered to their intended destination in the correct format and followed the rules for formal record-keeping in public organizations. However, information frequently went missing and was difficult, and sometimes impossible, to find. This problem coincided with a national governmental decree to improve and restructure all public services through digital transformation. Based on a request from the head of the secretariat, HealthOrg's management board formed a team to analyse the viability of the organization's current information management practices. The existing legacy platform, Alpha, had wide-ranging functionality, including a database-driven client-server system with e-mail management, shared virtual document folders, threaded discussions and application development capability. Nonetheless, in 2001, the team presented a report that concluded Alpha lacked the functions needed to efficiently support Headquarters' core activities. Furthermore, in June 2002, representatives from several departments published a second report that revealed staff members often managed information using idiosyncratic routines and software installed on their personal computers rather than following a standardized approach. Although Alpha was accessible to all Headquarters' employees, the report concluded it had grown to incorporate numerous applications and solutions; therefore, from an overarching efficiency perspective, Alpha provided inadequate standardization support. The report thus recommended initiation of a technology renewal initiative. In response, the management board tasked a team with producing detailed requirements for a new digital platform. The team worked swiftly and published an extensive report in October 2002, setting the stage for technology renewal at HealthOrg Headquarters.

We now present a detailed process narrative of how, over a 9-year period, Headquarters was confronted with a string of salient tensions each of which provoked an organizational response, which, in turn, impacted the renewal initiative's trajectory and triggered the manifestation of additional tensions (see Table 4). As such, this narrative reveals both how salient tensions manifested as expressions of the paradoxical tensions and how the dynamic interplay between tensions and organizational responses impacted the initiative trajectory. We conclude the empirical account with follow-up information about the evolution of digital platform usage at HealthOrg a decade later, in June 2020.

### 4.1 | A new platform (November 2002-March 2004)

The three internal reports leading up to initiation of technology renewal reinforced the recognition of a problematic Headquarters situation and also revealed a strong preference among staff members to maintain local information

### WILEY 209

management practices. At the same time, HealthOrg faced extensive and increasing requirements for public organizations mandated by governmental legislation. As a result, during the first stage, there was a tension between *inner renewal contexts* at Headquarters, where problems in current information management practices were recognized. There was also a desire to accommodate specific practices in various departments, and *outer renewal contexts*, which included the government directive to improve, restructure and standardize digitalized services across all departments. Among other mandates, that directive required HealthOrg to differentiate public information from private information, enable access to public information, protect personal integrity, maintain transparency and increase digital services. Proponents within Headquarters expressed these externally generated requirements in an internal report as follows:

"Information that is no longer needed when a specific task is finished should be identifiable and possible to remove; information should be stored in a system-independent fashion and in a standardized format; information should be stored in a secure medium; information should be searchable and include several options for search; and information should be available electronically."

Proponents also believed that standardizing information creation, storage and distribution across HealthOrg could improve work process efficiency and quality to remedy issues with critical information getting lost, deadlines being missed and information being inaccessible to relevant actors. Accordingly, the requirements specification concluded the following:

"Our investigation of requirements shows there is a need for ... a simplified distribution of information, an increased scope for locating information, and improved capabilities for controlling and defining the scope of projects and tasks."

Although the secretariat championed the standardization of information management across the organization through technology renewal, there were other conflicting needs. For instance, to sustain efficiency at the department and individual levels. In fact, Headquarters had previously promoted the development of strong inner contexts and information management cultures aimed at improving the management of specific tasks. Thus, individuals and departments had become dependent on customized support of their idiosyncratic needs, and the externally driven standardization conflicted with existing practices and traditions within Headquarters. So, while the secretariat embraced a standardized approach, most other staff members adopted a bounded departmental perspective, largely ignoring the demands for better record-keeping and inter-departmental coordination. The project manager from the secretariat commented:

"Internally, things are not strictly controlled. If you receive an assignment and are expected to present the results six months later, the way you produce the results is basically your own choice."

In this context, initiating a renewal initiative was an attempt to address this tension through a considerable investment in *Beta*, a comprehensive ECM platform. Beta was implemented in spring 2004, with extensive user training to facilitate assimilation. The platform was chosen because it focused on efficiency through increased standardization and, like Alpha, it also had generic capabilities to function as a development platform to cater to specific needs as necessary. It was, therefore, positioned as a viable and capable long-term alternative. Although Alpha was the legacy platform, IT managed it, while Beta was managed by the secretariat because of its responsibilities for record-keeping and process management. However, Beta was rolled-out without clearly communicating how it related to Alpha, which was the backbone of day-to-day Headquarters' operations. Alpha thus continued to function as the organization's main digital platform. Headquarters had attempted to decisively and constructively address diverging needs and requirements stemming from both within and outside the organization. Thus, the chosen

approach was built on the expectation that staff members would gradually transition to the new platform because the legacy platform was deeply ingrained in the organization and involved a multitude of specific applications catering for specific needs. Thus, the gradual transition was deemed as the most pragmatic and viable way forward in order to maintain efficiency while simultaneously moving to the new platform.

### 4.2 | Diverging user communities (April 2004-February 2006)

Although the goal was to solve Headquarters' pressing information management problems, implementing Beta without clearly articulating Alpha's future quickly created divergent user communities with different requirements and patterns of information management. Unsurprisingly, some individuals and units began transitioning to Beta, but others did not. This situation rapidly fuelled a tension between the *established technology usage* within most departments supported by Alpha and the *renewed technology usage* focused on information creation and sharing across all departments supported by Beta.

As the Headquarters' technological backbone, Alpha's base functionality had been extended to include more than 80 specific applications. Inter-departmental coordination was principally supported by Alpha's e-mail and intranet capabilities, and nearly all staff accessed the platform daily in one way or another. Thus, over time, HealthOrg had leveraged Alpha's platform capabilities to meet specific individual and department requirements. The Alpha manager offered a glimpse at the customization process:

"I help them by setting up the database, and they administrate it themselves. They can, for example, add calendars where they post things that will happen this week. So these types of document and project databases, they control themselves."

For its part, Beta was a highly adaptable, process-controlled ECM platform with elaborate functionalities for record-keeping, document management and process support; it also included administration and advanced search capabilities. Thus, if widely adopted, Beta was capable of serving as a common digital platform and providing better support than Alpha.

Concerns about information ownership also contributed to the tension between established and renewed technology usage. As a staff member from the department for regional growth and development noted, having a vast array of tasks and processes that depended on individual skills generated a culture that promoted personal or departmental information ownership:

"I deal with sensitive information and sensitive tasks. I only store information on my own computer since I feel insecure about who can access information if I store it on some platform."

Given this culture, staff in many departments apart from the secretariat considered the information they produced to be their own property, and they used specific Alpha databases or personal computers to store and retrieve it. One of the reasons for implementing the Beta platform was to foster a culture in which knowledge and information were shared to make work processes transparent, efficient and compliant with governmental regulations. As the Beta manager put it:

"We must make information less dependent on individuals ... so we can participate in others' work processes, in terms of access to both documents and processes."

