



UMEÅ UNIVERSITY

The Dynamics of Digital Transformation

The Role of Digital Innovation, Ecosystems
and Logics in Fundamental Organizational
Change

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Abstract

This dissertation investigates digital transformation, understood here as processes where organizational actors engage in digital innovation and transform their organizations in order to respond to change in their business and technology environments. Specifically, it examines the dynamics of digital transformation, seeking to understand the key sociotechnical elements and their relationships that drive digital transformation processes and influence how they unfold over time. To theorize the dynamics of digital transformation, I synthesize extant knowledge with contributions from four appended research papers.

The outset for theorizing in this dissertation is a body of literature that has begun to accumulate knowledge on digital transformation as a distinct phenomenon. Within this literature, I identify three main areas that are vital to understanding digital transformation processes, yet have so far not been sufficiently theorized. First, research on digital transformation often describe it as a complex and longitudinal process that involves several sequences of digital innovation, yet it has primarily been studied in the form of discrete instances of innovation decoupled in time and space. As a result, current knowledge on digital transformation as a longitudinal process is limited. Second, the literature on digital transformation emphasize that interactions between digital business and technology environments and organizations are crucial for explaining why and how digital transformation unfolds. At the same time, however, the literature has so far not been able to offer a conceptualization of these interactions in ways that make formative influence over time visible. Third, existing research on digital transformation has remained dominantly focused on the role of managers and paid limited attention to other organizational actors in digital transformation.

Addressing the limitations identified in existing digital transformation research, I draw upon established theoretical concepts and the four appended research papers to theorize a conceptual framework on digital transformation dynamics. The conceptual framework contributes to research by clarifying a set of theoretical concepts and relationships that are instrumental for addressing digital transformation as a sequential and cumulative process, and the actors, agency and actions that realize digital transformation over time. It is supportive of future theorizing of digital transformation as a subject matter related yet distinct from other forms of organizational change enabled by technology use.

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One thing you often hear from people who have pursued a PhD and finished their dissertation is how it has actually been a team effort. Seldom has this been truer than in this case, and there are indeed several persons who deserve to be acknowledged here.

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Preface

This dissertation is based on research described in the following appended papers. I refer to these in the text by the corresponding numbers.

Paper 1: Nylén, D., Skog, D.A., Lyytinen, K., & Holmström, J., (manuscript). The Longitudinal Dynamics of Digital Transformation: A Process Study of Change in a Newspaper Organization.

Paper 2: Skog, D.A., (2016). Local Game, Global Rules: Exploring Technological Heterogeneity Exploitation in Digital Creative Cluster Evolution. *Industry and Innovation*, 23(6): 531–550.

Paper 3: Skog, D., Wimelius, H., Sandberg, J. (2018). Digital Service Platform Evolution: How Spotify Leveraged Boundary Resources to Become a Global Leader in Music Streaming. *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS-51)*: 4564-4573

Paper 4: Skog, D.A., Wimelius, H., Sandberg, J., (2018). Digital Disruption. *Business & Information Systems Engineering*, 60(5): 431–437.

1. Introduction

Extensive digitalization is changing business and technology environments, presenting organizations with opportunities and challenges that may either motivate or pressure them to change. Indeed, during the last two decades we have witnessed the emergence of digital products and services that are open for organizations other than the owners to use for different business purposes. For example, social media services, such as Facebook and Twitter, are increasingly integrated by organizations as channels for interacting with customers in diverse ways, organizations increasingly offer services through apps developed for mobile phones, and many organizations are searching for ways to retrieve, analyze and act upon the digital data generated through use not only of their own products and services, but also those of other organizations. We have seen organizations leverage results of digitalization to their advantage, for example Uber and Spotify, but also witnessed the downfall of long-established and traditionally successful organizations such as Kodak, Blockbuster, Nokia, Xerox and Tower Records. These examples show that when technology and business environments change, so do the foundational conditions that organizations within them rely upon to create and capture value. Thus, when environments become dynamic and generate constantly changing conditions, organizations may exploit opportunities and protect against threats by continuous adaptation and proactive change. This is where digital transformation comes into play.

Digital transformation refers to processes whereby organizations continuously engage in digital innovation to develop or improve products, services and business models. Since new products and services may require different types of resources and work procedures from those associated with old products and services, organizations also need to engage in deeper change to their operational structure to support new forms of value creation and capture in digital transformation. Besides products, services and operational structures, new forms of value creation enabled by digital technology may even require an organization to question and change its purpose, means and identity. Given the profound potential consequences of transforming, and not transforming, it is perhaps unsurprising that digital transformation has gathered significant attention from practitioners and policy-makers. So far, however, it has not attracted as much research attention, and the few previous studies have primarily focused on mapping particular digital technologies with seemingly useful features to organizational areas that may potentially be improved by their implementation, and highlighting managerial challenges in digital transformation. Hence, we know a little bit about aspects that change, or should change, during digital transformation and what may potentially obstruct it, but we know very little about the *process* of digital transformation: how does digital transformation actually unfold?

To advance general understanding of digital transformation processes, I theorize what I refer to as digital transformation dynamics in this thesis. This means that I build on what is already known and described in extant literature and draw upon what I have found in my own studies to identify key social and technological elements, how they are interrelated, and how they are likely to interact to generate conditions that stimulate organizational actors to initiate and adjust their digital transformation over time. Ultimately, I develop a conceptual framework detailing how digital transformation may be understood and studied as a longitudinal and recurrent cycle of digital innovation processes and outcomes embedded in the wider context of digital ecosystems. To better understand the initiation of, and adjustments to, digital transformation trajectories over time, I propose a concept of digital logics as a means to capture how and why actors act based on their interpretation of their past, present, and future; and how they perceive their internal as well as external circumstances. By integrating this conceptual framework with what was previously known, and explicating how it may be used to support further theorizing efforts, I contribute to the ongoing discourse on digital transformation and digital innovation in the Information Systems (IS) research field.

In the rest of this introductory chapter, I first provide a deeper explanation of the empirical and theoretical background of digital transformation. After clarifying the phenomenon and how it has been addressed in extant research, I turn to formulating the more precise research problem and question that guided my work leading to this dissertation. Finally, I present my main contributions in relation to the specific problem addressed.

1.1. Background

Digital transformation essentially concerns technology and organizational change, two subjects that have a strong tradition in IS research. In fact, the interest it directs to the relationship between Information Technology (IT) and organizations is often considered to be a defining attribute of IS research. To that end, it has been argued that IS research should broadly involve the generation of knowledge about systems in organizations (Alter, 2003; Guthrie, 2003). More specifically, it should consider how IT is designed, developed, implemented and used, and consequences of these processes on individual, group and organizational levels (Benbasat and Zmud, 2003). Concerning what IT means in this context, there is an overall consensus among IS researchers that IT systems are constellations of hardware and software that enable or support particular tasks (Benbasat and Zmud, 2003) primarily due to their abilities to inform, automate, coordinate and control (Robey and Sahay, 1996; Zuboff, 1985). The particular task defines the purpose of an IT system and the way it is matched and adapted to a social system as part of an information system. An information system is therefore generally seen as a sociotechnical system that stores, processes, manipulates and transfers information to effectively and efficiently serve its defined task within an organization (Lyytinen and Newman, 2008).

With this dominant view of IT, IS research has focused on different aspects of its relationship to change in organizations and made significant contributions to our understanding of what is often referred to as IT-enabled organizational transformation (e.g. Besson and Rowe, 2012; Sarker and Lee, 1999; Venkatraman, 1994). Under that umbrella, some IS researchers have, for example, investigated the strategic role of IT systems in organizations and the resulting extent to which it is likely to result in fundamental organizational change (Venkatraman, 1994). Briefly, this line of research has found that IT strategy is often treated as a functional level strategy subordinate to the strategies that define what an organization does and how it does it. Hence, IT is strategically designed, implemented and used primarily to make an organization more efficient and effective within a predetermined business scope and market (Henderson and Venkatraman, 1999; Venkatraman, 1989). Therefore, according to this view, IT systems generally come to support value creation and capture with existing products and services; they rarely lead to any substantial changes within them (Bharadwaj et al., 2013). Other IT and IS innovation researchers have focused on the adoption and diffusion of preexisting IT systems in organizational contexts (Fichman, 2004) or how IT systems may be applied within organizations and the organizational consequences (Swanson, 1994). As emphasized by the latter, IS innovation is usually intended to improve the efficiency of processes, and seldom directly affects the organization beyond the targeted processes (ibid.). Finally, others have studied processes of IT implementation and use in organizations under the flag of social construction and structuration, emphasizing how organizational consequences are situated in contexts and depend on how organizational actors interpret IT systems as social objects (e.g. Barley, 1986; Orlikowski, 1996; Robey and Boudreau, 1999; Robey and Sahay, 1996). Briefly, this stream of research has found that IT-enabled organizational transformation is a slow and gradual process with both intended and unintended consequences. Overall, IT-enabled organizational transformation can thus be said to be a process enclosed within organizations that usually follows a bottom-up trajectory: IT systems are introduced into organizations to reinforce what they do and how they do it, and help them do it more efficiently and effectively. Over time, the use of new IT systems leads to both intended and unintended outcomes that may result in wider organizational change.

Interestingly, in relation to this view of IT-enabled organizational transformation as a primarily bottom-up endogenous process, digital transformation is often described in practice as initiated and driven by managers' strategic intent to leverage opportunities and respond to threats in their business and technology environments. For example, digital transformation has recently been identified as a critical issue at the top of policy agendas of the European Union (EU), the Organization for Economic Co-operation and Development (OECD), and Swedish government (European Commission, n.d.; OECD, 2017; Regeringskansliet, 2017). A key concern of these entities is that a proliferation of new digital technologies is leading to fundamental restructuring, destruction, or replacement of societal, industrial, and market structures. Ultimately, this is leading to

shifts in established *modi operandi* for business and innovation, and enormous growth potential for organizations that can adapt. Further, various IT and management consultancy firms have addressed the phenomenon of digital transformation during the last couple of years (e.g. Catlin et al., 2017; CGI, 2016; Purohit, 2016). Their publications have frequently described organizations' increasing use of digital tools and technologies to transform internal and external functions through planned strategic moves, controlled transitions or responses to acute performance crises (Bonnet, 2011). They have also considered how organizations can use digital technology not only to improve internal processes, but also to directly change value propositions and customer relationships, in response to external competition and new customer demands for services and products (Westerman et al., 2011). These types of publications also often argue that digital transformation needs to be a top-down process, driven and implemented through engaged leadership (Bonnet, 2011; Fujitsu, 2018; Westerman et al., 2011), implicitly of course with the help of consultants such as the authors.

As it has attracted significant interest in practice, and is evidently of interest to IT executives in particular (Kappelman et al., 2018), it is surprising that digital transformation has not attracted more attention in IS research (Gerster, 2017). In my review of the limited IS literature that has explicitly focused on digital transformation (presented in section 2.2), I find that digital transformation is generally considered to involve processes driven by digital product, service and business model innovation. Wider and more holistic organizational transformation is inherent to such processes, and primarily described as being either the result of or undertaken to enable (or support) new digital products, services and business models (e.g. Gimpel et al., 2018; Hartl and Hess, 2017; Matt et al., 2015). In accordance with the expressed view of consultancy firms, previous studies have often treated digital transformation as a process whereby organizations respond to, and leverage, change in their business and technology environment, driven by strategic intent, portraying it primarily as a management issue. In such studies, it is often assumed that digital transformation starts with the disruption of business models by the emergence of new digital products and services that change the rules for business and innovation (Hinings et al., 2018; Karimi and Walter, 2015; Sebastian et al., 2017). In the midst of such disruption in organizations' business and technology environments, managers are often attributed with capacities to identify opportunities and threats, map the right digital technologies to organizational areas of improvement, manage potential internal resistance, and both lead and exert overall control over the digital transformation of their organizations over time. We would prefer, 'In sum, this view of digital transformation is reflected in the tendency of most previous studies to focus on inputs, outputs, or managers' roles as mediators. Input-focused research has sought to understand and explain certain digital technologies and their features (Alexander and Lyytinen, 2017; Woerner and Wixom, 2015). Output-focused research has sought to map internal areas of organizations that can either be improved by digital transformation, or could be improved to provide better support for digital

transformation (Gimpel et al., 2018; Karimi and Walter, 2015; Matt et al., 2015). Managers are generally positioned between input and outputs, and seen as powerful actors who can translate technological features into organizational improvements, so some researchers have also focused on identifying the key challenges that managers must address in this process (Piccinini et al., 2015; Westerman and Bonnet, 2015).

Against this backdrop, we may draw conclusions regarding at least two aspects that help explain digital transformation as a distinct phenomenon and concept. First, digital transformation is a process that is related to, but distinct from, the process of IT-enabled organizational transformation that has been so extensively studied in IS research. While the latter has been conceptualized as driven by process innovation, where the development, implementation and use of IT systems is leveraged with the intent to make an organization more efficient and effective in achieving its predetermined business scope, digital transformation entails new ways of creating and capturing value with digital technology through digital product, service, and business model innovation. Therefore, the introduction and use of IT-systems tend to lead to wider organizational transformation through a bottom-up trajectory, in which use of new IT-systems first leads to new practices and adaptations of organizational structures over time, and ultimately may come to redefine what an organization does and how it does it. In contrast, the nature of digital transformation suggests a top-down trajectory where the scope for innovation initially concerns changes to what an organization does and how it does it, and holistic organizational transformation follows as a result of, or to enable, the new purpose and means. Second, in both research and practice, digital transformation is portrayed as inherently influenced by a technology and business environment serving as the locus of challenges that motivate organizations to transform, but also of vital opportunities and resources for organizations as they actually transform. Since IT-enabled organizational transformation is commonly described as a process endogenous to organizations, an inherent dependency on business and technology environments further distinguishes digital transformation from IT-enabled organizational transformation.

We may also distill an internal discrepancy between digital transformation's characterization and how it has been studied and theorized. To clarify this point, we may more closely consider how digital transformation has often been described in holistic and processual terms. For example, digital transformation has been characterized as a continuous undertaking that will probably have to be reassessed and adjusted due to changing circumstances over time (Matt et al., 2015), as likely to involve organizational exploitation and adaptation to several digital technologies (Lanzolla et al., 2018), as the cumulative result of several digital innovations (Hinings et al., 2018), as involving a rethinking of whole business logics rather than incremental business improvements (Piccinini et al., 2015) and as a holistic transformation of an organization (Henriette et al., 2016). While this strongly suggests that the phenomenon of digital transformation spans further in time and scope than a single or even a couple of instances of digital

innovation, it is not reflected in the focus on inputs and outputs that has dominated previous research. Longitudinal studies of digital transformation are rare (Kutzner et al., 2018), so we simply lack insight into how instances of digital innovation become the processes of holistic organizational transformation that digital transformation entails.

In addition to the revealing discrepancy in extant literature, there are several empirical and theoretical reasons for questioning the relatively simple and static description of digital transformation conveyed by an input-output view, and complementing it with a better understanding of digital transformation as a process. First, prominent empirical examples show that even when organizations can innovate with digital technology and occasionally launch new products and services, they may still be unable to adapt to changing environmental conditions over time. Indeed, many once successful companies that have been significantly diminished or disappeared during the last 20 years were technological pioneers, including the following three. Kodak was the inventor of the first megapixel sensor and one of the first producers of digital cameras (Lucas and Goh, 2009). Xerox had a legendary (Xerox Parc) research and development center that either solely or in collaboration with other actors created the first object-oriented programming language, the first laser printer, the first graphical user interface, and ethernet networking. Nokia was a mobile phone behemoth that pioneered the concept of mobile apps with its S60 platform. Despite obviously having the internal resources and capabilities to realize digital product and service innovations, all of these organizations fell or severely stumbled when conditions in their business and technology environments changed. These examples support the idea that successful digital transformation lies not in the ability to successfully launch innovations, but in the ability to successfully exploit and adapt over time. Second, from the long tradition in IS research to generate knowledge about IT-enabled organizational transformation, we know that the relationship between technology and organizational change is complex, often characterized by both intended and unintended consequences, planned as well as unplanned change, and an innovation agency that in practice extends beyond managers and designers to include other actors within organizations that work with the technology (e.g. Orlikowski, 1996; Robey and Boudreau, 1999; Robey and Sahay, 1996). Considering the characteristics of digital transformation, it seems likely to entail even more complex processes, involving not only endogenous structures, agency and dynamics, but also exogenous factors that influence how and why it unfolds over time.