Although the Beta champions continuously stressed these issues, the management board remained passive and the secretariat staff had insufficient power to effectively promote platform usage. Consequently, in August 2005,

more than 18 months after the technology renewal initiative started, the original information management problems persisted. Although the secretariat had completed its internal transition to the new platform, many other departments and staff still relied on the legacy platform for their operations. Thus, only some information was sent to the secretariat through Beta while other information was delivered via Alpha's e-mail or on paper. One secretariat staff member commented:

"We would gain considerably if people used Beta when they have things that need to go through us. We have such short deadlines, so we are highly dependent on people doing this. We try everything from asking nicely to threatening to get people to use it."

Faced with increasingly conflicting use patterns, the emergence of two distinct user communities and having insufficient power to directly change the status quo, in August 2005, the secretariat initiated a collaborative research project with the local university to analyse problems and propose potential remedies. The research project lasted 7 months, during which time Headquarters continued to accommodate the two diverging user communities based on functionally overlapping and partially competing digital platforms.

### 4.3 | Ambiguous management mandate (March-December 2006)

During March and April 2006, the university researchers shared their findings in two workshops with representatives of the secretariat, the management board and the IT strategy group. Briefly, their findings were that: Beta's purpose was unclear to many employees; Beta (unsurprisingly) duplicated the functionality of several existing but incompatible technologies, especially Alpha; and it was generally impossible to exchange information between Alpha and Beta. Thus, the researchers concluded that the original information management problems had been exacerbated. These findings clearly showed that Headquarters faced a tension between *emergent renewal practices*, in which staff increasingly behaved as if Beta was dedicated to a subset of distinct activities involving record-keeping within the secretariat, and *deliberate renewal practices*, in which the secretariat continued to promote Beta as the new foundational digital platform for all departments.

These practices represented conflicting ideas about Beta and its role within Headquarters. However, the emergent renewal practices were rarely explicitly supported. Instead, they reflected widespread uncertainty about how and for what purposes to use Beta, which adversely impacted platform adoption. As one staff member commented:

"I'm not really sure. It's a platform that I've only been in contact with a few times ... but what type of platform it is? Well, I don't really know."

In contrast, the deliberate renewal practices were typically related to the governmental mandate and well explicated. For example, the report presented to the management board in October 2002 stated that the new platform should support information management beyond the secretariat:

"It is of great importance that a future task and document management system supports the entire organization and not only specific parts of document management and work processes."

Similarly, the team implementing Beta sent an internal memo to the management board that stated:

"The system should be shared by the whole of HealthOrg ... and it should be clear that implementing it will require changes to existing routines and ways of conducting work."

The management board recognized that it needed to take action; it responded in early August 2006 by mandating the use of Beta for all information subject to record-keeping within Headquarters, which, in practice, involved most of the information produced within the organization. The decision was communicated to all staff in a written memo that clarified the distinct roles of the two platforms, and also explained the long-term strategy: A complete transition to Beta, and a gradual dismantling of Alpha. The management mandate was nonetheless ambiguous and failed to specify follow-up procedures to enforce it. As a result, the polarized perceptions of, and approaches to, the new digital platform persisted.

### 4.4 | Strengthening the new platform (January-December 2007)

By January 2007, user adoption of Beta had increased but, in the absence of formal follow-up procedures, most staff members still relied on Alpha. Headquarters staff, therefore, experienced a tension between *established technology usage* to maintain collaboration with users who relied on the legacy platform and *renewed technology usage* to follow the workflow based on the new platform. Although Alpha and Beta overlapped functionally and users could perform similar tasks on both platforms, there were fundamental differences in how the platforms modelled and managed workflows. One board member recalled:

"I remember the first time I was confronted with Beta and realized that we have implemented a system that gives me a completely new and unwanted role in the organization ... For example, in Beta, I alone receive information that should and previously did go directly to our operations managers. But since I'm ultimately responsible for some parts of our work, the workflow in Beta is designed to deliver that information to me instead of them. This bypasses our existing workflows and makes things more complicated."

While Beta included pre-configured roles to improve the efficiency of internal workflows, the Beta and Alpha mapping between roles and information flows radically differed. Moreover, because only some staff members had transitioned to Beta, workflow issues impacted both inter-departmental and intra-departmental coordination. As one staff member said:

"Internally, some of us have changed to Beta for some tasks, but others refuse, and we have no common agreement within the department to change all operations. It causes a lot of problems in how we work with each other."

Other staff members voiced concerns regarding the reliability of the new workflows, as one information department staff member noted:

"The other day, I received a notice to attend a meeting. It was sent to me in Beta, but it was also sent by e-mail in Alpha and distributed on paper simply because of the uncertainty present in the organization related to how we share information."

Thus, requests to resolve workflow issues not only came from the secretariat, which had invested heavily in transitioning to Beta, but also from other staff members who now relied on the new digital platform. Because the management board remained passive in the face of this tension, Beta champions resorted to relying on informal and incremental strategies to increase its usage. The Beta manager argued:

"We really try our best to pitch Beta to users and to be accommodating. We try to focus on some important groups of people because, if we can get them to use it, that will generate ripple effects."

Realizing that such strategies had limited impact on user adoption, the Beta manager decided to develop and release a new application for the key activity of exception management:

"We have just launched an application for exception management based on Beta. We chose to rename this new application so that it would not be called Beta and the interesting thing is that we have a high level of usage. I don't think people realize they are in fact using Beta."

The application quickly became widely used and, therefore, strengthened Beta's overall strategic position. However, this organizational response did not address the tension between the traditional technology usage and the renewed technology usage based on Beta, nor did it alter the trajectory of relying on multiple overlapping digital platforms.

### 4.5 | Upgrading the legacy platform (January 2008-June 2009)

During spring 2008, the slow but steady increase in Beta adoption continued. There was now widespread recognition within Headquarters that the simultaneous use of two platforms caused unsustainable inefficiencies in information management. Specifically, staff became increasingly aware of the tension between *inner renewal contexts*, where there was strong desire to continue idiosyncratic practices within departments, and *outer renewal contexts*, with increasing pressure to improve and standardize information creation and sharing across the organization.

The overall situation had turned critical as staff members who had transitioned to Beta no longer wanted to rely on Alpha to access information sent to them, and staff members who had not transitioned to Beta were unable to access information sent to them via Beta. Thus, the adverse impacts of using two platforms were widely known and several memos voiced discontent to platform managers and the board. The Beta manager said:

"We can do similar things in Alpha and Beta, so when someone is about to launch a project, the solution they use depends on tradition: who is more flexible, or who they happen to know ... It's not a good situation because we put our energy in two different places and just continue to develop."

The IT department also recognized the problematic situation, as the department head noted:

"Alpha is first and foremost a development platform on which you build applications, but you can also build applications on the Beta platform. They are slightly different, but we have applications that could be built in either ... In terms of functionality, the two platforms do things in very different ways, but they achieve the same thing."

Beta's growing momentum and the continued use of Alpha simultaneously reinforced interest in supporting local practices and in improving information sharing and coordination in day-to-day practices. While HealthOrg's management was unable to respond to the tension, other actors attempted to shift the balance. By this time, manufacturer support for Alpha's current version was phased out; the Beta manager, therefore, argued for full transition to the new platform. However, the IT department, which was slow to accept Beta as the new, overarching digital platform and had already invested heavily in Alpha, instead rolled out a new Alpha version in June 2009 with additional functionality for sending and receiving instant messages. As this staff member's comment exemplifies, the feature was well received:

"The new chat function is really great. You don't have to write a complete e-mail, instead if I see a green light next to that person, I can simply send a short direct message to ask for a clarification about a document or something."

The new version also included functionality for project coordination, which was well addressed by Beta. While this organizational response removed the uncertainty related to Alpha's future within Headquarters, it did nothing to change the underlying tensions. Instead, it further propelled the failing course of action by deepening the original problems and further increasing the functional overlap between the two platforms.

### 4.6 | Disconnected management practices (July 2009-October 2011)

The management board was aware of the pressing information management problems, but it decided not to interfere with the new Alpha version roll-out as it was considered a technology decision that the IT strategy group should manage. The head of the IT strategy group found this approach problematic:

"The fact that we're responsible for IT doesn't necessarily mean that we own all core processes, and this is where things are unclear."

Thus, from the IT strategy group's perspective, decisions regarding the production, storage, distribution and access of information were beyond the technologists' remit. As the head of the group put it: Someone else should assume responsibility for such strategic issues. Thus, following implementation of the new Alpha version, a tension emerged between *emergent renewal practices* that focused on coordination to manage information and technology, and *deliberate renewal practices* that continued to rely on management of information and technology as separate activities.

In September 2009, the IT strategy group responded to this tension by initiating a broad analysis of information management within the wider context of HealthOrg's healthcare and medical units to investigate whether other divisions in the organization faced similar issues. Based on data from a survey distributed to all HealthOrg units, the report stated:

"The investigation has revealed obvious flaws related to quality and efficiency along with a lack of common routines and guidelines ... A problematic situation is that several different solutions are used for one and the same purpose."

The team had identified several functionally overlapping platforms and applications across HealthOrg's healthcare and medical units, including document management systems, shared folders, databases and operating systems, along with Alpha's e-mail capabilities. Thus, the overall situation was similar to that unfolding within Headquarters. The report added:

"To improve the situation, a central information management policy should be formulated to serve as a foundation for future activity of this kind."

However, beyond the investigation, no explicit responses addressed the tension. Instead, the IT strategy group continued to regard information management as an important and separate strategic issue, while the management board expected the IT strategy group to deal with it as part of its technology management strategy. As a result, Headquarters continued to rely on multiple, overlapping digital platforms, and the disconnected management strategies offered little hope that the resulting tensions would be effectively addressed.

In October 2011, nearly 9 years after it had decided to launch a technology renewal initiative to address pressing information management problems, HealthOrg was continuing its failing course of action, despite broad awareness of its negative impacts. Although the six identified tensions that played out during the initiative all triggered organizational responses, none of these responses were substantive enough to steer the renewal process towards completion. Instead, each of the responses triggered new tensions and responses that further reinforced the failing trajectory.

### 4.7 | Follow-up (June 2020)

A decade later, in June 2020, we conducted a follow-up interview with the main project manager, who at the time was still engaged with digital technology management at HealthOrg. The manager, who now worked within a new division focused on IT strategy, informed us that the Beta platform was still in use within Headquarters, albeit in a radically different way than originally envisioned. HealthOrg never succeeded to make a full transition to the new platform. Instead, only specific parts of its functionality focused on deviation management and management of highly sensitive information subject to record-keeping remained. Thus, the legacy platform had prevailed, and the technology renewal initiative was largely considered a failure that added rather than resolved complexity. Nevertheless, in 2018, history repeated itself when the IT department and the IT strategy group deemed the legacy platform out of date and in urgent need to be replaced. This realization was driven by staff at Headquarters, who once again had voiced concerns about the lack of adequate and modern digital capabilities to support their tasks. Interestingly, the manager pointed out that the previous experience with technology renewal had generated profound insights into the difficulties and complexities of replacing the digital core of the organization. The manager said:

"We have a greater understanding of the process ahead of us now. In fact, based on the past experiences, we have set and clearly communicated a timeframe of six years for the renewal initiative. That is, we expect the dismantling of the legacy platform and the full transition will take approximately six years to complete."

Thus, despite its previous failure, HealthOrg still relied on the idea of a gradual transition as the best approach to perform the renewal initiative. As the manager concluded:

"Believing that simply mandating and enforcing a switch to a new digital core will do the trick is a very naïve way of thinking. When you are dealing with large complex digital systems with multiple features that extend into all types of processes in the organization, it's unavoidable to have to keep them running for a period of time, otherwise operations will simply stop."

### 5 | THEORY DEVELOPMENT

In the digital era, organizations must periodically replace their core digital platforms and infrastructures to leverage technological developments and realize their strategic goals. We argue that such technology renewal is an understudied type of digital transformation that is of increasing theoretical and practical importance. To address this, we conceptualized technology renewal as a distinct and paradoxical form of digital transformation in which organizations must remove their technological foundation while simultaneously building on the practices that depend on it to implement a new technological foundation. To advance theory, we consolidated insights from a broad range of IS research streams into three paradoxical tensions in technology renewal (Table 1). Furthermore, we applied a paradoxical framing at HealthOrg, resulting in a detailed empirical account of how tensions manifested and organizational actors responded to them to affect the firm's technology renewal trajectory over the 9-year period, 2002-2011, and with a follow-up status a decade later in 2020. In the following, we leverage this qualitative case study to further advance our theorizing (Eisenhardt, 1989) through analytical generalizations that both build on existing concepts (Yin, 2013) and create new ones (Lee & Baskerville, 2003; Walsham, 1995). That is, we move from idiosyncratic insights into the paradoxical nature of technology renewal at HealthOrg to insights that apply to other, similar contexts (Mason, 2002). In this process, we address our research question (*how and why do paradoxical tensions affect the trajectory of initiatives to renew an organization's foundational digital technology*) by advancing a mid-range theory on how tensions manifest during technology renewal initiatives, how organizational actors respond to these manifestations and how these responses impact renewal trajectories.