Overall, I have thus described how digital transformation may be seen as a distinct phenomenon and concept that concerns processes inherently driven by digital product, service and business model innovation that realize fundamental organizational change through top-down trajectories. As it is therefore distinct from IT-enabled organizational transformation, we cannot assume by default that the deep and comprehensive knowledge about the relationship between IT and organizational change provided by IS research is directly translatable to digital transformation. At the same time, digital transformation is

an issue that should be at the core of IS research. This is manifested in the considerable interest it is attracting from both practitioners and policy-makers, and exemplified by the recent turmoil, including disappearance or severe decline of well-established companies, in diverse industries in the face of new digital products and services. Clearly, digital transformation is associated with both opportunities for innovation and growth, and severe consequences for those that cannot transform when necessary, or cannot manage digital transformation over time. So far, however, IS research has contributed limited knowledge and insights that help clarify such issues. This provides the background for the research problem addressed here, which is explained in further detail in the next section.

1.2. Problem statement and research objective

Digital transformation is a contemporary phenomenon of fundamental organizational change driven and enabled by digital technology. Due to its potential for generating both growth and decline, digital transformation has become a key concern of both organizations and policy-makers. Therefore, it is difficult to think of a more relevant and timelier topic for IS research. Indeed, how technology changes and is changed by the embedding contexts (Benbasat and Zmud, 2003) and wider environments (Agarwal and Lucas, 2005) has been suggested to lie at the core of IS research interest. Moreover, the ability of the IS field to remain plastic and salient as technology and technology use generates new phenomena has been emphasized as one of its key strengths (Avgerou, 2000; Lyytinen and King, 2004). From that perspective, the general lack of research on digital transformation in IS journals (Gerster, 2017) is puzzling.

From my review of both IS journal and conference publications (section 2.2), I find that the limited stream of literature that does explicitly address digital transformation has made substantial contributions by conceptualizing, framing and characterizing an important contemporary phenomenon as distinct within the general IS discourse. It has also identified some of the key challenges and opportunities associated with digital transformation in practice. However, I also find that while digital transformation is often described as a longitudinal and complex process that involves several digital innovation processes, multi-level interactions, and continuous adjustments to new conditions over time, limited analytical attention has been paid to the *process* of digital transformation, i.e. how digital transformation actually unfolds. This neglect of process may be partly due to a general lack of studies that have approached digital transformation from a longitudinal perspective (Kutzner et al., 2018), and has resulted in inputs or outputs of digital transformation and managers (as the actors who convert one to the other) receiving most attention. Further, while extant literature stresses that digital transformation is a process embedded not only in the inner context of organizations, but also in the outer business and technology environments of organizations, it offers limited means for understanding their interdependencies and interactions over time.

Without rigorous, extensive research and theorizing that considers the distinct characteristics of digital transformation processes, practitioners are left to deal with the myths surrounding digital transformation (Andriole, 2017) and develop their own digital transformation strategies without theoretical foundations (Haffke et al., 2016). Considering its complex, holistic and longitudinal characteristics, it is easy to see how digital transformation poses severe challenges that no sane organization would want to engage in without clear cause and guidance. Yet without further insights into the process of digital transformation to draw upon, IS research is ill-equipped to provide answers to vital questions, such as when should companies transform, and why? How can digital innovation be sequenced over time to enable desirable long-term effects? And what may cause organizations to reassess and adjust their planned transformation course?

While I consider these questions to be important, my objective in this dissertation is not to provide direct answers to them, but primarily to provide means for exploring them. Hence, my primary intent is to provide more fertile foundations for further knowledge generation on the process of digital transformation in IS research. In so doing, I engage here in theorizing (Weick, 1995) the dynamics of digital transformation, signaling an interest in the social and technical conditions, influences and properties that may be expected to constitute or stimulate digital transformation over time. In theorizing, I draw upon and distill relevant existing knowledge and research perspectives to explain and understand how digital transformation unfolds over time, I synthesize that body of research with empirical, methodological and conceptual insights from my own studies, and clarify how this advances current knowledge on digital transformation generally, and particularly how it may be conceptually and analytically approached with a process-oriented perspective. Specifically, my theorizing efforts are guided by the following research question:

What are the main elements and relationships in digital transformation and how do they come to produce digital transformation over time?

By theorizing the dynamics of digital transformation, I contribute to existing and future IS research as detailed further in the following section.

1.3. Contributions

As further detailed in chapter 5, the primary contribution of this dissertation is a conceptual framework on digital transformation dynamics that detail the main concepts, their relationships, and how we may expect them to interact over time in digital transformation processes. I make this contribution through a theorizing process where I build on what came before, how my own efforts leads to a progression into a new state, and how this new state may support further theorizing efforts (Holmström, 2005; Weick, 1995). Rather than as an attempt towards the development of full-fledged theory, this

framework should therefore be seen as an interim effort in the wider struggle of developing theory for analyzing, explaining and to some extent predicting (Gregor, 2006) the when, why, what, and how of digital transformation.

The conceptual framework theorized here promotes an emergent view on digital transformation by providing conceptual means with which to examine and better understand why and how organizational actors take the actions that constitute digital transformation over time. To that end, I synthesize extant literature with findings, insights and conceptual developments from the four appended papers to propose longitudinal digital innovation, embeddedness in digital ecosystems, and the enactment and materialization of digital logics as concepts that capture the main dynamics of digital transformation. By directing focus on digital innovation, not as decoupled instances, but as sequential processes productive of cumulative effects, I argue here that we, as IS researchers, will better understand not only how discrete innovations are designed and developed, but also how the process and outcome of one digital innovation comes to set enabling and constraining conditions for the next. Furthermore, as we direct attention to longitudinal digital innovation, we will also become sensitive to how organizations form relationships and dependencies to other actors in digital ecosystems. Seen here to be dynamic sociotechnical networks of digital technologies and associated actors delineated by contexts of use, digital ecosystems are a fertile way to conceptualize the relevant business and technology environment for organizations engaged in digital transformation. As explained here, digital ecosystems contextualize the organization and its digital products and services in an outer context that is formative to, and that may also be formed by, digital transformation. Finally, I suggest here that the concept of digital logics is productive in accounting for the human agency relevant to how digital transformation processes unfold. Digital logics refers to the rationales that guide organizational actors in digital transformation that are shaped by actors' interpretation of previous digital innovation processes and outcomes, current needs, resources, constraints and opportunities, and what prospective state is sought by engaging in digital transformation. By studying how such logics are formed out of actors' interpretation of personal and organizational experiences and objectives as well as of previous, current and prospective events and states in digital ecosystems, we may better account for the temporal and contextual dependencies that influence digital transformation processes. By also remaining attentive to that digital logics to some extent materialize in the design of digital innovations, we may also better understand how digital transformation processes may come to shape digital ecosystems. Hence, by detailing these concepts and their relationships, my main aim is to provide a theoretical foundation that is both generative of, and supportive to, further theorizing of digital transformation as a distinct phenomenon in IS research. As a first step in this theorizing effort, I begin by describing in detail the current state of knowledge on digital transformation and its theoretical roots in IS research.

2. Digital transformation in theoretical and empirical contexts

In this chapter, I describe the phenomenon of digital transformation and the theoretical context within which I theorize its dynamics. To that end, I first outline the historical foundations of digital transformation research in IS literature gathered under the term IT-enabled organizational transformation. I then review the existing literature to derive an overall description of the phenomenon of digital transformation and how it has been conceptualized as a distinct area of theorizing. With the explicit intent to analyze the extent to which a process-oriented understanding is accounted for in extant work on digital transformation, I structure my review according to concepts that direct attention to how and why it has been found to unfold over time. Next, to provide stable footing to support my theorizing of digital transformation as a distinct type of process, I define it in process terms and stake out boundaries in the theoretical context of digital transformation. This entails distillation from existing literature a definition of digital transformation that is aligned with existing work and generative of further research on the process of digital transformation. It also entails clarification of how IT-enabled organizational transformation and digital transformation may be seen as related but separate due to their conceptual foundations. Finally, I end this chapter by explaining why a conceptual framework on digital transformation dynamics is needed and detailing some of the aspects that such a framework needs to account for.

2.1 IT-enabled organizational transformation

IS studies that have addressed the relationship between IT and organizational transformation have applied various terms, sometimes with the explicit purpose of highlighting empirical and theoretical nuances and sometimes not. Hence, IT and organizational change (Markus and Robey, 1988), IT-enabled business transformation (Venkatraman, 1994), IS and organizational change (Keen, 1981), IS-enabled organizational transformation (Besson and Rowe, 2012), and technochange (Markus, 2004) have all be used as conceptual terms to frame essentially the same phenomena: the processes whereby the design, implementation and use of IT may lead to change in an organization. To avoid potential confusion, IT-enabled organizational transformation is used hereafter as a term that captures the relationship between fundamental organizational change and IT, whether or not it is strictly enabled by IT or IS.

Generally, organizational transformation has been understood to involve qualitative change in what an organization does and how it does it. For example, Aldrich and Ruef define organizational transformation as a “*major change in an organization involving a break with existing routines and a shift to new kinds of competencies that challenge organizational knowledge*” (2006, p. 134), which they further propose results from

change in organizational goals, boundaries or activity systems. A change in organizational goals usually manifests in either alteration of products and services an organization offers, or in decisions to change targeted markets. Organizational boundaries may either expand or contract through, for example, mergers or downsizing, and changes to activity systems include new routines, restructuring of labor division, and the introduction of new IT.

IT can be generally understood as artifacts composed of hardware and software that (as the name suggests) provide and process information for diverse purposes in organizations, including automation, coordination, control and communication. By using IT for automating processes, costs can be decreased and control increased, but IT can also generate information about processes that enable organizations to better comprehend their operations and thereby improve them (Zuboff, 1985). Because it has the “*capacity to gather, store, manipulate, and transmit information efficiently*” IT can also be used to “*support more effective forms of organizational co-ordination and control*” (Robey and Sahay, 1996, p. 93). Sets of IT interconnected for specific purposes comprise IT systems, which are often defined by those purposes, e.g. Customer Relationship Management (CRM) or Enterprise Resource Management (ERP) systems. When fused with an associated social system, an IT system is part of an IS, whose main tasks are to store, process, manipulate and transfer information to effectively and efficiently serve its defined purpose within an organization (Lyytinen and Newman, 2008).

Due to IT's potential for making organizational operations more efficient, IT-enabled organizational transformation rests heavily on business rationales. As expressed by Robey and Sahay, “[t]ransforming organizations with information technologies is an important business objective because traditional structures are often ineffective in producing desired levels of productivity, customer service, employee welfare, and shareholder value” (1996, p. 93). However, since the mere implementation of IT systems provides limited benefits for an organization without accompanying changes in organizational characteristics and conditions, the organizational value of IT is modulated by the extent that the organization can change (Venkatraman, 1994). Therefore, organizational resistance or inability to change following the introduction of new IT has become a key subject in research on IT-enabled organizational transformation (Besson and Rowe, 2012; Keen, 1981; Silva and Hirschheim, 2007). Indeed, Besson and Rowe argue that it “*is organizational inertia that makes [organizational transformation] an important theoretical and practical problem*” (2012, p. 105). The general notion of inertia is perhaps best explained as “*a complicated way of saying that no matter how you try, nothing seems to happen*” (Keen, 1981, p. 24). More specifically, organizational inertia is often deduced from ideas that organizations have ‘deep’ structure.

In general, the concept of deep structure refers to choices made over time concerning how a system will be organized and the activity patterns that will run the system (Gersick,

1991). In an organizational context, deep structure may be understood as developed through a trail of strategic choices that start at the point when the purpose of the organization is initially defined and this is translated into core activities that enable the organization to fulfill its purpose. Over time, deep structure is proposed to lead organizations to favor options that align with previous choices (Gersick, 1991), so choosing products and services to produce, or markets to target, and deciding how to organize to ensure effective and efficient production, becomes dependent on earlier choices (Tushman and Romanelli, 1985). Since it leads organizations to rule out options that do not align with previous choices, and established activity patterns reinforce it, the deep structure of organizations is argued to be highly stable and difficult to change (Gersick, 1991).

The notion of deep structure is reflected in the literature on strategic IT alignment, which has heavily influenced research on IT-enabled organizational transformation (Besson and Rowe, 2012). The general idea of IT alignment is that organizations need to design and procure IT that enables them to achieve their strategic business goals (Chan et al., 1997). Reflecting the hierarchy of deep organizational structure, the strategic business goals of an organization are defined in a business strategy, which is derived from a higher-level corporate strategy. While the corporate strategy defines the business scope, i.e. particular business or portfolio of businesses that an organization is engaged in, the business strategy is concerned with how the organization should compete effectively within the product-market (or markets) set by the corporate strategy (Henderson and Venkatraman, 1999; Venkatraman, 1989). Within this discourse, IT strategy is concerned with allocating IT resources to best support the determined business strategy. IT strategy is seen as a functional strategy at the lowest level in the hierarchy, subordinate to both corporate and business strategies (Henderson and Venkatraman, 1999).

Venkatraman (1994) provides a useful framework for illustrating the extent to which IT can potentially transform organizations that maps the hierarchy of organizational strategies to different forms of IT-enabled change initiatives (Table 1). The framework consists of five levels of IT-enabled transformation, from simple automation of processes to the redefinition of business scopes. The first two levels are both considered to be evolutionary, implying that they entail minimal adaptations of business processes and organizational routines. The other three are considered revolutionary, meaning that they require more fundamental organizational transformation. The five levels also differ in terms of the overall scope of change they imply, the first three fostering change within the boundaries of a focal organization while the other two include changes to external processes and relationships.

At the first level, standardized and isolated IT systems or applications are deployed within particular functional units of the organization with small, if any, adjustments to existing business processes and organizational routines. The second level refers to cases where IT

capabilities are leveraged to improve whole business processes, often to automate them (or parts of them) to increase their efficiency. This commonly entails technical integration to ensure interoperability across systems, but rarely leads to any wider organizational restructuring. The third level involves leveraging IT capabilities to redesign business processes. The extent to which such activities manifest in wider organizational transformation depends on whether they are performed to make adjustments within an existing business strategy or enable a new business strategy. At the fourth level, IT is used to breach organizational boundaries in order to redesign or extend an organization's business network. This often involves reviewing and altering internal operations to enable exploitation of external resources, but it may also require the organization to question perceptions of organizational boundaries as solid and static and perceptions that IT's value is limited to streamlining internal operations. Lastly, the fifth level refers to instances where IT is leveraged to redefine an organization's business scope. This implies truly transformational outcomes since it entails redefinition of the types of business that organizations engage in and the exact activities that should be performed within and outside them.

Table 1. The five levels of IT-enabled organizational transformation (adapted from Venkatraman 1994)

Level of IT-enabled change	Expected organizational outcomes	Nature and overall scope of change
<i>1. Deploying isolated IT in a particular organizational unit</i>	Minimal internal change	Evolutionary intra-organizational change
<i>2. Leveraging IT to improve whole business processes</i>	Limited internal change	Evolutionary intra-organizational change
<i>3. Leveraging IT to redesign business processes</i>	Limited or extensive internal change depending on rationale for redesign	Revolutionary intra-organizational change
<i>4. Leveraging IT to redesign business networks</i>	Extensive internal and external change as well as reviewing assumptions about the organization and the value of IT	Revolutionary inter-organizational change
<i>5. Leveraging IT to redefine business scopes</i>	Fundamental internal and external transformation based on alterations to the core purpose and activities of an organization	Revolutionary inter-organizational change

Notably, the above framework aligns with the typology of IS innovations presented by Swanson (1994). As in Venkatraman's framework, this typology suggests that IS innovations may be hierarchically structured according to their potential for organizational and business impacts. Referring to IS innovation as new applications of IT that are principally managed by the IS departments of organizations, Swanson notes that only certain types of IS innovations are likely to lead to wider organizational change. To that end, basic IS innovations that are restricted to particular units of organizations (e.g. the IS unit) are argued to lead rarely to any changes outside of that unit. However, the closer IS innovation comes to influencing the external relationships, products and services of an organization, the greater its potential for generating fundamental organizational transformation becomes (Swanson, 1994). Overall, this suggests that while using IT to improve organizational processes generally results in limited organizational change, IT-enabled change to products and services, and the ways organizations attain resources to enable production of products and provisioning of service, tends to lead to more fundamental transformations.

Hence, so far, we have considered why organizational transformation is sought in relation to IT implementation and use, why that may not happen, but also when IT is likely to lead to organizational transformation. Often, it is initiated by the intent to use IT strategically for improving organizational performance, primarily in terms of increasing processes' efficiency. Such endeavors may face various forms of inertial resistance in the organizational context, but the closer an organization gets to making substantial changes to products and services, targeted markets, or organizational boundaries, the greater the potential for fundamental organizational transformation becomes. An important, but generally neglected, question this raises is how may IT implementation and use lead to organizational transformation? As noted in an extensive analysis of publications on IT-enabled organizational transformation: *“many papers develop discourse concerning the transformation, before and after [...] many case studies rely on stage models, assuming that [organizational transformation] follows a teleological model of diffusion. However, the mechanisms that explain the changes in stages and how events and actions unfold remain unknown”* (Besson and Rowe, 2012, p. 114).