### 5.1 | Manifestation of paradoxical tensions

Drawing on paradoxical thinking (Cyert & March, 1963; Hargrave & Van de Ven, 2017), we view the paradoxical tensions (Table 1) as meta-level concepts that organizational actors may experience as salient tensions at specific junctures of a technological renewal initiative (Smith & Lewis, 2011; Wareham et al., 2014). That is, when these tensions manifest in practice, they assume specific material characteristics that present organizational actors with conflicting choice opportunities (Farjoun, 2010; Gregory et al., 2015). In our analysis of HealthOrg's technology renewal, we drew on paradoxical thinking to reveal evidence of how the tensions manifested as empirically observable salient tensions during the six stages of technology renewal (Table 4).

The tension between *inner and outer renewal contexts* manifested during two stages of the renewal process. During the first stage, HealthOrg's highly idiosyncratic information management practices based on the legacy platform clashed with the governmental mandate to improve and restructure the organization's digitalized services; this clash was intensified by a lack of internal coordination and control. Our analysis of this manifestation demonstrates how internal structures, processes and cultures may be incongruent with each other (Hoffman & Klepper, 2000), and how external pressures, such as strategic moves by competitors, or governmental mandates (Brown et al., 2002), can shape transformation agendas in ways that clash with internal conditions (Gregory et al., 2015; Liang et al., 2007). Moreover, during stage five, this tension resurfaced, albeit in a different manifestation. During this stage, Headquarters found itself deeply reliant on two separate digital platforms to perform its business activities. As such, the tension manifested as conflicting strategic objectives; in isolation, the objectives made sense, but from an organizational perspective, they were clearly at odds with each other. These findings suggest that managers of technology renewal initiatives will likely face incongruences in structures, processes and cultures across different internal contexts, while they simultaneously must accommodate external technological, competitive and political forces.

During the HealthOrg renewal initiative's second and fourth stages, the tension between *established and renewed technology usage* manifested as ambiguous choices between two digital platforms. Technology renewal unavoidably involves functional and operational overlaps. In this case, during the second stage, the new platform, which emphasized information sharing and standardization, had been implemented, was fully functional, and attracted some HealthOrg staff and departments. Meanwhile, the legacy platform continued to operate and cater to the idiosyncratic needs of most HealthOrg units and individuals. Thus, HealthOrg found itself using two functionally overlapping and partially incompatible platforms. During stage four, the tension resurfaced as two distinct use patterns within the daily operations at Headquarters. Our analysis of these two manifestations emphasizes how foundational legacy technologies contribute to deeply ingrained structures (Fichman & Kemerer, 1997) and processes that are difficult to change (Polites & Karahanna, 2012; Robey et al., 2002; Wessel et al., 2020), even in the face of strategic attempts to use new technology to shift organizational trajectories. To address this, managers of technology renewal initiatives must move beyond HealthOrg's approach and provide compelling incentives and support to transform legacy structures and processes to suit the new technologies.

Finally, the tension between *deliberate and emergent renewal practices* manifested during stages three and six of HealthOrg's renewal initiative. During stage three, the new platform's internal champions pushed hard to promote a full transition to meet explicitly stated objectives and the governmental mandate. Their attempts to form and execute a broad, deliberate implementation strategy (Nah & Delgado, 2006) and gain top management support (Martin & Huq, 2007) nevertheless clashed with the widespread perception that the new platform was simply a

<sup>216</sup> WILEY-

specialized technology dedicated to record-keeping. Such misperceptions flourished at the micro-level within most organizational units, illustrating the challenges involved in managing socio-psychological barriers (Orlikowski, 1992) and unanticipated events (McGann & Lyytinen, 2005) during complex digital transformations. In a similar vein, this tension's manifestation in stage six involved an emerging realization of the need to coordinate the management of information and technology, whereas the deliberate renewal practices included a continued separation of concerns and responsibilities between different departments. Together, these insights highlight the need for organizational actors to recognize the existence of and manage situated perceptions, ambiguous processes and emergent improvisations as they pursue technology renewal through rationally driven agendas and approaches.

Because we developed the three paradoxical tensions theoretically, based on insights from different research streams, they may also manifest outside the technology renewal context—such as in the implementation of new applications, transformation of digital infrastructures and management of enterprise system platforms. However, as our empirical analysis shows, HealthOrg's renewal initiative was particularly challenging because combinations of salient tensions related to all three tensions arose across the initiative's six stages (Table 4). Our analysis further revealed that all manifestations of the tensions had important impacts on HealthOrg's renewal trajectory. These findings support our claim that technology renewal is a distinct and paradoxical digital transformation process that is driven by three mutually constituent paradoxical tensions (Farjoun, 2010).

### 5.2 | Organizational responses to paradoxical tensions

Paradox research (eg, Lewis, 2000; Lüsher & Lewis, 2008; Smith & Lewis, 2011) suggests that the effects of tensions depend on how organizations respond to them (Jarzabkowski & Lê, 2017), and that these responses may reinforce both positive and negative change cycles (Lewis, 2000; Smith & Lewis, 2011). For example, cognitive and behavioural forces tend to push for consistency (Cialdini, Trost, & Newsom, 1995), which can make organizational actors ignore a salient tension or engage to resolve it; similarly, organizational inertia in existing structures, processes and cultures (Gilbert, 2005; Gregory et al., 2015; Henderson & Clark, 1990) may cause actors to respond defensively and reluctantly, or challenge them to develop radical resolutions.

Furthermore, Smith and Lewis (2011) note that organizational actors may reject or avoid tensions, or accept and address them, by either integrating or splitting their opposite poles. Here, integrating entails deliberately accommodating both opposite poles, whereas in splitting, the actors actively choose between them (Smith & Lewis, 2011). To generalize the different responses during HealthOrg's technology renewal, we build on these concepts and also develop new ones. Table 5 summarizes the results of our theorization, generalizing the six organizational responses during HealthOrg's renewal initiative (Table 4) into four response types—integrating, splitting, pretending and avoiding.

In an *integrating* response, the organization accepts the tension it faces and addresses it by accommodating both poles (Smith & Lewis, 2011). During the first stage at HealthOrg, the decision to acquire a new ECM platform and simultaneously allow continued use of the legacy platform accommodated the conflicting requirements (ie, standard-ized vs customized approaches to information management). As such, management embraced a paradoxical situation, deliberately pursuing two parallel platform paths, while intending to gradually switch its operations to the new digital platform.

The *splitting* response is also resolution-oriented: the organization accepts a tension and addresses it by prioritizing one pole over the other. At HealthOrg, this response is illustrated in stage two, when the secretariat initiated a joint research project with the local university to develop knowledge about how to fully transition to the new digital platform. Although the response did not have an immediate effect, it was motivated by the recognition that having two distinct but overlapping digital platforms and user groups was unsustainable in the long term.