Besson and Rowe's finding notwithstanding, at least three studies that adopt a process-oriented approach are worth mentioning here. Overall, they show that while processes of IT-enabled transformation are often initiated by strategic intentions to use IT to induce certain organizational improvements in a direct manner, the ways it actually unfolds are slow and gradual, with both intended and unintended organizational consequences. One, a seminal paper by Barley (1986), concerns the introduction and organizational consequences of installing computed tomography scanners in two hospitals. It shows how this led to similar outcomes in the two organizations as they both experienced disruptions in the established division of labor and relational roles, and both developed more decentralized organizational structures. Most importantly, however, the study shows that

one of the organizations became significantly more decentralized due to the particular circumstances of implementation and use in its organizational context. Hence, Barley argues that “*the scanners occasioned change because they became social objects whose meanings were defined by the context of their use*” (1986, p. 106). Taking a similar approach, Orlikowski (1996) examines how the implementation and use of a new IT system at a customer support unit led to changes in customer support agents’ practices, including the ways they interacted, distributed and coordinated work, and evaluated performance. These changes were initially triggered by the new IT system, but it was ultimately the customer agents that interpreted how it would enable or constrain their work, and changed their organizing practices and structures accordingly. Further emphasizing a situated view of IT-enabled organizational transformation, Robey and Sahay (1996) report how the introduction of a particular geographic information system in two similar organizations resulted in different processes and very different extents of organizational change. Based on these observations, they find support for “*the idea that information technology’s consequences are socially constructed, i.e., that technology’s social consequences depend upon its social meanings more than on its material properties*” (p. 106) and that IT-enabled organizational transformation is likely to be a gradual and continuous, rather than a radical and discontinuous, process.

To conclude, I have explained the phenomenon of IT-enabled organizational transformation in this section, outlined the body of research that has addressed it, and shown how particular theoretical assumptions have come to shape the general understanding of what it entails. In essence, the overall view that emerges is that of a process driven by the design, implementation and use of IT systems within an organization that leads to a change in the organization’s purpose and core activities through which it achieves it. The characteristics of IT systems and their strategic position within organizations suggest that IT-enabled organizational transformation is likely to follow a bottom-up trajectory. Initially implemented and used to support predetermined organizational purposes and activities rather than redefine them, lower-level changes caused by IT may generate new practices, routines and organizational structures that may lead to higher-level organizational transformation over time, through intended and unintended consequences. This process has primarily been seen as enclosed within the organization and primarily affected by internal social structures and dynamics. In the following section, I address digital transformation as a related phenomenon in that it involves organizational transformation with technology, but with a distinct trajectory from IT-enabled organizational transformation.

2.2 The content, context, and process of digital transformation

In this section, I review, synthesize and analyze the IS research literature concerning digital transformation for several purposes. First, I analyze how the phenomenon of digital transformation has been understood and addressed in previous IS research. Since

my ultimate aim is to claim a contribution stemming from my own process-oriented research, I approach the literature with specific consideration of its strengths and weaknesses in understanding and explaining digital transformation from a process perspective. Second, I draw upon the literature to distill a definition that is congruent with extant work but also generative of a process understanding of digital transformation. I then build on this definition to clarify how digital transformation may be seen as a phenomenon and concept that is related to but distinct from IT-enabled organizational transformation. Finally, I analyze and discuss the extant literature to explain the need for more research on digital transformation dynamics and the analytical elements required to facilitate such endeavors.

Briefly, my approach to collecting relevant literature was as follows. To generate a corpus representative of the current understanding of digital transformation in IS research, I searched for publications on the topic in all journals and conferences indexed by the Association of Information Systems (AIS) digital library, the journals in the AIS basket of eight that are not in the AIS digital library and the journal *Information and Organization*. This resulted in a total of 94 papers that I screened for presence of the term digital transformation in their title, abstract or keywords. This reduced the number of papers to 32, which were more thoroughly read to judge their relevance. After reading the papers, another five were excluded because they focused on IT-enabled organizational transformation rather than digital transformation (e.g. Schmid and Recker, 2017), or only used digital transformation in a background description of other phenomena (e.g. Goes, 2015). Initial reading also revealed that a limited number of papers on digital business strategy (e.g. Bharadwaj et al., 2013) and practitioner-oriented papers on digital transformation in management (e.g. Westerman et al., 2011) have provided important foundations for digital transformation research in IS studies. Therefore, including these papers, the corpus analyzed in the following review consists of 44 papers.

To understand how the phenomenon of digital transformation has been understood in previous research, and analyze the extent to which it can account for a process view of digital transformation, I draw on concepts of content, context and process presented by Pettigrew (1990, 1987). These concepts are useful since they are relatively easy to grasp, but powerful since they essentially capture the elements relevant to a process understanding of change. In line with Pettigrew (1987), *content* here refers to *what* is changing, and is therefore used to describe the phenomenon of digital transformation. *Context* refers to the inner organizational context and outer context of organizations, which, as explained by Pettigrew, may reveal much of *why* change happens over time. Finally, *process* refers to the actions, events and temporal patterns that drive change and may therefore explain *how* change happens.

Content: organizational change follows digital innovation

In terms of content, it is largely agreed that digital transformation refers to processes of holistic organizational change that are driven over time by changes to organizational means for value creation and appropriation. For example, it has been said to encompass “*the digitization of sales and communication channels, which provide novel ways to interact and engage with customers, [...] the digitization of products and services*” and “*the launch of digital business models that allow new ways of value capture*” (Haffke et al., 2016, p. 2). Similarly, Hinings et al. argue that digital transformation “*comes from the combined effects of several digital innovations*” (2018, p. 55). Hence digital product, service and business model innovation constitute the main content of change in digital transformation, but it also encompasses the consequential changes that an organization undergoes to accommodate these processes and their outcomes.

Besides product, service and business model innovation, digital transformation inherently entails changes to organizational structures and operations (Matt et al., 2015). An often-mentioned overall rationale for organizational redesign during digital transformation is to enable “ambidexterity” (Gimpel et al., 2018; Piccinini et al., 2015; Sebastian et al., 2017). This refers to enabling the organization to maintain efficiency and stability in order to keep exploiting existing business successfully, while simultaneously enabling agility to respond to emerging opportunities and threats. While general organizational ambidexterity is not necessarily a rationale unique to digital transformation, it is associated with the specific challenge of simultaneously managing legacy “physical” business and digital business (Karimi and Walter, 2015; Piccinini et al., 2015). As digital technology continuously evolves and fragments into new resources, it requires organizations innovating with it to align their arrangements so that a dynamic and heterogenous base of knowledge and skills can be accessed and matched to dynamic demands over time (Gimpel et al., 2018; Karimi and Walter, 2015). This may entail reorganizing innovation structures within the organization, shifting for example from static organizational units to agile cross-functional project teams formed to meet the situated requirements of particular tasks (Rigby, 2014). Primarily, however, digital transformation has been associated with the formation of relationships with actors outside the organization, for which digital technology may serve as an enabler. By leveraging standardized digital infrastructure, organizations may form or engage in inter-organizational networks that can provide them with complementary competences on a need-to-use basis (Andal-Ancion et al., 2003). Due to the holistic scope of organizational transformation involved, digital transformation has been associated with the appointment of Chief Digital Officers (CDOs) as a new management role within organizations that are often assigned to head digital transformation (Haffke et al., 2016).

To support new products, services and business models, and to enable and leverage changes to organizational structure, organizations need to reorganize internal operations, including routines, practices and IT during digital transformation (Matt et al., 2015).

Organizational ability to apply and change IT infrastructure to support new forms of digital business and inter-organizational collaboration is associated with superior business performance during digital transformation (Nwankpa and Roumani, 2016). However, while flexibility may be sought through infrastructure change, it is also important for operational structures to remain sufficiently stable and reliable to support legacy business (Gimpel et al., 2018; Sebastian et al., 2017). Further, digital transformation also entails exploration of possible ways to use digital technology for process innovation by extending the automation of operational processes and augmenting activities of human workers (Westerman and Bonnet, 2015), and for generating and gaining insights from customer use data (Alexander and Lyytinen, 2017; Woerner and Wixom, 2015).

Hence, drawing on extant research on the subject, the phenomenon of digital transformation may be described as processes of fundamental organizational change driven by the use of digital technology to foster innovation in organizational means for value creation and appropriation. Therefore, the content of change is primarily digital product, service and business-model innovation, but it also includes changes within organizations that are carried out as a result of, to enable, or to support new digital products, services and business models. Following this overall portrayal of what is changed in digital transformation, the next section examines what the literature has suggested regarding why and how digital transformation is initiated and unfolds.

Context: organizational conditions and organizational environments

As already mentioned, Pettigrew suggests that in order to understand why a process unfolds, we should examine the context in which the process is embedded and the interactions and interdependencies between them (1987). In the literature, elements of both the inner organizational context and outer organizational environment are recognized as potential triggers, enablers and inhibitors of digital transformation. Important internal drivers frequently recognized include organizational actors' explicit intentions. Viewed as a process of organizational change centered on enabling and exploiting digital innovation for competitive gains, it is often argued that the rationale behind digital transformation is the realization of digital business strategy within organizations (Haffke et al., 2016; Hartl and Hess, 2017; Kutzner et al., 2018; Matt et al., 2015; Nwankpa and Roumani, 2016). Defined as “*organizational strategy formulated and executed by leveraging digital resources to create differential value*” (Bharadwaj et al., 2013, p. 472) digital business strategy goes beyond the use of IT to increase efficiency and productivity, encompassing the strategic intent within organizations to leverage digital technology to acquire more direct competitive advantage and strategic differentiation (Bharadwaj et al., 2013). Overall, the view of digital transformation as a rational and strategic choice is prevalent across the literature. A notable exception among the screened papers mentions the possibility of unplanned outcomes in digital

transformation (Henriette et al., 2016), but provides little insight into exactly how, why and in what way this may manifest.

While less prominently than in literature on IT-enabled organizational transformation, digital transformation research has also located sources of inertia within organizations, primarily socio-cognitive limitations, inhibiting organizational cultures and specific tensions. For instance, it is argued that managers and employees need a digital mindset that fosters creativity, high ambitions, and activities that both explore new opportunities and exploit existing business (Gimpel et al., 2018). Particularly in the act of making sense of emerging digital technology, there is argued importance in seeing opportunities rather than challenges, and escaping cognitive schemes and assumptions formed through experience with legacy technology when exploring possibilities afforded by new digital technology (Westerman and Bonnet, 2015). The importance of a digital mind-set is also emphasized for revealing new opportunities associated with existing products and services (Iansiti and Lakhani, 2014), so it has been argued that managerial cognition may be the first thing that needs to change in digital transformation (Li et al., 2017). To avoid hampering the process of digital transformation, it is therefore said that organizations capable of fostering an internal culture that focuses on customer needs, and promotes openness towards new ideas and willingness to change, innovate and learn, will be more successful in digital transformation (Hartl and Hess, 2017). Finally, digital transformation has also been identified to generate specific tensions, primarily in processes where organizations with experience of physical product development attempt to integrate digital elements. As observed by Piccinini et al. (2015), this may result in organizations facing two conflicting logics for business and innovation, each promoting adherence to different rules and standards. As they may both be important for the organization's long-term competitiveness and survival, their conflicting relationship is a key management issue during digital transformation.

Hence, the inner context concerns conditions within organizations that enable and constrain digital transformation. Generally, a strategic intent regarding the use of digital technology for business purposes is assumed to reside within organizations and contribute to its initiation and evolution over time. As constraining conditions, the inner context may host different forms of inertia, stemming from cognitive and cultural path-dependencies and tensions emerging between the digital and the physical, and exploitation and exploration.

The outer context refers to the environments that an organization is embedded in and that come to influence and be influenced by processes of organizational change (Pettigrew, 1987). According to the literature, the outer context most relevant to the process of digital transformation is the technology and business environment within which organizations reside, digital innovation takes place, and digital products and services are used. The interest in outer context in the digital transformation literature is underlain by recognition

of how digital technology is altering industries and markets by eroding boundaries, shifting the basis of competition from individual products and services to complex digital platform ecosystems, and generating more open environments for innovation (Gimpel et al., 2018; Piccinini et al., 2015; Woerner and Wixom, 2015). These structural transformations of the outer context have been argued to be generative of both challenges and opportunities that motivate the redesign of value propositions with digital technology (e.g. Hansen et al., 2011; Hartl and Hess, 2017; Matt et al., 2015). As noted by Haffke et al. (2016), the business and technology environment constitutes both a source of challenges and a provider of resources that trigger and enable digital transformation:

“[t]he pressure to include digital elements in a company’s business strategy is primarily driven by the external environment. Changes in customer behavior and needs, competitors’ demonstration of digital advances, new market entrants with disruptive digital business models, and the technological progress in general create opportunities and threats to established firms” (Haffke et al., 2016, p. 11)

In terms of challenges, Hinings et al. argue that digital transformation *“starts when there is disruption and destruction of established business models, value chains and organizational processes”* (2018, p. 56) and proceed to explain how this may be brought about through new digital technologies and associated actors emerging in an organization’s environment. Often captured by the term digital disruption (Karimi and Walter, 2015; Sebastian et al., 2017), digital business and technology environments are prone to change with the entrance of new actors with digital innovations that build on and promote new relationships and business conditions that are often difficult for incumbent organizations to respond to. Further, it has been argued that consumer behaviors, preferences and expectations are becoming increasingly dynamic due to the rapid diffusion of digital consumer products and services, and that organizations need to engage in digital transformation to improve their ability to align with this dynamism (Henriette et al., 2016; Piccinini et al., 2015). Consequently, competitive, technological as well as user-driven changes pose important challenges in the outer context of organizations that may motivate them to transform.

The technology and business environment of organizations is also often emphasized as a source of opportunities and resources that enable them to improve and alter their approach to value creation and appropriation. In order to redesign organizational structures to improve their alignment with a dynamic outer context and support for innovation, organizations have been found to establish relationships with external actors during digital transformation, leading to the formation of business networks that span organizational and industrial boundaries (Piccinini et al., 2015). Further, since emerging digital products and services launched by external actors are often designed for use by other digital products and services, they often represent opportunities for focal organizations to expand the functionality or reach of their own products and services. By

engaging with external digital platforms, for example, organizations can accelerate product development and enable the distribution of products and services to a global customer base with relative ease (Gimpel et al., 2018).

In conclusion, regarding the role of outer context, there is a strong consensus that the business and technology environment in which organizations and digital transformation are embedded is a dynamic generator of challenges, opportunities and vital resources that feed into digital transformation at the organizational level. That said, the literature also tends to relegate the business and technology environment to the background, drawn upon primarily to motivate why organizations initially need, or are able, to launch digital transformation initiatives. Interactions and interdependencies between organizations and the outer environment are often assumed rather than empirically observed, so there is a general lack of theorization regarding the outer context and its role in digital transformation. Studies that have adopted the concept of digital ecosystems come closest to theoretically describing the business and technology environments of organizations and their interactions in digital transformation processes. Thus, approaches and frameworks including this concept may have the greatest potential for improving knowledge about digital transformation (e.g. Gimpel et al., 2018; Haffke et al., 2016; Hinings et al., 2018; Piccinini et al., 2015; Tan et al., 2017).

Process: continuous digital innovation in context

Pettigrew (1987) takes process to mean the temporally interdependent actions and interactions that drive change over time, and in those terms extant literature on digital transformation is sparse. Since longitudinal studies of digital transformation are rare (Kutzner et al., 2018) the field is primarily dominated by either conceptual papers (e.g. Hinings et al., 2018), or empirical research with a static approach to digital transformation (e.g. Gimpel et al., 2018; Hartl and Hess, 2017). Hence, overall the literature reflects the input-output view and an emphasis on managerial force majeure. Therefore, a considerable amount of empirical papers on digital transformation focus on drawing causal relationships between specific digital technologies and areas of organizational improvement, such as the impact of big data capabilities on business models (Woerner and Wixom, 2015) or social media on value propositions (Berman, 2012). Others focus on areas within organizations that are important to consider or can be fruitfully changed during digital transformation (Gimpel et al., 2018; Matt et al., 2015); the managerial challenges associated with digital transformation (Piccinini et al., 2015; Westerman and Bonnet, 2015); and factors affecting the success of digital transformation, such as organizational competencies (Alexander and Lyytinen, 2017) and organizational culture (Hartl and Hess, 2017), without considering temporal dynamics.

Notable exceptions include Li et al. (2017), who investigate the digital transformation of seven small firms within the Alibaba platform ecosystem. Overall, their study suggests that digital transformation may be a cyclical process that starts with managerial

capability-building, primarily based on learning and cognitive renewal, that enable them to better see the potential of digital opportunities. This development then provides a foundation for organizational capability-building, in which the organizational structure and resources are altered to accommodate the realization of innovation. Finally, strategic change is implemented, based on the identified opportunity, and if these changes lead to the identification of new opportunities, the cycle starts again. Their study also indicates that relationships and interactions with a technology and business environment may both enable digital transformation and pressure organizations to never stop transforming. While Alibaba provided the organizations with important resources throughout the three stages as an external digital platform, the authors also observe that companies likely need to continuously transform themselves to market and technology change, leading them to “*emphasize that digital transformation [...] is likely a never-ending iterative process*” (Li et al., 2017, p. 16). Another processual account of digital transformation is provided by Heilig et al. (2017), who primarily focuses on the horizontal level by showing how results of prior digital innovations create enabling conditions for future digital innovation in the context of maritime ports. Spanning a period of almost 40 years, their study highlights the cumulative nature of digital transformation, but stops short of theorizing the process of digital transformation, focusing instead on providing insights into some of its critical aspects and challenges.

In summary, these two studies direct attention to certain aspects of the process of digital transformation. First, they both indicate that digital transformation is a cumulative process where one cycle of digital innovation generates conditions for the next, in accordance with other descriptions of digital transformation as being the result of several digital innovations (Hinings et al., 2018). Second, the observation by Li et al. (2017) concerning the nature of digital transformation as a never-ending process inherently dependent on environmental factors deserves further attention. Elsewhere, it has also been argued that digital transformation is a continuous undertaking (Matt et al., 2015) and since dynamic environments will change and generate new opportunities and challenges over time, digital transformation trajectories will likely have to be continuously adjusted (Gimpel et al., 2018; Matt et al., 2015; Tan et al., 2017). However, this has not yet been studied empirically.

2.3 Defining and distinguishing digital transformation

There are two main objectives in this section. First, drawing on the analysis of existing literature presented above, I distill a definition of digital transformation that supports its continued theorization as a process. Second, I compare and contrast IT-enabled organizational transformation and digital transformation to distinguish them as related but distinct phenomena and concepts. Underlying the latter objective is my intent to maintain and protect the cumulative theorizing on what I see as two types of phenomena that share some common characteristics but are sufficiently distinct to require different

conceptualizations and explanations. Therefore, I engage here in detailing the conceptual foundations that I consider useful for staking out the boundaries of each concept.

Recollecting my analysis of the content of digital transformation, it has been understood to refer to processes where digital technology is used primarily to change market-facing elements of an organization, but also to include the changes within organizations that result from, or are carried out to enable, new digital forms of value creation and capture. Since the primary scope of change is directed at the products, services and business models of organizations, digital transformation entails alterations to the path-dependent core that defines what an organization does and how it does it, more specifically affecting its purpose, boundaries and activities (cf. Aldrich and Ruef, 2006; Gregory et al., 2015; Piccinini et al., 2015; Venkatraman, 1994). It is also apparent that digital transformation does not occur in isolation, but is inherently influenced by challenges, opportunities and resources within both inner and outer contexts. While the relationship between the outer context and digital transformation has usually been relegated to the background and perceived to be directed outside-in, limited research has also indicated that this is an important two-way relationship and shown the potential of the digital ecosystem concept to enable its theorizing. Finally, my analysis of investigations and understandings of the process of digital transformation revealed a general dearth of processual empirical accounts in the reviewed literature. However, the hitherto limited empirical insights and conceptual work support a view of the process of digital transformation as unfolding through successive processes of digital innovation and organizational capability-building. Further, although extant research on digital transformation is dominated by the idea of a teleological process driven and under the control of managers, the long tradition of studying the relationship between technology and organizational change within IS research tells us that we are likely to encounter strategic intent, emergent strategy as well as unintended consequences. These characteristics are all embodied as I distill them into a definition of digital transformation as:

Emergent processes of qualitative organizational change driven by continual digital innovation situated in digital ecosystems

To clarify the distinction between IT-enabled organizational transformation and digital transformation as defined here, we may more closely examine their respective conceptual constitutions. First, IT-enabled organizational transformation concerns the development, use and implementation of IT. IT refers to hardware and software artifacts that are often clustered into a delineated system defined by its purpose within organizations. Generally, IT systems are designed and used to inform, automate, co-ordinate and control, and their essential business value stems from their ability to improve organizations' operational efficiency. While malleable and highly likely to be altered by degrees over time, IT systems are also likely to remain true to the purpose for which they were initially designed and thus retain their overall shape and meaning. In contrast, digital transformation

concerns the use of digital technologies to redesign existing or create new products, services and business models. I argue here that digital technology refers to resources whose primary ability is to be unboundedly recombined and reprogrammed, essentially rendering them inherently dynamic and distributed. Rather than being designed and maintained over time to serve a particular organizational purpose, digital technologies are often designed to enable customization, integration and combination, and are therefore assigned with ambivalent ontologies (Kallinikos et al., 2013). In making this distinction, I build on previous descriptions of digital technology as a new “*species of IT artifact*” (Tilson et al., 2010, p. 756) and as essentially “*different animals*” from IT (Besson and Rowe, 2012, p. 116). In part, this reflects technological capabilities gained with the emergence of global digital infrastructure (Tilson et al., 2010) and distinct digital architecture (Besson and Rowe, 2012; Yoo et al., 2010). However, since contemporary IT and digital technology both rest on, or are at least essentially compatible with, similar infrastructure with similar capabilities, they are both theoretically capable of being and supporting dynamic and distributed artifacts. What largely confines IT and makes digital technologies open and flexible then is how human actors assign meaning to them and decide to use them in research as well as in practice.

Table 2. Distinctions between IT-enabled organizational transformation and digital transformation

Main theoretical assumptions	IT-enabled organizational transformation	Digital transformation
Conceptualization of technology	<i>IT</i> : Relatively static and delineated technology that primarily enables automation, information, coordination and control	<i>Digital technology</i> : Dynamic and distributed technology that primarily enables combination and value orchestration
Strategic foundation	<i>IT (IS) strategy</i> : IT is an enabler aligned to business strategy	<i>Digital business strategy</i> : Digital technology is an innate part of business strategy
Type of innovation	<i>IT (IS) innovation</i> : the organizational application of new IT, often to make processes more efficient.	<i>Digital innovation</i> : The design, development and exploitation of new digital products, services, business models and processes.
Consideration of context	Focus on <i>inner organizational context</i> , particularly deep organizational structure and internal social dynamics	Focus on <i>inner and outer organizational contexts</i> , particularly inter-organizational business and technology dynamics

Second, IT-enabled organizational transformation and digital transformation are associated with different approaches to strategic use of technology. As previously clarified, IT-enabled organizational transformation is closely intertwined with the concept of strategic alignment where IT is seen as an enabler of, and subordinate to, the business goals of an organization (Bharadwaj et al., 2013; Haffke et al., 2016; Henderson and Venkatraman, 1999). Within the strategical hierarchy of organizations, IT is therefore often seen as a tool for improving the efficiency of processes under an established regime of determined markets, products and services. Digital transformation, in contrast, is connected to the realization of digital business strategy where digital technology is promoted to a rank of direct strategic business importance. Digital business strategy includes leveraging digital technologies for actual product and service innovation and for ensuring and maintaining their operation and strategic positioning in the external environment (Bharadwaj et al., 2013).

Third, IT-enabled organizational transformation and digital transformation are associated with different forms of innovation. While the former is driven by the application of IT within organizations primarily to realize process innovation (Swanson, 1994), the latter is driven by digital innovation to realize product, service, business-model and process innovation (Nambisan et al., 2017) and hence is more likely to involve more fundamental and direct change to what an organization does and how it does it (Swanson, 1994; Venkatraman, 1994).

Lastly, due to the conceptual characteristics of IT and digital technology, their strategic use in organizations, and their respective scopes for innovation, organizational contexts and environments play different roles in IT-enabled organizational transformation and digital transformation. In IT-enabled organizational transformation, the inner organizational context is often regarded as playing a major role in transformation processes. Moreover, in traditional IS research literature organizations are generally viewed as relatively stable entities delineated by identifiable boundaries (Majchrzak et al., 2016) and IT-enabled organizational transformation as unfolding within those boundaries, isolated from the outer environment. This view is corroborated in a review of the literature on IS change by Lyytinen and Newman (2008), as follows

“past studies build primarily ‘horizontal’ descriptive or prescriptive process explanations of IS change [...] [a]s they mostly focus on one level of change they tend to forego interactions with multiple systems and the organizational environment” (Lyytinen and Newman, 2008, p. 592)

In contrast, a key argument made here is that empirical characteristics of digital transformation, and the underlying theoretical foundations shaping its conceptualization, demand its consideration as a process inherently embedded in and affected by, not only local organizational contexts, but also wider organizational environments. The relevant

outer context in IT-enabled organizational transformation may be stretched to include institutional, social, political and competitive environments (Lyytinen and Newman, 2008; Orlikowski and Barley, 2001). However, digital transformation is a process influenced by external innovation agency (Nambisan et al., 2017) and the emergence of external technology threats and opportunities, which require recognition of an outer technological environment as well.

To conclude, I suggest here that IT-enabled organizational transformation and digital transformation may be seen as related but distinct concepts that are intended to capture slightly different phenomena. Essentially, IT-enabled organizational transformation is seen here as primarily driven by the use of IT to upgrade organizational performance within a regime defined by existing products, services and business models. Therefore, it usually involves improvements of quantifiable variables (e.g. faster and cheaper production or more efficient customer service) to improve support for what an organization does and how it does it. In contrast, digital transformation is seen here as primarily driven by digital product, service and business model innovation, which involves more direct and qualitative changes to what an organization does and how it does it. By mapping IT-enabled organizational transformation and digital transformation to subtle differences in their approach to strategy, innovation and context, I have shown here why and how they may both be distinctively defined. Next, I build on existing research and the definition of digital transformation presented here to corroborate my assertion that process-oriented research on digital transformation is needed, and identify particular elements required for fruitful analytical foundations for such studies.

2.4 Digital transformation dynamics: the need for a process framework

Evidently, digital transformation is a key concern of many contemporary managers (Fitzgerald et al., 2013; Kappelman et al., 2018). Moreover, since it concerns the relationship between technology and fundamental organizational change, digital transformation issues and practical approaches to handle them should presumably be major concerns in IS research. However, they have received little attention to date. For example, Gerster (2017) found that digital technologies, digital innovation and digital transformation were only addressed in about 2% of the studies published between 2007 and 2016 in the most high-profile IS journals.

In my analysis of the literature on digital transformation presented in section 2.2, I note that the bulk of IS research primarily emphasizes the inputs and outputs of digital transformation by focusing on mapping causal relationships between broad categories of digital technology with abstract features and the improvement of specific organizational elements. Often, factors within the inner context of organizations (such as management leadership or organizational culture) have been proposed to modulate this relationship. These approaches have apparent merits, primarily in their ability to abstract and quantify

complex empirical phenomena and claim widely generalizable findings. They have also been important in building an initial body of knowledge on digital transformation. At the very least, they have contributed by defining and staking out an important area of research and raised awareness of some of the opportunities and challenges it encompasses, and made headway in producing a general understanding of how they may be exploited and managed.

However, I also find that limited attention has been paid to understanding the process of digital transformation. Thus, we have limited knowledge about the ways in which digital transformation is actually carried out by organizational actors situated in inner and outer contexts over time. It has been argued that digital transformation is likely to involve the development, adoption and use of several digital technologies (Lanzolla et al., 2018). It has also been claimed that digital transformation is best understood as constituted by the cumulative effects of several digital innovation processes (Hinings et al., 2018), and that organizations probably need to reassess and redirect their strategic transformation trajectories over time due to technology and market evolution (Li et al., 2017; Matt et al., 2015). However, these claims have not been previously empirically tested and confirmed. Hence, vital questions have remained unexplored. I argue here that, in order to study and theorize the process of digital transformation in ways that allow such issues to be addressed, IS research needs theoretical foundations that enable capture of the dynamics of digital transformation.

By dynamics, I refer here to the social and technological elements and the interactions between them that stimulate changes that either constitute digital transformation or are relevant to how it unfolds over time. Thus, a longitudinal perspective of digital transformation is needed to address digital transformation dynamics, directed towards understanding its sequential and cumulative nature and why and how organizational actors may come to redirect transformation trajectories over time. In addition, the technology and business environment of organizations, and the interactions and interdependencies between them over time, must be recognized as integral elements of digital transformation dynamics. These observations highlight at least four requirements for a conceptual framework to facilitate analyses of these dynamics. First, it must be based on and support an approach to organizational change that acknowledges social agency, which may be both enabled and constrained by technology. Second, it must recognize digital innovation, not as discrete instances, but as successive and possibly interdependent processes and outcomes driven and produced by organizational actors over time. Third, it must provide means for understanding and theorizing the situated nature of digital transformation over time, including how and why actors act based on relevant enabling and constraining conditions in inner as well as outer contexts. In addition, it must recognize the possibility of these conditions changing through both external and internal actions. With the ultimate purpose of developing a conceptual

framework for understanding and theorizing digital transformation, I address the requirements identified here in chapter 5.

3. Research design

Since I detail the specific methodological approach taken in each of my studies in the appended papers, my aim here is to provide an overview of my philosophical underpinnings, the methodological choices I have made, and how these have come to shape my research. To that end, I begin by explicating my ontological view on causality in the relation between technology and organizational change. Following that, I explain and motivate my choice of process-oriented case studies as means to scientific enquiry. Lastly, I outline the approach I have taken to collect and analyze data in the appended papers. Since I account for my own actions and rationales, but also for the actions of coauthors, I refer to both myself as ‘I’ and to ‘we’ as in the author teams in this chapter.

3.1. An emergent perspective on technology and organizational change

Within the IS literature, technological determinism, an organizational imperative perspective and an emergent perspective represent three dominant ontological assumptions regarding causality in the relationship between technology and organizational change (Leonardi and Barley, 2010; Markus and Robey, 1988; Orlikowski, 1996, 1992). Since this dissertation concerns digital transformation and thus essentially addresses the relationship between technology and organizations, it is of relevance that I clarify my ontological position in relationship to these perspectives. As illustrated by Leonardi and Barley (2010), these perspectives have gone in and out of research fashion in a way that can be likened to the swing of a pendulum. Accordingly, early explanations of how the implementation and use of IT would affect organizations assumed technology to have a deterministic impact, i.e. that it would determine or strongly constrain the behavior of human actors and that organizational change could be predicted based on the features that a technology had (Markus and Robey, 1988b). During this era, Kling (1999) describes how research addressing phenomena related to computerization was almost exclusively designed towards answering questions of a deterministic nature, i.e. what will happen in organizations if a particular type of technology is implemented? Similarly, Orlikowski notes how adopters of technological determinism treated technology *as an independent influence on human behavior or organizational properties, that exerts unidirectional, causal influences over humans and organizations, similar to those operating in nature*” (1992, p. 400). Primarily because it does not recognize the agency of social actors, technological determinism has been criticized for leading to oversimplified explanation that do not account for any proactive organizational change nor the ways in which social actors customize technology in use (Orlikowski, 1996).

As a counter-reaction to technological determinism, the pendulum therefore later swung over towards an organizational imperative perspective that directed focus on human

voluntarism (Leonardi and Barley, 2010). In describing their differences, Markus and Robey state that:

“[w]hereas the technological imperative argues that information technology constrains or determines human and organizational behavior, the organizational imperative assumes almost unlimited choice over technological options and almost unlimited control over the consequences” (1988b, p. 587)

Also referred to as the strategic choice model (Orlikowski, 1992), and planned change (Orlikowski, 1996), the organizational imperative assumes that powerful organizational actors, such as managers and designers, are the primary source of organizational change. Primarily managers are attributed with almost unlimited agency to strategically choose what IT to develop and implement, and to control the organizational consequences, so that IT-enabled organizational change manifests as the realization of a pattern exactly as originally intended (Orlikowski, 1996). Similar to technological determinism, the organizational imperative leads to a general focus on the inputs and outputs of technology-enabled organizational change (Markus and Robey, 1988b), and to explanations that fail to recognize empirical complexity.