In the *pretending* response, the organization articulates a solution to a perceived tension without committing to consequential actions to realize that solution. As such, this response represents a form of window dressing. Stage

Response type	Response characteristic	Empirical manifestation
Integrating	The organization responds by accommodating the opposite poles of a tension	During stage one, the board responded to a tension between local information management practices and a governmental mandate to standardize information management. Their response integrated the two poles of the tension by investing in a new platform and envisioning a gradual shift towards its exclusive use. As such, the response accommodated requirements originating from the outer context through the new platform, while still catering to the requirements originating from the inner context through the legacy platform's continued use.
Splitting	The organization responds by choosing one pole of a tension	During stage two, the secretariat responded to a tension between established use of the legacy platform and the emerging use of the new platform. This response initiated an investigation aimed at clarifying how best to ensure that information was created and shared effectively across the departments. As such, the response stressed the need to complete the move to the new platform.
Pretending	The organization articulates a solution to a tension without committing to consequential actions	<ul> <li>During stage three, the board responded to a tension between an emergent and a deliberate renewal practice by mandating use of the new platform. However, the mandate was not enforced, and the board did not commit to consequential actions; in practice, this nullified the response.</li> <li>During stage six, the board responded to a tension between an emergent and a deliberate renewal practice. Its response initiated an investigation of information management practices across HealthOrg to see whether similar tensions were present in the broader organization. This response did not, however, specify or enforce any consequential actions pertaining to the tension.</li> </ul>
Avoiding	The organization does not address a tension	<ul> <li>During stage four, the organization faced a tension between established and renewed technology usage. While the organization did nothing to address this tension, the secretariat acted to strengthen the new platform's strategic position without considering the implications for the legacy platform.</li> <li>During stage five, the organization faced a tension between the inner and outer renewal contexts. The organization did nothing to address this tension; the IT department then implemented a new version of the legacy platform, which increased the functional overlap between the two platforms.</li> </ul>

TABLE 5	Responses to	tensions	during	technology	renewal	at HealthO	rg
		CUIDIONS	uui iiis	LCCINIOLOSY	I CIIC WU	at i icaltilo	

three at HealthOrg offers an example of this response type: The board mandated use of the new digital platform, a decisive and likely productive response, but offered neither incentives nor sanctions that might impact staff behaviour and thereby enforce that mandate.

Finally, in the *avoiding* response, the organization accepts a tension without addressing it. That is, actors experience manifestations of tensions and may contemplate how to respond, but they take no actual actions to resolve the tension. At HealthOrg, this response type was illustrated in stage four, when the organization experienced a tension between established and renewed technology usage. While organizational actors engaged during this stage, for example, the secretariat strengthened the new platform's strategic position, none of its actions addressed the dominating tension.

As these conceptualizations show, technology renewal is a complex undertaking in which tensions at particular junctures present the involved actors with a variety of choice opportunities. It is the interplay between the tensions that actors experience and, in turn, the responses they enact that drives technology renewal by impacting trajectories and outcomes.

-WILEY-

### 5.3 | Impacts on technology renewal

Having detailed both how paradoxical tensions manifest in renewal initiatives and the various ways in which actors may respond to these tensions, we now examine how generative mechanisms that are based on underlying deep structures (Pentland, 1999; Van de Ven & Poole, 1995) shape renewal trajectories and outcomes. At a general level, the paradoxical tensions *are* the deep structures that, when triggered, activate a generative mechanism of on-going interplay between experienced tensions and organizational responses. This unfolding of a technological renewal initiative is a recursive pattern in which a paradoxical tension manifests as an experienced tension and a related response, which, in turn, impacts the renewal configuration and trajectory, which then triggers the manifestation of a paradoxical tension, and so on.

This recursive pattern is illustrated in the unfolding of HealthOrg's renewal initiative. During the first stage, the organization faced conflicting requirements for its information management practices, which expressed the tension between inner and outer contexts. The experienced tension was triggered by an internal investigation that revealed two critical issues: the serious problems in HealthOrg's information management practices, and a government mandate to standardize and improve information management across public organizations. HealthOrg responded to the experienced tension by investing in a new digital platform that would allow it to meet the government mandate, improve current practices and continue to serve idiosyncratic needs. However, while this integrating response acknowledged the tension and provided a short-term solution to a pressing problem, the response's fully transformative impact depended on a successful long-term switch to the new platform. Because this long-term strategy was not explicitly communicated to staff members, however, the response's actual impact was to make the organization increasingly dependent on two functionally overlapping and incompatible digital platforms. This triggered the manifestation of the tension between established and renewed technology usage: The legacy platform met the requirements of most employees and departments, while the new platform supported information creation and sharing across departments. This, in turn, produced a splitting response from the secretariat; it prioritized one pole (renewed technology usage) over the other (established technology usage) by investigating how it could realize a transition to the new digital platform. Over the subsequent stages, the technological renewal initiative continued to unfold through this recursive pattern, albeit with different tensions, responses and renewal impacts.

Interestingly, paradox studies have demonstrated how organizational responses to salient tensions can generate both virtuous and vicious cycles. Smith and Lewis (2011) argue that *virtuous cycles* require organizational actors to accept rather than reject the tensions they face, and to constructively address them by either integrating or splitting their opposite poles. In the HealthOrg case, we saw signs of such a virtuous cycle in the renewal initiative's early stages. However, from stage three onward, HealthOrg actors responded to the tensions they faced by pretending or avoiding responses; this eventually led to a failing initiative in which the organization continued to invest in and rely on two overlapping and partially incompatible digital platforms. As such, the HealthOrg case eventually came to represent a *vicious cycle* in which a persistent pattern of pretending and avoiding responses reinforced a trajectory towards renewal failure.

Drawing on Smith and Lewis (2011) and our HealthOrg findings, we suggest that, to reinforce a virtuous cycle and increase the likelihood of a successful technology renewal, managers must pursue a persistent pattern of integrating and splitting responses. In contrast, persistent patterns of pretending and avoiding will likely reinforce a vicious cycle and lead to renewal failure.

### 6 | CONCLUDING REMARKS

Our paradoxical perspective on technology renewal (summarized in Table 6) is an important contribution to theory. Following Bacharach (1989), we set the boundary condition for this theorizing by defining the focal activity; we then adopted paradoxical thinking to conceptualize technology renewal, paradoxical tensions, organizational responses