Recognizing the lack of empirical fidelity and general inability to account for processes of change with technological determinism and the organizational imperative perspective (Markus and Robey, 1988b), I explicate my ontological stance to align with an *emergent perspective* on technology and organizational change. The emergent perspective directs focus to the situated outcomes of actors engaging with IT. While recognizing that it has bifurcated into several related streams (Leonardi and Barley, 2010), the emergent tradition can still be said to share ontological assumptions that highlight certain aspects of technology-enabled organizational transformation as particularly important. *First*, by adopting an emergent perspective, I highlight the nature and importance of human agency. The argumentative baseline for this aspect is that organizational transformation cannot be understood as the direct result of features embedded in technology. While technology has the potential to enable organizational transformation, it can only be realized by human actors that translate this potential into actual organizational outcomes (Boudreau and Robey, 2005). Overall, I emphasize the ability of human actors to shape their environments and their objectives (Leonardi and Barley, 2010) including not only managers and designers, but all human actors that design, use or strategize with technology. *Second*, by adopting an emergent perspective, I direct focus to the importance of context. Opposing deterministic explanations of IT-enabled organizational change, the emergent perspective assumes that technology only occasions change, and that the change occasioned by similar technologies is highly likely to be different in different contexts (Barley, 1986; Leonardi and Barley, 2010). *Third*, I pay particular attention to the ways in which technological materiality comes to enable and constrain the actions of human actors, and how human actions in turn come to shape materiality. Thus, while I recognize

that human actors can be flexible in their interpretation of technology in both design and use processes, and thereby come to take different actions at different times, I also emphasize that this flexibility is not infinite (Orlikowski, 1992) and that there are situations where materiality is rigid. For me, this has become particularly evident in the analysis of design processes where digital products and services need to be developed in ways that align with the materiality of other digital technologies, e.g. how mobile app development needs to align with what is possible and allowed by the rules and resources of a mobile platform. *Lastly*, with an emergent perspective I direct attention to process. Specifically, I assume that materiality and other social structures will change over time, and that this will alter core conditions for human actors as change agents. This opens up for seeing digital technology as malleable, and that it is therefore likely to be changed over time by human actors who thereby alter the structural properties for their subsequent actions (Orlikowski, 1992). Further, I assume other structural aspects of the organizational context as likely to change, either as the result of internal or external actions, and that this in turn enables and constrains new types of actions (Boudreau and Robey, 2005; Orlikowski, 1992). Moreover, with a focus on process, I direct attention to the ways in which past experience and future plans come to influence present interpretation and action (Boudreau and Robey, 2005). Ultimately, with an emergent perspective I therefore regard technology-enabled organizational transformation as a processes unfolding as the result of both intended consequences of technology design and the unintended consequences of IT use, making it a dynamic process constituted by both deliberate and unanticipated change (Orlikowski, 1996).

In all, an emergent perspective on technology-enabled organizational transformation hence suggests that it is driven by human actors that design and use technology, that it is enabled and constrained by digital materiality, that it is situated in context, and that it is inherently processual. This resonates with both substantive metaphysics and process metaphysics that underlie studies that adopt a process methodology. While the former assumes change as something that happens to entities that while changing retain their overall identity over time, the latter views the world itself as constituted by processes and entities as just temporary instantiations in constant becomingness (Langley and Tsoukas, 2017a). In the following section, I explain how I have in my studies travelled along the continuum between substantive and process metaphysics, and how an emergent perspective on technology and organizational change and the general ontology inherent to a process orientation aligns with an interpretative epistemology.

3.2. Process-oriented case studies

In all of the appended papers that are based on empirical studies, I have adopted a longitudinal case study design and process methods for the collection and analysis of data. A case study is “*an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and*

context are not clearly evident” (Yin, 2003, p. 13). It is particularly suitable as an approach to scientific enquiry when the researcher has little or no control over the empirical phenomena s/he is studying, and when the researcher seeks to answers questions of ‘why’ and ‘how’ (ibid). A longitudinal case study is therefore the study of a phenomenon that unfolds over time where the researcher seeks to answer why and how it unfolds (Yin, 2013). As such, the objective of longitudinal case studies are congruent with process study methods that are overall oriented towards “*understanding how things evolve over time and why they evolve in this way*” (Langley, 1999, p. 692).

To understand and theorize processes, I have assumed an *interpretative stance*, which has had specific implications on the ways in which my studies have been conducted and how I have come generalize from them. *First*, I have sought to understand that which I study “*by iterating between considering the interdependent meaning of parts and the whole that they form*” (Klein and Myers, 1999, p. 72). To that end, I have iterated between the identification of specific incidents, micro-processes and driving mechanisms to understand processes of wider change and temporal scale. An example would be how we in Paper 3 iterate between specific micro changes, how micro changes were temporally connected, how they came to produce the change that represented phases, and how phases in turn could explain the overall evolution of a digital service platform. *Second*, I have put emphasis on the importance of context in order to providing readers with the background that explains the research setting (Klein and Myers, 1999), but primarily because contextualization is an inherent part of process study methodology (Langley and Tsoukas, 2017a) that rests on the assumption that interactions between actors and their inner and outer contexts often serve to explain why processes unfold in certain ways (Pettigrew, 1987). Further, for interpretative studies in general (Klein and Myers, 1999), and or process studies in particular (Langley and Tsoukas, 2017a), it is important to acknowledge that contexts change over time. Therefore, all my empirical studies account for context, how contexts change, and how this relates to the process studied in detail, and all papers include background descriptions of the cases studied to the extent that it has been possible within given space limitations and to ensure that informant anonymity is maintained (the latter being relevant primarily in Paper 2). *Third*, I have sought to understand processes through accessing the interpretations of other persons, either as expressed in oral interviews or in written form (Walsham, 1995). Therefore, it has been important to recognize that social actors are likely to make different, sometimes conflicting, interpretations of their context and therefore seek to take different actions (Klein and Myers, 1999). In the appended papers, this is perhaps most evident in Paper 1 where we identify conflicting frames and actions for each narrative. *Lastly*, I have conducted my studies with the intent of theoretical rather than statistical generalization (Walsham, 1995; Yin, 2013). To that end, the use of theory has been critical in guiding me in designing my studies and in collecting and analyzing data, and I have contextualized my findings within existing research so as to clarify how I contribute to the cumulative progress of theorizing (Walsham, 1995; Weick, 1995). In so doing, I have

leveraged the strength of a single case study design to enable in-depth examinations that would not have been possible with other designs (Flyvbjerg, 2006) to embrace the complexities of empirical processes and through theoretical abstraction improved the general understanding of certain types of change. For example, in Paper 2, I apply concepts native to cluster theory as well as the concept of institutional logics as “a sensitizing device” (Klein and Myers, 1999, p. 75) to study an empirical instantiation of cluster evolution. Through theoretical abstraction, I generalize my findings to extant cluster theory and contribute to the body of knowledge on how clusters evolve.

To provide an overall description of how I have utilized process methodology to understand and theorize certain forms of change, the model for categorizing process studies provided by Langley and Tsoukas (2017b) is useful. They suggest that process studies may be overall categorized based on the approach taken to process and the focus of the research. In terms of approach, process may be studied either from the inside with an interest of capturing the meaningful experiences of actors, or from the outside with the intent of capturing the development of phenomena over time. In terms of focus, process research may be divided into studying process in the flow or after the fact. While the former aims to study process as it is being enacted, the latter usually takes off at a particular outcome or state and trace the process backwards to understand how it came to be.

Table 3. Four process research categories (adapted from Langley and Tsoukas 2017, p.54)

Focus of research	<i>In the flow</i>	Prehensive	Configurational
	<i>After the fact</i>	Reconstructive	Developmental
		<i>From within</i>	<i>From outside</i>
Approach to process			

The two types of focus and two types of approaches manifests in four main categories of process research (see table 3) First, prehensive studies aim to capture process from the inside as it unfolds. To that end, researchers examines how the past influences the present and how meaning and experiences evolve in real time by situating themselves close to or within the process. Second, configurational studies also seek to capture process when it

unfolds, yet from the outside. Such studies seek to understand patterns in a flow and the actions that make up the pattern rather than the experience of agents. Third, reconstructive studies seek to capture process in retrospect from the inside. This usually entails focusing on a particular outcome, event or state and understanding how it came to be by studying the evolution of meaning and experiences often with an explicit aim to highlight dependencies between the past, present and future. Finally, developmental studies account for process in retrospect from the outside. Such studies aim to understand how a particular outcome, event or state came to be by studying the process producing it backwards. The different categories represents ideal types and a single process study may combine elements from several categories in order to investigate process from different angles (Langley and Tsoukas, 2017b). To clarify their focus and approach in relation to process, the empirical papers appended to this dissertation can be categorized as follows. Paper 1 combines elements from all categories, yet it is mainly reconstructive in nature. In that study, we combine retrospective interviews and archival data to trace process back in time with interviews and observations that regard events as they unfold. In Paper 2, I strive towards understanding a process by tracing it backwards from a particular state. To that end, I engage with secondary data to understand what had changed but also interviews to capture the meanings and experiences of actors involved in the process. Hence, paper 2 can be positioned at the intersection between reconstructive and developmental. Paper 3 aligns clearly with the developmental category as we seek to understand the process leading to a particular digital platform becoming the dominant actor in its field through analysis of secondary retrospective data.

Having thus provided an overall view of longitudinal case studies, an interpretative stance and process methods and how they have come to guide me in my research, I now turn to outlining how I have accordingly collected and analyzed data.

3.3. Data collection and analysis

Process data can be characterized as inherently longitudinal, rich and varied (Langley et al., 2013). Since process method is geared towards observing and understanding how processes unfold over time, it relies on the collection of longitudinal data, and the relevant sample size for a process study is determined by the number temporal observations it includes (Langley et al., 2013). This has led me to always strive towards collecting data that allows me to account for the relevant empirical events in a process as completely as possible. To that end, I have in the appended papers combined data collected in real time with different forms of retrospective data, including interviews, archival material, web data, annual reviews and project documents. Further, as process phenomena inherently tends to extend not only over time but also over space (Langley, 1999) and since it cannot be fully understood without consideration to the inner and outer context in which the process is embedded (Pettigrew, 1987), I have in the appended papers collected data to take multiple levels of analysis into account. For example, to understand the evolution of

the network in Paper 2, I collected data that allowed me to understand what had happened in individual organizations, key events and developments in the region and how scopes in individual and collaborative projects had developed over time. In that paper, as well as in Paper 1 and Paper 3, this has implied the collection of data that is rich, varied and complex and therefore reflective of the organizational phenomena I have studied.

To analyze data that is longitudinal, rich, varied and complex is not an easy task. Indeed, as put by Langley, “*process data are messy. Making sense of them is a constant challenge*” (1999, p. 691). To assist me in this endeavor, I have leaned on a procedure that overall can be described as stabilization, segmentation and replication. First, stabilization has inferred pinning down and structuring the flow of reality to enable it to be systematically analyzed (Langley and Tsoukas, 2017a). Depending on the particular case and what is studied, this step has implied somewhat different activities. Particularly in Paper 3, we collected a broad sample of data that spanned an extended time period, and data structuring therefore involved the preliminary step of screening the collected data in order to exclude that which was irrelevant to the process we were trying to understand and theorize. In order to determine the relevance of the collected material we drew upon established concepts in the discourse on digital platform evolution to construct an initial conceptual framework that we considered broad enough to overarch the phenomena studied and specific enough to exclude irrelevant actions and events. After we had converged on the meaning of each concept and that we had grounded them sufficiently in existing research, we utilized the concepts to sift out data that were not related to these concepts. When the collection of data has been considered to contain at least mostly relevant data, the next objective of stabilization has been to temporally arrange relevant empirical events and actions between a beginning and an end. At this stage, I have sought to arrange empirical events in a systematic way that allows me to understand “*the stories about what happened and who did what when*” (Langley, 1999, p. 692). Key here has been to structure in temporal order, and to get as complete a picture as possible, of the actors involved, what actions, choices, incidents that have occurred and when, and whether the process has been influenced by gradual background trends (Langley, 1999). The output of this step has been two analytical artifacts: a timeline that has been used as a visual mapping tool (Langley, 1999) and an event sequence database (Poole et al., 2000). Even though timelines have never been published in the final version of any of the papers so far, they have been vital for making sense of and analyzing data in Paper 1, Paper 2 as well as in Paper 3. To these ends, I have found that timelines have been useful since they provide an overview that facilitates communication within research teams, and therefore, I have often developed different versions during the analysis process to represent different levels of theoretical abstraction. While timelines have thus served to provide process overviews, event sequence databases have provided structured and detailed information about specific empirical events. To give an idea of the detail of this information, table 4 shows one entry in the event sequence database constructed for the analysis in Paper 3.

Table 4. An example of one event in the event sequence database for Paper 3

Label	Information
<i>Title</i>	Spotify App Finder is launched
<i>Event nr.</i>	2.2.1
<i>Date</i>	20111214
<i>Condensed description</i>	Spotify’s proprietary apps for desktops (i.e. windows and macOS) now feature the App Finder, an “app store” through which users can search for install applications. Applications are developed by third-party developers through using a Javascript API provided by Spotify and HTML5 (submissions for apps opened 30/11 2011). All apps have to be submitted to an approval process before they become available.
<i>Architecture effects</i>	A new interface is established to enable third-parties to develop and distribute apps within Spotify desktop applications
<i>Governance effects</i>	App approval process instated. No monetization of apps offered. Premium not required for use.
<i>Ecosystem effects</i>	The new interface may attract developers and enable users to customize the service.
<i>Verbatim description</i>	(this field contains the text from the original blog post(s) in full)
<i>Url</i>	(this field contains the link to the original source(s))

Second, segmentation has involved the decomposition of a process along its horizontal and its vertical dimensions. Here, the horizontal dimension refers to “*the sequential interconnectedness among phenomena in historical, present, and future time*” while the vertical dimension refers to “*interdependencies between higher or lower levels of analysis upon phenomena to be explained at some further level*” (Pettigrew, 1990, p. 269). Hence, horizontal segmentation has concerned analyzing the temporal structure of a process to identify discontinuities or key events over time that have been useful for breaking down a process into smaller temporal segments. As can be seen in Paper 1, horizontal segmentation of the process studied is conducted through the identification of distinct narratives, and in Paper 3, we identify fundamental changes to the Spotify platform that we use to divide the process into phases. Vertical segmentation, on the other hand, has implied identifying processes and events that have had relevant influence on, or been affected by, the focal process studied, yet reside on other analytical levels. For example, we consider the ways in which changes to platform architecture and governance generates conditions for a surrounding platform ecosystem in paper 3. As exhibited by

these examples, the use of relevant theory has been important for both horizontal and vertical segmentation.

Finally, I have relied on longitudinal replication to leverage the horizontal and vertical segmentation done in the previous stage to examine vertical interactions and dependencies in each temporal segment, and how outcomes in each segment comes to affect subsequent segments. This strategy for analyzing process data is described by Langley as ‘temporal bracketing’:

“With this strategy, a shapeless mass of process data is transformed into a series of more discrete but connected blocks. Within phases, the data are used to describe the processes as fairly stable or linearly evolving patterns. Evidence is also drawn together to examine how the context affects these processes, and what the consequences of these processes are on the future context and other relevant variables of interest. Discontinuities lead to replication of the analysis in a new phase” (Langley, 1999, p. 703)

Since temporal bracketing rests on structuration theory (Langley, 1999) it implies assuming structure and agency to be a mutually constitutive duality (Jones and Karsten, 2008; Orlikowski, 1992). In short, this implies the assumption that the actions of actors are enabled and constrained by structures, and that through their actions, actors may either reinforce or change structures. Similarly as done by Barley (1986) I have operationalized this in temporal bracketing by analyzing individual time segments (or phases) to identify how contexts have influenced action and how action has led to changes in the context. To that end, I have drawn upon relevant theory to conceptualize the horizontal interactions and dependencies that have been identified in each phase, and thereby sought to form abstract theoretical ideas that may explain the why and how of events in each phase. In Paper 2, this manifests in how we in each phase look at how actors in their interaction with their regional context and digital ecosystem come to form the organizing rationales that in turn come to determine whether collaboration is going to be realized or not. In paper 3, we draw on the concept of boundary resources to understand micro events where changes to the platform sets new conditions for the surrounding platform ecosystem and to abstract these events into understanding individual phases as boundary resource configurations. When each phase has been individually understood in terms of how processes have been shaped and have come to shape context through horizontal interactions and dependencies, I have sought to understand how changes in one phase have set conditions that shape actions in subsequent phases. An interesting example of this is how we in Paper 1 observe how the organizational structure of VK is changed in one phase by the instatement of a web department as a unit loosely coupled to the rest of the organization. In a subsequent phase, we observe how this enable actors in the web department to enact a new aspect of organizational identity and to take actions with digital technology that would probably not have been taken if not for the change in the previous phase. Thus, at this final stage, I have explored and tried to replicate theoretical ideas

across all phases to gain a theoretical understanding of how and why processes unfold. Having thus outlined the general procedure that I have followed to collect and analyze data, I now turn to providing summaries of the appended papers.

4. Paper summaries

In this chapter, I outline the four papers appended to my dissertation. As can be seen below, the first paper is in a manuscript state and is still being developed towards being sent to an international journal. Out of the remaining papers, two are published in journals and one in the proceedings of a conference.

4.1 Paper 1: The digital transformation of a newspaper organization

Nylén, D., Skog, D.A., Lyytinen, K., & Holmström, J., (manuscript). The Longitudinal Dynamics of Digital Transformation: A Process Study of Change in a Newspaper Organization.

In this manuscript, we report on our current efforts in studying the digital transformation of the regional newspaper organization Västerbottens-Kuriren (VK). In this study, we seek to theorize digital transformation as a longitudinal and cumulative firm-level process by directing particular attention to its key elements and how they interact over time.

This paper shines light on the cumulative nature of digital transformation by showing how digital technology offered different capabilities over time, how organizational actors leveraged these capabilities to induce organizational change, and how the results of one change came to enable subsequent change. To that end, we observe how early computers, software and the digitization of news content enabled unprecedented editing capabilities. This was followed by the Internet that offered unforeseen capabilities to transfer and distribute content, which was leveraged by organizational actors in the development of a newspaper website. As the newspaper then became a digital product, new digital content and services could be integrated to expand it. Leveraging this, organizational actors integrated comment fields and a blog portal, thus enabling consumers to become content producers.

The analysis in this paper also reveals how actors may assign different aspects to organizational identity, and how they by enacting different aspects may come to interpret digital technology differently. For example, those who assigned and enacted an organizational identity of craftsmanship tended to see emerging digital technologies as a threat. This included graphical workers who reacted against the ways in which digital technology simplified the complex and skilled-based work of doing graphics, and reporters who reacted against the ways in which digital technology enabled consumers to publish content. On the other hand, actors who emphasized the importance of being an efficient and profitable organization tended to view digital technology as an opportunity when it offered means to rationalize printing and distribution.

4.2 Paper 2: The evolution of a regional digital innovation network

Skog, D.A., (2016). Local Game, Global Rules: Exploring Technological Heterogeneity Exploitation in Digital Creative Cluster Evolution. *Industry and Innovation*, 23(6): 531–550.

In this paper, I study the evolution of a regional network of organizations that collaborate in the realization of digital innovation projects. I observe how the evolution process was characterized by a rise and fall in the intensity of regional collaboration, and thereafter seek to understand why this has been the case. In so doing, I examine the ways in which actors in the network interpret previous experience of regional collaboration and developments in their digital ecosystem to develop the organizing rationales that determine whether regional collaboration should be sought or not.

In relation to digital transformation, this paper provides several interesting insights. First, it represents a case where the challenges and opportunities of maintaining intense and intermittent digital innovation over time are highlighted. As shown in the paper, a strive for novelty drives actors to constantly be at the forefront of digital technology development in a time where it develops both radically and rapidly. This results in a continuously changing technological heterogeneity in project scopes, and ultimately in the challenge of tackling heterogeneous and dynamic resource requirements over time. Further, it shows how the development of technological specializations that are relational, i.e. where one organization aligns its specialization to other organizations, may be a very efficient and effective way for small organizations to cope with technological heterogeneity. Particularly when they are able to leverage geographic proximity and a common history, organizations that maintain relational technological specializations may utilize collaboration to realize far more heterogeneous digital innovation processes and outcomes than any of them would be able to do alone. However, as I also observe in this paper, the exploitability of relational technology specializations is unlikely to sustain due to the pace with which digital ecosystems may evolve to assume qualitatively different forms over time. Since peripheral ecosystem members may find it difficult to predict change in digital ecosystems and are likely to have limited internal resources, they may find it difficult to timely attain new knowledge and skills and transform themselves. Second, the paper shows how organizational actors engaged in intermittent digital innovation realize organizational change as a result of their interpretation of internal as well as external events and actions. Lastly, it shines light on the dissolution of boundaries in digital technology and business environments. This includes the dissolution of geographic boundaries as exemplified by how distant actions and events come to fundamentally change local conditions, and by how some organizations come to engage in international collaboration. It also includes the dissolution of industry boundaries as exemplified by the heterogeneity of actors engaged in the network, and by how actors from different industries come to influence the evolution of the digital ecosystem.

4.3 Paper 3: The evolution of Spotify's digital service platform

Skog, D., Wimelius, H., Sandberg, J. (2018). Digital Service Platform Evolution: How Spotify Leveraged Boundary Resources to Become a Global Leader in Music Streaming. *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS-51)*: 4564-4573

In this paper, we study Spotify as a case of digital service platform evolution by tracing the development of its platform from its official launch to the point where Spotify became the dominant music streaming service in the world. The focus of our analysis is on how Spotify, by altering the digital interfaces of its platform, cultivated a balanced growth of a platform ecosystem and gradually improved its capacity to leverage it.

The paper comes to illustrate the longitudinal and sequential nature of digital innovation, specifically the longitudinal design of digital interfaces during the early stages of digital platform evolution. To that end, it shows how Spotify was able to scale rapidly in terms of user growth by utilizing the local storage of end-users' devices, by implementing peer-to-peer technology that relieved the strain on central servers, and by continuously altering its governance structure. Further, it shows how Spotify gradually improved the capability of digital interfaces to generate valuable user data and how this was leveraged to continuously improve the Spotify service. We observed that this generally followed a cyclical pattern where Spotify provided digital tools that allowed users to manipulate and structure content, which generated data on user preferences that was then utilized to develop new tools and functionalities.

This case also makes apparent the layered and hierarchical nature of digital ecosystems, how different actors in digital ecosystems are faced with different architectural conditions, and how they therefore engage in digital innovation with different rationales for value creation and capture. Being a digital service platform, Spotify carves out its existence in the service layer of its digital ecosystem and it lacks any proprietary couplings to devices. Therefore, it comes to depend on external digital device platforms for its distribution and income generation and it needs to align with what is possible and allowed given the rules and tools supplied by digital device platform owners. Due to these conditions, our analysis suggests that for digital service platforms, leveraging external developers for generating functional diversity within the service is not a sustainable strategy. Instead, digital service platforms mainly gain more from encouraging external developers and device manufacturers to distribute a service by integrating it into external services and devices.

4.4 Paper 4: Digital innovation and digital disruption in digital ecosystems

Skog, D.A., Wimelius, H., Sandberg, J., (2018). Digital Disruption. *Business & Information Systems Engineering*, 60(5): 431-437.

In this paper, we address the phenomena and concept of digital disruption and how it may be understood in relation to digital innovation, digital ecosystems and digital logics. To that end, we suggest that digital disruption is caused by digital innovations that are able to change value logics that have been historically dominant and served as the foundation for the business of incumbent actors. We develop a conceptual model that details how this process may unfold, starting with the embedment of a logic for value creation and capture into the design of a digital product or service. As a result, the material features of the digital product or service come to be designed to promote use that aligns with the value logic, and as the digital product or service gains centrality in a digital ecosystem, the value logic may be imposed on other ecosystem actors. At this stage, we suggest that digital disruption manifests as the owner of the digital product or service acts upon relationships to other actors by changing the rules or resources, or as the new digital product or service comes to generate significant shifts in end-user behavior and preferences.

In relation to digital transformation, this paper thus primarily provides a conceptual foundation that facilitates the tying together of digital innovation, digital logics and digital ecosystems and their relationships in over time. It also provides particular insight into the ways in which digital ecosystems may generate substantial challenges as well as opportunities that may motivate organizations to engage in digital transformation, as well as into the ways that digital transformation may lead to change in digital ecosystems.

5. Theorizing a conceptual framework on digital transformation dynamics

As I detail in section 2.4, there is a need for a conceptual framework that may assist IS research in the study of the process of digital transformation, and in this chapter, I engage in theorizing such a framework. The term conceptual framework is understood here as an integrated set of theoretical concepts that can be used to guide current or future research on a particular phenomenon by clarifying the main variables or concepts and their possible relationships that may explain the phenomenon (Imenda, 2014). By developing a conceptual framework, I do not attempt to propose a strong theory that accounts for all aspects of digital transformation. Indeed, given its complexity and highly situated nature, such an ambition would probably be futile even if it was attempted in a much larger treatise. Also, as argued by Weick (1995), strong theories are not necessarily beneficial or sought when theoretical development of a subject matter is still at an early stage. Rather, I assume here the role described by Weick of a researcher engaged in an interim struggle to inch knowledge and research on digital transformation forward. Therefore, the value of the contribution claimed in this thesis “*lies in the context – what came before, what comes next?*” (Weick, 1995, p. 389). From this perspective, theorizing involves clarification of the past I build on, how I move this forward to a new position, and how this new position may support and guide future theorizing struggles (Holmström, 2005). Hence, in order to theorize a conceptual framework for digital transformation dynamics, I combine established perspectives and concepts with relevant insights, findings and conceptual developments from the studies reported in my four papers presented above.

5.1. Digital innovation driving digital transformation

As indicated in the summaries presented above, my appended publications all consider aspects of digital innovation and digital transformation. The empirical studies all address these processes from a longitudinal perspective, while my conceptual paper focuses on explaining the ways in which they are related to each other as well as to digital disruption. Apart from these studies, digital innovation has rarely been used to frame and theorize digital transformation in the literature. In one of just two identified papers, the conceptual paper by Hinings et al. (2018), digital innovation and digital transformation are portrayed from a perspective rooted in institutional theory. The authors propose that while digital innovation involves creating and launching new digital products and services, digital transformation concerns the combined effects of several digital innovations over time. Further, digital innovation has also been used to explain managerial challenges that may arise as incumbent organizations with substantial experience in traditional “physical” product development make organizational arrangements to enable digital innovation as part of their digital transformation process. In a Delphi study on the subject, Piccinini et al. (2015) observe how this may engender situations where an organization is faced with

managing two equally important but contradictory sets of rules and norms for value creation, change that extends beyond product development to organizational and cognitive structures, and ultimately how digital innovation may require organizations to redefine their core business logic. However, neither of these studies explores theoretical underpinnings of digital innovation in depth, and while Hinings et al. propose that digital innovation processes and outcomes engender digital transformation, there is a dearth of empirical studies showing how these processes may be interconnected over time. Before I further address my own contributions to situating digital innovation in relation to digital transformation, we need to consider digital innovation more carefully.

The characteristics of digital innovation processes and outcomes

Initially, the concept of digital innovation emerged as a contrast to process innovation: the dominant traditional focus in IS research (Fichman et al., 2014; Swanson, 1994; Yoo et al., 2010). Defined as “*the carrying out of new combinations of digital and physical components to produce novel products*” (Yoo et al., 2010, p. 725), the concept was useful for expanding research interest from how IT may be used to improve organizational processes to include the use of digital technology to change market-facing products. Reflecting an expansion of its scope, Nambisan et al. have more recently defined digital innovation as “*the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology*” (2017, p. 224), thus extending digital innovation to the use of digital technology for the design, development, delivery, and operations of market-facing artifacts. Although I find the definition provided by Nambisan and colleagues useful for capturing the essence of digital innovation, it is also limiting in the sense that it directs attention to the initial creation of an innovation. Therefore, to contextualize digital innovation within the process of digital transformation, I propose that the definition in Paper 4 may capture implications of digital innovation over time more holistically, and thus that digital innovation during digital transformation may be fruitfully defined as:

“the process of combining digital and physical components to create novel devices, services or business models, bundling them to constitute and enable market offerings, and embedding them in wider sociotechnical environments to enable their diffusion, operation and use” (Skog et al., 2018, p. 433)

Considering digital innovation processes as drivers of digital transformation raises questions about what, in turn, drives digital innovation. Potentially important factors identified in the literature include certain characteristics of digital technology that may bestow certain characteristics on digital innovation processes and outcomes (Kallinikos et al., 2013; Tilson et al., 2010; Yoo et al., 2010). Such characteristics of digital technology include the ability to be reprogrammed over time through a separation of form from function (Yoo et al., 2010, 2012a), which enables, for example, a smartphone to be changed at any time by installing new software applications on it. Second, digital

technology is said to be self-referential as it is an essential stimulant of the creation of more of its kind (Yoo et al., 2010). This implies a virtuous circle where an increase in the performance, diversity and accessibility of digital resources leads to the creation of additional resources.

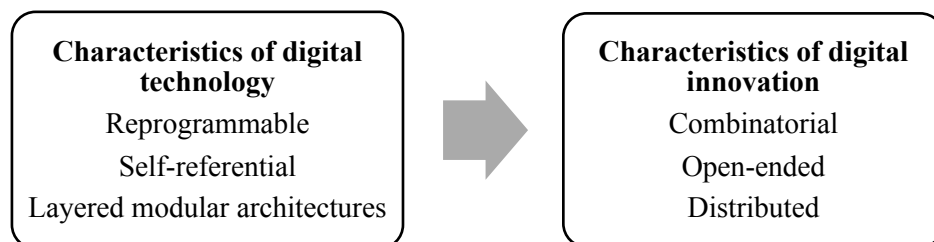


Figure 1. Digital technology bestows certain characteristics upon digital innovation

A third characteristic of digital technology often foregrounded in digital innovation research is Layered Modular Architecture (LMA) (Henfridsson et al., 2018; Nambisan et al., 2017; Selander et al., 2013; Tilson et al., 2010; Yoo et al., 2010). LMA extends the notion of modular architectures, where functions and components are mapped on a one-to-one basis (Sanchez and Mahoney, 1996; Ulrich, 1995), through incorporation of four loosely coupled layers (Figure 1): a layer of devices with associated hardware and software, a network layer providing means for data transfer, a service layer providing particular application functionalities, and a content layer containing digital text, images, audio and video (Henfridsson et al., 2018; Yoo et al., 2010). In contrast to components of a modular architecture, a module in LMA refers to a distinct technological element that provides functionality based on the particular layer in which it resides rather than its role in a particular product system. Rather than aligning with the design of a specific product's functional mapping scheme, modules in LMA are designed to be integrated into a wide range of products and services that are usually unknown when they are designed (Yoo, 2013). Similar to those in a modular architecture, interfaces in LMA enable loose couplings between modules, but with the important difference of extending them outside of a particular product system.

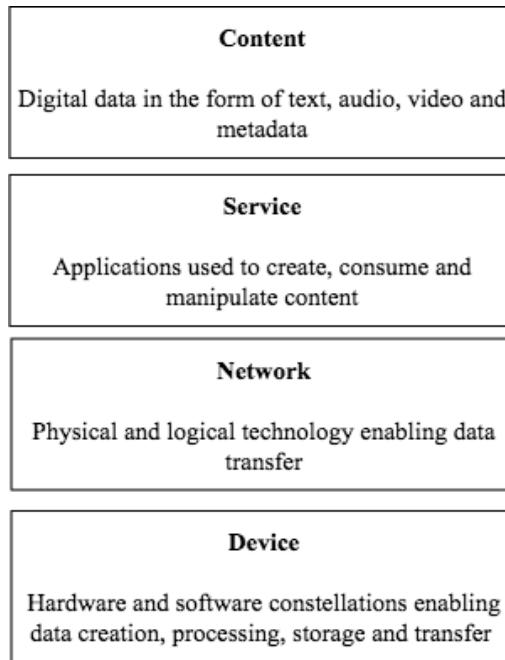


Figure 2. The layered architecture of digital technology (adapted from Yoo et al., 2010)

Thus far, I have presented the ability to be reprogrammed, a self-referential nature, and LMA as distinct characteristics of digital technology. I now turn to describing how digital technology comes to bestow certain distinct characteristics on digital innovation processes and outcomes. First, as LMA is operationalized in digital innovation, it is inherently associated with combinatorial processes, where relationships between new and existing modules are established in the creation of new products, processes and services (Henfridsson et al., 2018; Nambisan et al., 2017; Yoo et al., 2010). Therefore, digital innovation may be described as combinatorial in nature, focused on the design and development of composites of diverse modules rather than unitary artefacts. Being inherently combinatorial does not contribute much towards distinguishing digital innovation from other types of innovation (e.g. Schilling, 2000). However, more distinct characteristics of digital innovation appear in the ease with which digital modules can be combined together with digital technology's generic reprogrammability over time, and the horizontal and vertical openness of LMA.

Second, digital technology brings an open-ended character to digital innovation processes and outcomes (Henfridsson et al., 2018), manifesting in how the addition of new modules may enable changes in functions of a digital product or service over time. While modular architecture usually enables aftermarket addition of modules, these normally need to align with functional mappings defined within the particular product system (Ulrich, 1995; Yoo, 2013). Therefore, adding modules often leads to differences in degree (Yoo et al.,

2010), e.g. a new central processing unit improving the performance of an existing computer. In contrast, LMA and reprogrammability enable changes in kind of products and services over time (Yoo et al., 2010), manifesting in how new software applications can be added to change or extend functionalities offered by a digital device, or new instructions may be coded into a digital service to enable significant new uses. Finally, digital innovation processes and outcomes are distributed in nature. As “ordinary” modular architecture enables partitioning of production into specific tasks that can be performed simultaneously and autonomously (Sanchez and Mahoney, 1996) it enables the distribution of production tasks and component innovation across internal or external units (Baldwin and Clark, 1997; Langlois and Robertson, 1992). However, due to the potential for utilizing both horizontal and vertical interfaces within and across layers of LMA, digital innovation may involve nearly unbounded distribution, spanning product and industry boundaries as far as the compatibility of digital interfaces allow modules to interconnect (Yoo et al., 2010, 2012a).