Concepts	Definitions and claims	References
Technology renewal	<ul> <li>Technology renewal is the activity through which organizations seek to replace their digital platforms and infrastructures to realize strategic goals.</li> <li>Technology renewal is a paradoxical digital transformation process in which organizations must simultaneously remove their technological foundation and build on the practices that depend on it to implement a new technological foundation.</li> </ul>	Agarwal and Helfat (2009) Hanseth and Lyytinen (2010) Tanriverdi et al. (2010)
Paradoxical tensions	Technology renewal involves paradoxical tensions between: established and renewed technology usage, deliberate and emergent renewal practices, and inner and outer renewal contexts. Organizational actors may encounter manifestations of paradoxical tensions as salient tensions at specific junctures of a technology renewal initiative.	Eisenhardt and Zbaracki (1992) Smith and Lewis (2011) Polites and Karahanna (2012) Wareham et al. (2014)
Organizational responses	When tensions arise during technology renewal, organizational actors may respond through combinations of accommodating the opposite poles of a tension (integrating), choosing one of the opposites of a tension (splitting), articulating a solution to a tension without committing to consequential actions (pretending), and not addressing a tension (avoiding).	Jarzabkowski and Lê (2017) Lewis (2000) Smith and Lewis (2011)
Renewal impacts	Organizational responses to tensions in technology renewal may reinforce virtuous and vicious cycles. Reinforcing a virtuous cycle and increasing the likelihood of renewal success requires persistent patterns of integrating and splitting responses. In contrast, persistent patterns of pretending and avoiding responses will reinforce a vicious cycle and increase the likelihood of renewal failure.	Lewis 92000) Lüsher and Lewis (2008) Smith and Lewis (2011)

TABLE 6 A paradoxical perspective on technology renewal in digital transformation

and the resulting renewal impacts. Subsequently, we described how these concepts manifest and interrelate in practical initiatives to renew an organization's digital technology. Our theorizing is mid-range and thus has bounded relevance and validity (Avgerou, 2013). It is also based on a single qualitative case study, and, therefore, subject to certain limitations (Yin, 2013). Transferring our findings to other organizations and other types of digital transformation will require additional research and validation. Our theorizing also relies on paradoxical thinking (Jarzabkowski & Lê, 2017; Lewis, 2000; Lüsher & Lewis, 2008), and future research based on other perspectives, such as institutional theory (eg, Berger & Luckmann, 1967; Teo et al., 2003), structuration theory (eg, Giddens, 1979; Orlikowski, 1992) and escalation theory (eg, Keil, 1995; Staw & Ross, 1987), will likely contribute significant additional insights into technology renewal. As such, we hope that our research will stimulate and facilitate further studies into these complex and increasingly important digital transformation processes.

Because digital technologies will continue to fundamentally affect how organizations operate and compete (Brynjolfsson & McAfee, 2014; Tilson et al., 2010), organizations must periodically renew their established digital platforms and infrastructures if they are to maintain efficiency and remain competitive. Our paradoxical perspective offers a conceptual frame to help managers of these renewal initiatives understand how the deeper structures of tensions trigger manifestation of salient tensions at specific initiative junctures, and how different types of responses to these tensions can impact the initiative's continued trajectory and outcomes. These crucial insights can help managers grasp the magnitude of uncertainty in technology renewal and bring to these volatile change initiatives the

mindful sense-making and strong commitment required to both establish virtuous cycles and turn vicious ones around.

### DATA AVAILABILITY STATEMENT

Research data are not shared.

### ORCID

Henrik Wimelius D https://orcid.org/0000-0003-4019-2935

### **ENDNOTES**

- <sup>1</sup> The final observations consisted of two meetings between the first author and a representative from HealthOrg (the manager of the new platform). The meetings' purpose was to discuss whether the situation of persistent use of multiple, incompatible and functionally overlapping digital platforms had changed. As expressed during these meetings, the problematic renewal trajectory had continued to evolve.
- <sup>2</sup> Data triangulation has been criticized by some academic writers for implying that there is an objective social reality that can be discovered through triangulation (eg, Mason, 2002). Our approach to triangulation was pragmatic: we used it as a means to further improve the quality of data analysis and illuminate the phenomenon under investigation from as many angles and levels as possible.
- <sup>3</sup> Headquarters is comprised of seven departments with different responsibilities, so individual cases may span a broad range of specific tasks and information. Thus, the volume and number of different types of tasks and information that Headquarters manages and produces are considerably larger than the examples mentioned and considered here.

#### REFERENCES

Agarwal, R., & Helfat, C. E. (2009). Strategic renewal of organizations. Organization Science, 20(2), 281–293.

Alter, S. (2014). Theory of workarounds. Communications of the Association for Information Systems, 34(55), 1041–1066.

- Attewell, P. (1992). Technology diffusion and organisational learning: The case of business computing. *Organization Science*, 3, 1–19.
- Avgerou, C. (2013). Social mechanisms for causal explanation in social theory based IS research. Journal of the Association for Information Systems, 14(8), 399–419.
- Azad, B., & King, N. (2008). Enacting computer workaround practices within a medication dispensing system. European Journal of Information Systems, 17, 264–278.
- Bacharach, S. B. (1989). Organizational theories: Some criteria for evaluation. Academy of Management Review, 14(4), 496–515.
- Bacharach, S. B., Bamberger, P., & Sonnenstuhl, W. J. (1996). The organizational transformation process: The micropolitics of dissonance reduction and the alignment of logics of action. *Administrative Science Quarterly*, 41(3), 477–506.
- Barker, T., & Frolick, M. N. (2003). ERP implementation failure: A case study. Information Systems Management, 20(4), 43-49.

Behrens, S. (2009). Shadow systems: The good, the bad and the ugly. Communications of the ACM, 52(2), 124-129.

- Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. Academy of Management Review, 28(2), 238–256.
- Berger, P. L., & Luckmann, T. (1967). The social construction of reality. New York, NY: Doubleday Anchor.
- Bjerknes, G. (1991). Dialectical reflection in information systems development. *Scandinavian Journal of Information Systems*, 3, 55–77.
- Boudreau, M.-C., & Robey, D. (2005). Enacting integrated information technology: A human agency perspective. Organization Science, 16(1), 3–18.
- Brown, S. A., Massey, A. P., Montoya-Weiss, M. M., & Burkman, J. R. (2002). Do I really have to? User acceptance of mandated technology. *European Journal of Information Systems*, 11(4), 283–295.
- Brynjolfsson, E., & McAfee, A. (2014). The second machine age: Work, progress, and prosperity in a time of brilliant technologies, New York and London: WW Norton & Company.
- Calabretta, G., Gemser, G., & Wijnberg, N. M. (2017). The interplay between intuition and rationality in strategic decision making: A paradox perspective. *Organization Studies*, *38*(3-4), 365–401.
- Cameron, K. S. (1986). Effectiveness as paradox: Consensus and conflict in conceptions of organizational effectiveness. Management Science, 32(5), 539–553.

### 222 WILEY-

- Cho, S., Mathiassen, L., & Robey, D. (2007). Dialectics of resilience: A multi-level analysis of a telehealth innovation. Journal of Information Technology, 22, 24–35.
- Cialdini, R. B., Trost, M. R., & Newsom, J. T. (1995). Preference for consistency: The development of a valid measure and the discovery of surprising behavioral implications. *Journal of Personality and Social Psychology*, 69(2), 318–328.
- Cohen, M. D., March, J. G., & Olsen, J. P. (1972). A garbage can model of organizational choice. Administrative Science Quarterly, 17(1), 1–25.
- Crossan, M. M., & Berdrow, I. (2003). Organizational learning and strategic renewal. *Strategic Management Journal*, 24(11), 1087–1105.