Important elements of a framework for applying digital innovation to understand digital transformation can be derived from this detailed explanation of digital innovation and some of the underlying mechanisms and conditions that lend it unique characteristics. First, it further highlights the embeddedness of digital transformation, not so much in the inner organizational context as in the outer. If, as surmised, the process is driven by digital innovation, the enablers and constraints of actors in digital transformation must include the general evolution of digital technology and how it comes to generate new conditions for digital innovation over time. Key aspects here are that the reprogrammable nature of digital technology and emergence of LMA enable unforeseen possibilities for organizations to combine internal with external assets, thereby extending the functionality or distribution of their products and services. This is illustrated in all the appended papers, albeit in different ways. For example, the newspaper organization studied by my colleagues and I (hereafter we) in Paper 1 integrated several external digital services into its offering, including for example social media services. Further, the organizations in the network addressed in Paper 2 leveraged the loose couplings of LMA to specialize in particular digital technologies, thereby acquiring the ability to complement each other in digital innovation processes. For at least some time, this provided the organizations with substantial benefits as it enabled access to a flexible and heterogeneous resource base that none of the organizations could have mustered themselves. In addition, the continuous increase in the availability of resources within digital technology and business environments provided by self-referentiality can further fuel digital innovation via the combination of internal and external assets. For instance, as showcased in Paper 3, a continuous increase in external digital devices and services played an important role in the Spotify platform's evolution. Through constantly adding and adapting digital interfaces, Spotify was able to leverage this proliferation to extend the distribution of its service over time. However, as also shown in the case of Spotify, self-referentiality also signifies the formation of complex interdependencies that are

realized when distributed actors combine assets in digital innovation. As Spotify acts in the service layer of LMA, it is dependent on actors that act in the device layer for the distribution and consumption of its service. At the same time, a wide range of digital devices has become dependent on Spotify to enable digital music streaming functionality, including smartphones, HiFi equipment, TVs, game consoles and car infotainment systems.

Second, the open-ended and distributed character of digital innovation implies a lack of predetermined boundaries when products and services are changed during digital transformation. This indicates that there are no clear constraints on the qualitative differences that innovations may trigger in digital products and services, that predicting and planning associated changes in organizational boundaries will be challenging, and that both boundaries and contents of digital business and technology environments may be highly unstable. Paper 3 provides empirical evidence for these implications too, by outlining the substantial changes that Spotify underwent during its first couple of years. Starting as a basic music player application for PCs running Windows, it developed over time into an advanced and complex digital service platform that could tailor the music listening experience in unforeseen ways. Further, the substantial change to the core service was associated with substantial change in Spotify's business network, as over time it became a platform enabling resource exchange for diverse actors, including artists, record labels, advertisers, app developers, device manufacturers, top-lists, industry associations and individual users. Similarly, Paper 2 reveals that each instance of recurrent digital innovation recognized in a digital transformation process may be embedded in a qualitatively different business and technology environment that enables and constrains different innovation processes and outcomes. Moreover, it shows that in order to leverage rather than be damaged by inherently dynamic digital technology and business environments, organizations need access to dynamic pools of resources, particularly when there is high demand to remain at the forefront of digital technology development. For the organizations investigated in that study, this involved intense networking, for some in a regional arena, and for others on a global scale, but for all, often over industry boundaries.

To conclude, digital innovation refers to the processes and outcomes of using digital technology for creating and changing products, services, business models and business processes. When seen as the main driver for digital transformation, digital innovation affords recognition of why and how digital transformation becomes embedded in wider business and technology environments, and why and how this embeddedness may come to enable and constrain digital transformation over time. Due to the unforeseen capability to combine internal and external assets in digital innovation, and the continuous increase in the heterogeneity of external resources driven by self-referentiality, organizations are likely to become increasingly interconnected with their digital business and technology environments as they engage in digital innovation cycles over time. Since digital business

and technology environments are inherently dynamic, they are likely to generate different opportunities and challenges over time, implying that the outset for each instance of digital innovation will be shaped by different enabling and constraining conditions. Further, through closer consideration of digital innovation, we may better understand the top-down trajectory of digital transformation. Since it entails the use of digital technology to engender direct change to products, services and business-models, digital innovation is likely to lead to substantial changes in the overall means and ends that define what an organization does and how it does it. Hence, it is likely to ultimately lead to fundamental organizational transformation. What is more, the open-ended character of digital innovation suggests that changes to market offerings may be difficult to foresee and plan, which opens possibilities for emergent organizational transformations with characteristics that ultimately depend on how actors make sense of, and respond to, prevailing conditions over time. Finally, as it involves inherently distributed processes and outcomes, digital innovation motivates and enables organizations to breach their organizational boundaries to engage with external actors from within and across architectural layers, with limited recognition of product and industry boundaries. This explains the overall process of digital innovation and expectations of its general characteristics within the context of digital transformation. The next section considers its processual and cumulative aspects.

The longitudinal and emergent nature of digital innovation

To counter the tendency in extant literature to treat digital transformation as decoupled instances of digital technology implementation to improve particular organizational areas, attention to processes of digital innovation and their cumulative outcomes is needed. Indeed, analysis of digital innovation as an ongoing activity over time is essential for understanding the organizational consequences of simultaneous or sequential application of different digital technologies (Lanzolla et al., 2018), and ultimately if and how digital transformation unfolds as the result of several digital innovations (Hinings et al., 2018). However, considering digital innovation alone is not sufficient, as the concept tends to direct attention to specific digital innovation initiatives, ignoring how such initiatives interact with wider processes of change (Holmström, 2018).

To understand how cycles of digital innovation come to constitute digital transformation over time, we need to recognize that innovation never takes place in a historical vacuum, but rather that innovators are always enabled and constrained by what came before and ideas of what comes next. The digital transformation of the newspaper organization VK reported in Paper 1 illustrates this well. Early in its digital transformation, VK implemented computers to replace typewriters, which led to the digitization of news content. Digitized news content could be more easily edited and transferred between different units of the organization, and led to some restructuring in terms of who should do what in the newspaper production process. However, since digitized news content was ultimately printed in the same physical form that it had been for the preceding century,

VK was essentially doing the same thing but in a slightly different and more effective way. This stage of transformation at VK reflects what Tilson et al. (2010) vividly describe as digitizing the cow paths, i.e. use of IT to make existing processes more efficient without changing the processes or surrounding system in any substantial ways. Yet, as also described by Tilson et al., while the digitization of cow paths may not lead to direct transformation, it may generate it in the long run, which is what happened at VK with the advent of the Internet. At that point, digitized news content facilitated creation of a newspaper website, which was a substantial change to VK's product portfolio, and led to more fundamental organizational transformation. At first, the new medium's capabilities were leveraged to publish and distribute news in ways that were less dependent on time and space than before, leading to both new publication practices and new demands for continuous news reporting from readers. Since operations of the new product required other forms of internal support, it also led to establishment of a separate cross-functional web department to manage the newspaper website. Later, it became evident that digitized news content and the newspaper website had also opened up the newspaper product for combinatorial innovation, a capability that the web department experimented with and leveraged by integrating external content and services, and disseminating news content to external services. Analysis of interconnected processes of digital innovation may also reveal how organizations can cumulatively build vital capabilities and successfully scale through digital innovation. For example, scrutiny of the Spotify platform's evolution revealed how digital platform owners may incrementally improve their ability to grow and profit from platform ecosystems (Paper 3). In that case, we observed how Spotify gradually became better at generating valuable data from the use of its services, turning this data into insights, and acting on them to improve the service. Further, Paper 3 also shows how Spotify managed to balance extreme user growth, service quality and revenue generation through intricate sequences of changes to platform interfaces and rules associated with their use. Hence, as shown in both Paper 1 and Paper 3, prior change provides conditions that enable and constrain subsequent digital innovation processes, and we can only begin to understand the process of digital transformation when we understand how one leads to the other over time.

By paying attention to how processes of digital innovation feed into each other over time, we may also improve understanding of what an organization needs to change and what it may benefit from retaining during digital transformation. Indeed, building on existing assets rather than simply scrapping them has been recognized as a key success factor in digital transformation (Berman, 2012; Rigby, 2014; Westerman and Bonnet, 2015). However, when organizations are faced with constant pressure to either replace or improve their products and services, it is unclear exactly what, if anything, can and should remain unchanged. In Paper 2, I show how a longitudinal perspective of digital innovation can be utilized to provide more insight into what may be beneficially retained over time while products and services need to change. Set in a context where demands for novelty are continuously high and organizations intermittently face the challenge of meeting

those demands, Paper 2 provides an extreme example of how organizations may manage to successfully adapt to a dynamic business and technology environment. To that end, it shows both the value and vulnerability of technological specializations when the necessity for digital innovation is intermittent. As long as the basic technological constitution of products and services remained the same or developed incrementally, technological specialization was beneficially developed and cultivated over time, and fruitfully exploited in collaboration. Over time, collaboration based on exploiting specializations generated benefits that extended beyond complementarity to include efficiencies that could only be gained through extended periods of intense collaboration. However, when qualitative change in the underlying technologies for digital design and development materialized, some technological specializations were rendered obsolete, which had devastating effects on some of the organizations and collaboration within the network as whole. Nevertheless, while technological specializations were vulnerable to qualitative change, the value of two other capabilities persisted over time. One was a capability for graphical design, which was generic enough to be applied despite changes in the underlying technologies for digital products and services. The other was a capability to establish new relationships on a global scale and acquire both resources and revenue from them.

Through a focus on how digital products and services are designed and developed over time, we may also better account for the human agency involved in digital transformation and explore it as a process of emergence. For example, we observe in Paper 1 how the first newspaper website of VK was realized by a single individual who, despite facing managerial resistance and a lack of organizational support, designed and developed vk.se. Further, when Facebook and Twitter were first used as tools for news acquisition and reporting at VK, they were not implemented throughout the organization following an official management decision to do so, they were instead adopted by individual reporters who found them useful for doing their work. These findings stand in sharp contrast to the emphasis put on digital transformation as a process under the control of managers in extant research, and they suggest that we may have much to learn of digital transformation if approached with an emergent perspective (Markus and Robey, 1988b).

Hence, by recognizing that digital innovation involves continuous processes feeding in to each other over time, it provides a useful conceptual tool for identifying and analyzing the temporal interconnectedness, sequences, important cumulative events, actors and agency in studies of digital transformation. However, as digital innovation comes with no inherent consideration of business and technology environments, it is insufficient as a conceptual framework of digital transformation dynamics alone. In the next section, I explain how digital ecosystems complement digital innovation to that end.

5.2. Digital ecosystems as contexts for digital transformation

In my review of the literature presented in section 2.2, I observe how organizations' external technology and business environment is often highlighted as a key source of challenges and opportunities that explain the initiation of digital transformation. I also concluded that considerably less attention had been paid to if and how interactions and interdependencies between them come to influence digital transformation over time, and that the concept of digital ecosystems has considerable potential utility in efforts to remedy the neglect. In this section I clarify why and how. First, I explain how digital ecosystems may be usefully considered, for the overall purpose of understanding digital transformation processes, as sociotechnical networks of interdependent actors and digital technologies whose structure may be best understood as reflecting an extension of the LMA of digital products and services. I then explain the structure of digital ecosystems in more detail by considering the roles, relationships and nature of interactions that can be expected to influence digital transformation over time.

The architectural structure of digital ecosystems

In a recent comprehensive review, Jacobides et al. (2018) identify business, innovation and platform ecosystems as three major categories of ecosystem concepts used in management literature. They explain how they may be distinguished through the particular focal points that define the purpose, boundaries and relationships of a certain ecosystem. Hence, a business ecosystem is focused on an individual company, and it comes to comprise the actors that are in a position to affect that company, its customers and its supplies. Therefore, business ecosystems span actors across industry boundaries who are related by economic dependencies. Similarly, an innovation ecosystem is focused on a focal innovation, so the ecosystem includes the components, modules and associated actors that collaborate to realize and commercialize the innovation as a composite offering. Relationships between actors in innovation networks are therefore based on complementarities. Finally, the focal point of a platform ecosystem is a particular platform, hence a platform ecosystem comprises a platform owner, its platform and the actors and modules that add value to the platform (Jacobides et al., 2018). In the IS literature generally, and the stream of research on digital innovation particularly, the ecosystem concept often refers to platform ecosystems (e.g. de Reuver et al., 2017; Lindgren et al., 2015; Sørensen et al., 2015; Wareham et al., 2014).

As there are multiple interpretations and meanings of ecosystem in management and IS literature, it is important to specify exactly what is referred to by digital ecosystems here. Drawing on Adomavicius et al. (2008), they are defined in Paper 4 as “*sociotechnical networks of interdependent digital technologies and associated actors that are related based on a specific context of use*” (Skog et al., 2018, p. 433). It is important to note here that a digital ecosystem is not the same as a digital platform ecosystem, rather a digital ecosystem may host several digital platform ecosystems. The boundaries of a digital

ecosystem are defined instead by a context of use, meaning that it includes the users, the digital technologies that users can apply to realize a specific purpose, as well as the actors that either own or can substantially affect the technologies and how they are used.

With this understanding, the digital ecosystem concept is useful for understanding digital transformation dynamics for two reasons. First, it is focused on a context of use rather than a market or industry. Accordingly, it is often argued that intensive digitalization is causing convergence of previously separate products, markets and industries (e.g. Mangematin et al., 2014; Tilson et al., 2010). Consequently, focusing on a particular market or industry may fail to capture relevant relationships and interactions for digital transformation. For example, Spotify's evolution (reported in Paper 3) shows how technology companies may become dominant actors in other industries, as also illustrated by Uber and Apple. Further, as shown in Paper 1, VK's web department did not restrict its explorations of possible means to improve the value proposition of a newspaper product within the boundaries of the newspaper industry. As a result, external social media services were utilized, but it also came to host its own blog platform to allow readers to write and publish their own content. Second, the concept of digital ecosystems allows consideration of the perspective of actors who are not platform owners, but must orient themselves in relation to several digital platforms to realize value creation and capture. This probably applies to the vast majority of organizations that engage in digital transformation, but their perspective is seldom considered in digital innovation research. I fear it has been neglected in favor of a bias towards either examining successful digital platforms such as iOS (Eaton et al., 2015; Ghazawneh and Henfridsson, 2013) or large corporations (Svahn et al., 2017) that may not depend in the same manner on external ecosystems for their business and innovation activities. However, as shown in Paper 2, actors that do rely on external digital ecosystems for their innovation and business activities often face not one or two but several digital platforms, each with distinct rules and tools that enable and constrain actions in different ways. Even for Spotify, while being a powerful platform owner itself, orientation in relation to other platform actors has been central to its evolution, as shown in Paper 3.

It is suggested in Paper 4 that digital ecosystems emerge and evolve as actors combine different digital technologies in digital innovation, but exactly how this may manifest is not addressed in detail. As previously explained, a key interest in digital innovation research is how organizations combine digital modules from different sources to make the products and services they offer as value propositions to end-users. However, as recently emphasized by Henfridsson et al. (2018), end-users are often the ones who ultimately combine different digital products and services to support them in their situated contexts of use. Hence, digital ecosystems are constituted by, and evolve through, not only realized combinations of digital modules in distinguishable products and services, but also latent modules and combinations that may be realized at some point through unexpected combinations in use, or by unexpected entries of new actors. For example, as

described in Paper 2, the emergence and rapidly growing prominence of the Apple iPad fundamentally altered the digital ecosystem in which the studied organizations were embedded. Not only did this require of them new approaches for design and layout, it ultimately rendered Adobe Flash technology obsolete, which several organizations had specialized in and come to rely upon as their main source of income. Hence, digital ecosystems emerge through actual and latent combinations of digital technologies that designers, developers and users can realize for the fulfillment of a particular use purpose.