Cuganesan, S. (2017). Identity paradoxes: How senior managers and employees negotiate similarity and distinctiveness tensions over time. Organization Studies, 38(3-4), 489–511.

- Cyert, R. M., & March, J. G. (1963). A behavioral theory of the firm. Englewood Cliffs, NJ: Prentice-Hall.
- Denzin, S., & Lincoln, Y. (Eds.). (1994). Handbook of qualitative research. Thousand Oaks, CA: Sage.
- Eisenhardt, K. M. (1989). Building theories from case study research. Academy of Management Review, 14(4), 532–550.

Eisenhardt, K. M., & Zbaracki, M. J. (1992). Strategic decision making. Strategic Management Journal, 13(S2), 17–37.

- Farjoun, M. (2010). Beyond dualism: Stability and change as a duality. Academy of Management Review, 35(2), 202–225.
- Fichman, R. G., & Kemerer, C. F. (1997). The assimilation of software process innovations: An organizational learning perspective. *Management Science*, 43(10), 1345–1363.
- Floyd, S. W., & Lane, P. J. (2000). Strategizing throughout the organization: Managing role conflict in strategic renewal. Academy of Management Review, 25(1), 154–177.
- Furstenau, D., Rothe, H., & Sandner, M. (2017). Shadow systems, risk, and shifting power relations in organizations. Communications of the Association for Information Systems, 41, 43–61 [Article 3].
- Galliers, R. D., & Sutherland, A. (1991). Information systems management and strategy formulation: The 'stages of growth' model revisited. *Information Systems Journal*, 1(2), 89–114.
- Garcia, L., & Quek, F. (1997). Qualitative research in information systems: Time to be subjective? In A. S. Lee, J. Liebenau, & J. DeGross (Eds.), *Information systems and qualitative research* (pp. 444–465). London, England: Chapman & Hall.
- Gasser, L. (1986). The integration of computing and routine work. ACM Transactions on Information Systems, 4(3), 205–225.
- Giddens, A. (1979). Central problems in social theory: Action, structure, and contradiction in social analysis. Berkeley, CA: University of California Press.
- Gilbert, C. G. (2005). Unbundling the structure of inertia: Resource versus routine rigidity. Academy of Management Journal, 48(5), 741–763.
- Gregor, S. (2006). The nature of theory in information systems. MIS Quarterly, 30(3), 611-642.
- Gregory, R. W., Keil, M., Muntermann, J., & M\u00e4hring, M. (2015). Paradoxes and the nature of ambidexterity in IT transformation programs. *Information Systems Research*, 26(1), 57–80.
- Hanseth, O., Jacucci, E., Grisot, M., & Aanestad, M. (2006). Reflexive standardization: Side effects and complexity in standard making. MIS Quarterly, 30, 563–581.
- Hanseth, O., & Lyytinen, K. (2010). Design theory for dynamic complexity in information infrastructures: The case of building internet. *Journal of Information Technology*, 25(1), 1–19.
- Hargrave, T. J., & Van de Ven, A. H. (2017). Integrating dialectical and paradox perspectives on managing contradictions in organizations. Organization Studies, 38(3–4), 319–339.
- Henderson, R., & Clark, K. B. (1990). Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. Administrative Science Quarterly, 35(1), 9–30.
- Hoffman, N., & Klepper, R. (2000). Assimilating new technologies: The role of organizational culture. Information Systems Management, 17(3), 36–42.
- Huff, J. O., Huff, A. S., & Thomas, H. (1992). Strategic renewal and the interaction of cumulative stress and inertia. Strategic Management Journal, 13(S1), 55–75.
- Jarvenpaa, S. L., & Wernick, A. (2011). Paradoxical tensions in open innovation networks. European Journal of Innovation Management, 14(4), 521–548.
- Jarzabkowski, P., & Lê, J. K. (2017). We have to do this and that? You must be joking: Constructing and responding to paradox through humor. Organization Studies, 38(3-4), 433–462.
- Jay, J. (2013). Navigating paradox as a mechanism of change and innovation in hybrid organizations. Academy of Management Journal, 56(1), 137–159.
- Keil, M. (1995). Pulling the plug: Software project management and the problem of project escalation. *MIS Quarterly*, 19(4), 421–447.
- Kim, H. W., & Kankanhalli, A. (2009). Investigating user resistance to information systems implementation: A status quo bias perspective. MIS Quarterly, 33(3), 567–582.
- Kvale, S. (1997). Den kvalitativa forskningsintervjun [The qualitative research interview]. Lund, Sweden: Studentlitteratur.
- Langley, A. (1999). Strategies for theorizing from process data. The Academy of Management Review, 24, 691–710.

Langley, A. (2007). Process thinking in strategic organization. Strategic Organization, 5(3), 271–282.

- Lee, A. S., & Baskerville, R. L. (2003). Generalizing generalizability in information systems research. Information Systems Research, 14(3), 221–243.
- Lewis, M. W. (2000). Exploring paradox: Toward a more comprehensive guide. Academy of Management Review, 25(4), 760–776.
- Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. MIS Quarterly, 31(1), 59–87.
- Lüsher, L., & Lewis, M. W. (2008). Organizational change and managerial sensemaking: Working through paradox. Academy of Management Journal, 51(2), 221–240.
- Lyytinen, K., & Damsgaard, J. (2001). What's wrong with the diffusion of innovation theory? Paper presented at the Working Conference on Diffusing Software Product and Process Innovations.
- Lyytinen, K., & King, J. L. (2006). Standard making: A critical research frontier for information systems research. MIS Quarterly, 30, 405–411.
- March, J. G. (1991). Exploration and exploitation in organizational learning. Organization Science, 2(1), 71-87.

Martin, T. N., & Huq, Z. (2007). Realigning top management's strategic change actions for ERP implementation: How specializing on just cultural and environmental contextual factors could improve success. *Journal of Change Management*, 7(2), 121–142.

Mason, J. (2002). Qualitative researching. London, England: SAGE Publications Ltd.

- McGann, S. T., & Lyytinen, K. (2005). How information systems evolve by and for use. Sprouts: Working Papers on Information Systems, 5(15), 5–15.
- Merton, R. K. (1967). On sociological theories of the middle range. In R. K. Merton (Ed.), On sociological theory: Five essays, old and new (pp. 39–72). New York, NY: Free Press.
- Nah, F. F.-H., & Delgado, S. (2006). Critical success factors for enterprise resource planning implementation and upgrade. Journal of Computer Information Systems, 46(5), 99–113.
- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. MIS Quarterly, 41(1), 223–238.
- Öbrand, L., Augustsson, N., Mathiassen, L., & Holmström, J. (2019). The interstitiality of IT risk: An inquiry into information systems development practices. *Information Systems Journal*, 29(1), 97–118.
- Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. Organization Science, 3(3), 398–427.
- Orlikowski, W. J. (1996). Improvising organizational transformation over time: A situated change perspective. Information Systems Research, 7(1), 63–92.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. Organization Science, 11(4), 404–428.
- Patton, M. Q. (2002). Qualitative research and evaluation methods. Thousands Oaks, CA: Sage.
- Pentland, B. T. (1999). Building process theory with narrative: From description to explanation. Academy of Management Review, 24(4), 711–724.
- Peppard, J., Lambert, R., & Edwards, C. (2000). Whose job is it anyway?: Organizational information competencies for value creation. *Information Systems Journal*, 10(4), 291–322.
- Pettigrew, A. M. (1987). Context and action in the transformation of the firm. *Journal of Management Studies*, 24(6), 649–670.
- Pettigrew, A. M. (1992). The character and significance of strategy process research. *Strategic Management Journal*, 13 (S2), 5–16.
- Polites, G. L., & Karahanna, E. (2012). Shackled to the status quo: The inhibiting effects of incumbent system habit, switching costs, and inertia on new system acceptance. MIS Quarterly, 12(1), 21–42.
- Poole, M. S., & Van de Ven, A. H. (1989). Using paradox to build management and organization theories. The Academy of Management Review, 14(4), 562–578.
- Robey, D., & Boudreau, M.-C. (1999). Accounting for the contradictory organizational consequences of information technology: Theoretical directions and methodological implications. *Information Systems Research*, 10(2), 167–185.
- Robey, D., Ross, J. W., & Boudreau, M.-C. (2002). Learning to implement enterprise systems: An exploratory study of the dialectics of change. Journal of Management Information Systems, 19(1), 17–46.
- Rolland, K., Mathiassen, L., & Rai, A. (2018). Managing digital platforms in user organizations: The interactions between digital options and digital debt. *Information Systems Research*, 29(2), 419–443.
- Sabherwal, R., & Newman, M. (2003). Persistence and change in system development: A dialectical view. Journal of Information Technology, 18, 69–92.
- Sheep, M. L., Fairhurst, G. T., & Khazanchi, S. (2017). Knots in the discourse of innovation: Investigating multiple tensions in a reacquired spin-off. Organization Studies, 38(3-4), 463–488.

WII FY

### <sup>224</sup> WILEY-

Smith, W. K., & Lewis, M. W. (2011). Toward a theory of paradox: A dynamic equilibrium model of organizing. Academy of Management Review, 36, 381–403.

Staw, B. M., & Ross, J. (1987). Behavior in escalation situations: Antecedents, prototypes, and solutions. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 9, pp. 39–78). Greenwich, CT: JAI Press.

Strong, D. M., & Volkoff, O. (2004). A roadmap for enterprise system implementation. Computer, 37(6), 22-29.

Tanriverdi, H., Rai, A., & Venkatraman, N. (2010). Research commentary—Reframing the dominant quests of information systems strategy research for complex adaptive business systems. *Information Systems Research*, 21(4), 822–834.

Teo, H. H., Wei, K. K., & Benbasat, I. (2003). Predicting intention to adopt interorganizational linkages: An institutional perspective. MIS Quarterly, 27(1), 19–49.

Tilson, D., Lyytinen, K., & Sørensen, C. (2010, January). Desperately seeking the infrastructure in IS research: Conceptualization of "digital convergence" as co-evolution of social and technical infrastructures. Paper presented at the HICSS 43, Kauai, HI.

Van de Ven, A. H. (2007). Engaged scholarship: A guide for organizational and social research. Oxford, England: Oxford University Press.

- Van de Ven, A. H., & Poole, M. S. (1995). Explaining development and change in organizations. Academy of Management Review, 20(3), 510–540.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. Journal of Strategic Information Systems, 28(2), 118–144.
- Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. European Journal of Information Systems, 4 (2), 74–81.
- Walsham, G. (2006). Doing interpretive research. European Journal of Information Systems, 15, 320–330.
- Wand, Y., & Weber, R. (1995). On the deep structure of information systems. Information Systems Journal, 5(3), 203-223.
- Wang, P. (2010). Chasing the hottest IT: Effects of information technology fashion on organizations. *MIS Quarterly*, 34(1), 63–85.
- Wareham, J. D., Fox, P. B., & Cano Giner, J. L. (2014). Technology ecosystem governance. Organization Science, 25(4), 1195–1215.
- Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Jensen, T. (2020). Unpacking the difference between digital transformation and IT-enabled organizational transformation. *Journal of the Association for Information Systems* (Forthcoming).

Yin, R. K. (2013). Case study research: Design and methods. Thousand Oaks, CA: SAGE Publications, Inc.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary—The new organizing logic of digital innovation: An agenda for information systems research. *Information Systems Research*, 21(4), 724–735.

### **AUTHOR BIOGRAPHIES**

Henrik Wimelius (henrik.wimelius@umu.se) is an associate professor of informatics at Umeå University. His research focuses broadly on organizational consequences of digitalization and more specifically on the impact and nature of digital innovation processes on firms and organizations. Dr. Wimelius is also an active practitioner in the private industry, holding a position as head of digital investments at a venture capital firm.

Lars Mathiassen (Imathiassen@ceprin.org) is Georgia Research Alliance Eminent Scholar, Professor at the Computer Information Systems Department and Co-Founder of Center for Process Innovation at Robinson College of Business, Georgia State University. His research focuses on digital innovation, health informatics, and IT development & management. Dr. Mathiassen has published extensively in leading academic journals, including Information Systems Research, Journal of Management Information Systems, MIS Quarterly, Research Policy, and many others.

Jonny Holmström (jonny.holmstrom@umu.se) is a professor of informatics at Umeå University. Holmström is the director and co-founder of Swedish Center for Digital Innovation. He writes, consults and speaks on topics such as digital innovation, digital transformation and strategies for leveraging value from digitalization. His work has appeared in journals such as Communications of the AIS, European Journal of Information Systems, Information and Organization, Information Systems Journal, Information Technology and People, Journal of Information Technology, Journal of the AIS, Journal of Strategic Information Systems, MIS Quarterly, Research Policy, and The Information Society.

Mark Keil (mkeil@gsu.edu) is a Regents' Professor of the University System of Georgia and the John B. Zellars Professor of Computer Information Systems in the J. Mack Robinson College of Business at Georgia State University. His research focuses on IT project management and decision making and includes work on preventing IT project escalation, identifying and managing IT project risks, and improving IT project status reporting. He has published over 100 refereed journal articles. He holds B.S.E., S.M., and D.B.A. degrees from Princeton University, M.I.T. Sloan School, and Harvard Business School respectively. This research is partly funded by the Marianne and Marcus Wallenberg Foundation.

How to cite this article: Wimelius H, Mathiassen L, Holmström J, Keil M. A paradoxical perspective on technology renewal in digital transformation. *Inf Syst J*. 2021;31:198–225. https://doi.org/10.1111/isj.12307