In order to better interrelate digital innovation to digital ecosystems and understand how digital transformation may come to embed organizations in wider contexts, it is also useful to consider digital ecosystems as structured according to LMA (as illustrated in Figure 1). Indeed, it has been recently suggested that an ecosystem perspective may complement the dominant architectural view in digital innovation research since it can better account for the wider context of value creation in digital innovation (Nambisan, 2018). Moreover, all ecosystem concepts in management and IS research build on and are fueled by modularization in one way or another (Jacobides et al., 2018; Tiwana et al., 2010). Thus, LMA seems a reasonable structure for understanding how digital innovation leads to the interconnections and interdependencies comprising relationships in digital ecosystems. From that perspective, a particular digital ecosystem comprises the devices, network technologies, digital services and digital content that are, or can be, used to fulfill a particular use purpose, as well as the actors who use or provide the technologies necessary for the realization of use. For example, users who seek to consume streamed music have several devices, network and service options to choose from. If we consider a user wanting to listen to a certain music track, s/he may first choose the device through which the track is to be listened to, which may be a PC, smart phone, smart speaker, TV, gaming console, HiFi receiver, set-top box, or car stereo, depending on the situation. Depending on the device chosen, the user may use a cellular, WiFi or cable network connection, and even proprietary network protocols such as Spotify Connect or Apple Air Play, to stream the music track. The user may then, depending on what is possible given previous choices, choose between streaming services such as Spotify, Apple Music, Pandora or Tidal. These services, in turn, have different content suppliers that may or may not be able to supply the music track sought by the user. While the image that emerges is somewhat complex, the structure provided by LMA at least suggests a basic relational division of actors and technologies according to their purposes in a particular digital ecosystem.

To conclude, digital ecosystem is a useful conceptualization of the embedding business and technology environment of organizations engaged in digital transformation as it captures the realized and latent relationships that are shaped by, and in turn come to shape, digital innovation. Seen as centered on contexts of use, digital ecosystems span products, services, industries and markets to reflect the convergence driven by extensive digitalization, and accommodate actors that need to orient their business and innovation

activities in relation to several digital platforms during their digital transformations. I have suggested here that relationships in digital ecosystems may be understood to reflect the architectural roles of technologies and associated actors across LMA layers. In the next section I address how the roles and relationships may come to signify dependencies that may shape digital transformation.

Roles and dependencies in digital ecosystems

In Paper 4, we build on concepts presented by Adomavicius et al. (2008) to suggest that digital ecosystems should be considered as inherently hierarchical. This has also been repeated in the literature on digital transformation, where digital ecosystems have been said to consist of actors and technologies that play different relational roles attributed with different extents of power and control. Digital platforms and their owners have been regarded as the most influential actors. Referred to as standard-setting actors (Hinings et al., 2018) or orchestrators (Tan et al., 2017), they carve out central positions in digital ecosystems with the aim to enclose both suppliers and customers and become the mediators for their transactions (Gimpel et al., 2018). As central standard setters, digital platforms may come to enable, constrain and coordinate the actions and interactions of numerous actors in digital ecosystems (Hinings et al., 2018). However, the vast mass of digital ecosystems is not constituted by digital platforms and their owners, but by the actors that rely upon them to innovate and for their products and services to operate (Selander et al., 2013). This indicates that modules and module providers (Hinings et al., 2018) play subordinate roles in digital ecosystems. Modules build on and facilitate a mix-and-match capability of digital ecosystems, but while they come with a value-laden design that aims to steer the behaviors of users in certain ways (Hinings et al., 2018) their influence within digital ecosystems is relatively limited.

Based on findings elaborated in Paper 3, I argue here that the hierarchical relationships between actors and technologies may be better understood when LMA is acknowledged to provide the basic structure of digital ecosystems. The foundation for this argument is the simple observation that whatever type of digital service is used to consume whatever digital content, a digital device is always needed for use and consumption. This dependency of digital services on devices has poignant prominence in the architectural conditions of the digital ecosystem in which Spotify has evolved. With no proprietary device of its own, Spotify has been forced to rely on devices of other organizations for the distribution and consumption of its service. Since devices serve as the final gatekeepers to end-users, device owners are in a position to dictate rules for service owners. For example, Apple has been known to keep data generated from the use of apps on iOS from app developers, and to force the monetary transactions generated from app use to go through their App Store (Eaton et al., 2015). This suggests that while digital platforms are powerful digital ecosystem actors generally, those who reside at the device layer are in a particularly advantageous position to control the actions of others. We expand on this in Paper 4 where we suggest that digital platforms that become highly

central in digital ecosystems may be able to fundamentally alter the dominant conditions for value creation and capture that numerous actors have previously relied upon for organizing their business and innovation activities. We suggest there that digital platforms gain centrality in digital ecosystems through being widely adopted by end-users as well as by other products and services. Through rapid cycles of digital innovation (Huang et al., 2017) and through leveraging network effects (Parker et al., 2016), digital platforms have been observed to rapidly amass and continuously grow user-bases, and through supplying digital interfaces, digital platforms may both enable external actors to create new digital products and services and control their distribution and revenue generation (Eaton et al., 2015; Ghazawneh and Henfridsson, 2013). Hence, depending on their position within the layered architecture of digital ecosystems, digital platforms and their owners are able to exert different forms and degrees of control.

As with digital platforms and owners, digital modules and module providers are also distributed within and across layers of digital ecosystems. A digital module is either a collection of digital contents, a digital service, a logical or physical transmission technology, or a digital device that can be used as a building-block in the creation of digital products and services (Henfridsson et al., 2018; Yoo et al., 2010). As emphasized by Hinings et al. (2018) a module comes with a value-laden design and material features that are intended to enable and constrain its use in accordance to what is beneficial for the module and its provider. Therefore, a module may come to influence its wider digital ecosystem, but since it always relies on a wider system to function, a module will still remain dependent on one or several external platforms. A digital platform owner may also be a module provider within a wider digital ecosystem. For example, Spotify, Facebook and YouTube are all modules in the massive digital ecosystem of digital media consumption, and as such, they align their operations to different degrees in relation to the digital platforms that they rely upon to realize the use of their services.

Hence, as digital modules and platforms are combined within and across layers to make up products and services through digital innovation, hierarchical dependencies manifest between technologies and associated actors. Through identifying whether a particular organization is a module provider or platform owner in a given ecosystem, and on which layer its products or services primarily exists within, it becomes possible to more precisely situate a particular digital transformation process within a digital ecosystem and identify the relationships and dependencies that are likely to influence the way it unfolds. Following, I address how the concept of value logics may be utilized to capture organizational actors' perception and interpretation of a digital ecosystem, and how this may serve to explain actions in digital transformation.

5.3 Digital logics

As a result of reviewing the literature on digital transformation, I conclude that it has so far primarily focused on the inputs and outputs of digital transformation and paid considerably less attention to the actors, actions and events that constitute digital transformation processes. Therefore, I argue in section 2.4 that a conceptual framework on digital transformation needs to be able to account for how and why actors take situated actions based on enabling and constraining conditions in organizations and organizational environments, and how these conditions may change as a result of both external and internal actions, over time. In this section, I explain how the concept of digital logics can provide means to capture these dynamics.

The concept of logics has recently surfaced in the discourse on digital innovation and digital transformation. So far, however, the meaning assigned to it and its application has remained somewhat fragmented, as it has been used to understand and explain how technological change suggest new ways for organizations for organize certain internal activities (Sambamurthy and Zmud, 2000; Svahn, 2012; Yoo et al., 2010), how organizational actors legitimize organizational roles and claim jurisdiction over organizational activities (Tumbas et al., 2018), how organizations position themselves and their products and services in digital ecosystems (Pagani, 2013), how rules and norms become designed into the material features of digital products and services, and how single digital products and services may come shape the behaviors and actions of other digital ecosystem actors (Gawer and Phillips, 2013; Hinings et al., 2018). Seeded by these existing notions of logics in digital innovation and digital transformation, the work represented by the four appended papers progress the concept of digital logics towards a more unified view beneficial for understanding the agency and actions of actors in processes of digital transformation.

While it has been taken to imply different meanings for different research purposes, the above synopsis of how logics have been used testify to that a logic may generally be understood as the basis that suggests that a certain action or a course of actions is necessary or beneficial. Translating this to the context of digital transformation, I suggest here that we may refer to *digital logics* as *rationales that guide organizational actors as they engage in digital innovation and transform their organizations over time*. In forming digital logics, we may assume that actors interpret previous innovation processes and outcomes, current needs, resources, constraints and opportunities, and what prospective state digital transformation is intended to lead to. In so doing, organizational actors take into consideration personal or organizational experiences and objectives, but they also consider previous, current and prospective events and states in digital ecosystems. We may also assume that digital logics to some extent materialize in the design of digital innovations, and as digital innovations are embedded in digital ecosystems, they may come to affect other actors in the ecosystem. Hence, I suggest here that in order to better

understand the process of digital transformation we may fruitfully explore three types of digital logics that each may explain important types of interpretation and action.

First, I suggest that *digital organizing logics* can be used to capture how organizational actors enable and legitimize change within organizations as a result of, to enable, or to better support the exploitation of digital innovation. To that end organizing logics has been applied to emphasize how organizations need to adopt new rationales for organizing IT activities within the enterprise (Sambamurthy and Zmud, 2000), and for organizing product innovation (Svahn, 2012; Yoo et al., 2010), in digital business environments. In a similar manner, I apply institutional logics in Paper 2 to understand how actors in the digital innovation network reshape local organizing rationales over time by intermittently interpreting both internal and external structures, events and actions. Looking locally, actors considered the efficiencies that could be gained from extended experience of local collaboration. Looking externally, actors considered an industry norm that rewarded those who excelled in creativity as well as the opportunities and constraints presented by a digital ecosystem in constant change. Further, in Paper 1, we take organizing logics to manifest in organizational identity and cognition, and we examine the role they play in digital transformation. To that end, we focus on the interplay between internal and external ideas of what an organization is and what it does, cognitive framing that suggest what is possible and beneficial to do with technology, and change to the products, processes and structure of the organization over time. Importantly, we show that organizational actors may draw upon different aspects of an organizational identity and thereby legitimize different actions. An interesting example of this shown in Paper 1 is the narrative where VK launched the first version of its newspaper website. As that narrative unfolds, one employee saw the newspaper organization as primarily having the role of being a public enlightener, and therefore considered the possibilities of the web for rapidly and widely distributing news content throughout the day as salient opportunities to be leveraged by VK. On the other hand, management primarily saw the newspaper organization as a business, and since the web was associated with unclear means for revenue generation and seen as something that would decrease the efficiency of employees, management initially resisted the development of the newspaper website. Yet, despite managerial resistance and without other organizational resources, the employee designed, developed and launched the first version of vk.se. In all, these findings suggest that by considering digital organizing logics, we may better understand the ways in which organizational actors interpret their inner organizational contexts and outer digital ecosystems, and how they come to act upon these interpretations in digital transformation. Equally valuable, findings in Paper 1 and Paper 2 show that digital logics are not necessarily neutral and stable rationales that only come to affect managers (c.f. Sambamurthy and Zmud, 2000), but that there is a value to treating them as multifaceted, dynamic and available to all actors in digital transformation.

Second, while digital organizing logics draw attention to the ways in which organizational actors organize local activities and structures in digital transformation, we suggest in Paper 4 that *digital value logics* represent “*foundational rationales for designing, bundling and embedding a digital innovation to fruitfully create and capture value*” (Skog et al., 2018, p. 434). This type of digital logic is reflected in the work of Pagani (2013) who uses the concept of value creation and capture logics to draw attention to the ways in which organizations may appropriate value through assuming different positions in digital industry architectures. To that end, Pagani suggests that module providers may appropriate value from creating modules that can be integrated into as many external products, services and processes as possible. More central actors, on the other hand, may profit from orchestration and gatekeeping by coordinating and controlling modules, and by controlling access to content or customers. We make a similar argument in Paper 3 where we suggest that for digital platforms, different logics for innovation, value creation and capture are beneficial depending on the role and architectural position that a particular platform assumes in a digital ecosystem. Spotify, as a digital service platform, carves out its existence primarily in the service layer of its digital ecosystem and is void proprietary couplings to any devices. Therefore, Spotify must instead rely on the devices of others to distribute its service to end-users. This may be contrasted with digital device platforms characterized by proprietary couplings, such as the Apple App Store, iOS and ‘idevices’ bundle, that own and control a channel for service distribution. Since they are positioned differently within the LMA of digital ecosystems, digital service platforms and digital device platforms approach interface design with different value creation and appropriation logics. Whereas digital device platforms may supply digital interfaces at the service layer to enable external app developers to extend the functional heterogeneity of a device (Ghazawneh and Henfridsson, 2013), digital service platforms have no inherent rationale to do so. Rather, as shown in Paper 3, digital service platform owners may gain more from utilizing digital interfaces to encourage external developers to distribute its service, and to encourage device manufacturers to integrate the service into their devices. In all, this suggests that digital value logics is a concept viable to capturing the basic rationales that comes to guide organizational actors in the design of digital innovations and how they choose to position them in digital ecosystems. We may expect these logics to take shape as actors interpret the structure and combinatorial possibilities of digital ecosystems, or that they mimic or adapt to already dominant logics for value creation and capture in digital ecosystems, which we examine more closely next.

Lastly, an *ecosystemic digital value logic* represents the rationales for value creation and capture that characterizes a digital ecosystem as a whole and that often diffuse through relationships and dependencies between actors and technologies in digital ecosystems. This type of digital logic rests on the assumption that the realization of a digital innovation is also the materialization of a digital value logic, and therefore digital products and services are designed with material features that are intended to guide those

who use them in ways that are aligned with the digital value logic. This resonates with Hinings et al. (2018) who suggest that institutional logics are designed into digital innovations with the purpose of guiding behaviors toward what is beneficial to a focal digital innovation and organization. As a digital innovation is embedded within a wider digital ecosystem, it comes to guide the behaviors of other ecosystem actors by provisioning rules that conditions its use. Similarly, Gawer and Phillips (2013) observe how institutional logics may become instantiated in a technological platform and expressed in its material design. They find that as the platform becomes increasingly adopted within an industry, the platform may come to shape relationships, interaction patterns and notions of value creation within it. Hence ecosystemic digital value logics may serve to explain how specific organizations and digital innovations may come to change the conditions for other digital ecosystem actors. As we suggest in Paper 4, it is when new digital value logics diffuse across digital ecosystems that digital disruption may manifest, and this may result in both challenges and opportunities for actors that are in or seek to enter into a digital ecosystem. On the one hand, new ecosystemic digital value logics may come to erode or alter core conditions upon which incumbent actors have traditionally relied to create and capture value. On the other, new ecosystemic digital value logics may create opportunities for those actors who are able to align with and exploit them. For example, as shown in Paper 3, different forms of digital services (such as Napster, DC++, Kazaa and Bitorrent) had enabled the distribution of illegally copied music files and different forms of digital devices had enabled their consumption before Spotify was launched. This had fundamentally altered the behaviors and preferences amongst many music consumers who had become accustomed to sharing, and in turn having free and instant access to, a wide selection of music that could be played not only on CD-players, but on every digital device that was compatible with the MP3 format. In developing its platform, Spotify took several measures to leverage what had happened before in the digital ecosystem, including that it adopted peer-to-peer technology and designed its revenue model to align with the preferences of digital music consumers.

To conclude, I suggest here a consolidation of the different variants of logics that have recently been growing increasingly prominent in research on digital innovation and digital transformation. Gathered under the concept of digital logics, I propose that we may capture the distinct rationales that come to guide organizational actors as they make changes within their organizations, design new digital products and services and position them within digital ecosystems, and how individual digital innovation processes may come to alter vital conditions in digital ecosystems. By also examining how actors form such logics through interpretation of both inner organizational contexts and outer digital ecosystems, we may better understand why and how digital transformation processes unfold.

5.4 Synthesizing the conceptual framework

As previously stated, digital transformation is often described as a longitudinal, complex and dynamic process driven by digital innovation and embedded not only in the inner context of organizations, but also in the outer business and technology environments of organizations. Notwithstanding this description, limited research attention has been paid to how digital transformation processes actually unfold. Not only are empirical insights into the cumulative and sequential nature of digital transformation largely missing, but so is also recognition to the actors and the agency that makes it progress over time. This has motivated me to in this dissertation explore what the main elements and relationships in digital transformation are, how they come produce digital transformation over time, and how we may conceptualize this to better understand and study digital transformation as a distinct phenomenon. To that end, the conceptual framework suggested here is developed with the primary purpose of supporting future research on the process of digital transformation. As has been explained in detail above, the conceptual framework includes three main concepts: digital innovation, digital ecosystem, and digital logics.

Regarding digital innovation, it is argued here that research seeking to understand the process of digital transformation will benefit from directing analytical focus to digital innovation from a longitudinal perspective. This involves examination of digital innovations are developed but also how one digital innovation comes to set conditions for the next. By so doing, future research may better understand and explain why and how the cumulative effects of digital innovation comes to produce digital transformation, and explore the top-down trajectory of organizational change where change starts in areas that are defined by higher level of corporate and business strategy and subsequent change follows as an effect of, or to support, the initial change (c.f. Swanson, 1994; Venkatraman, 1994). By looking closer at how digital products and services are combined with external modules and platforms in digital innovation, future research may also explore why and how digital transformation comes to constitute a process inherently embedded not only in organizational contexts but also in digital ecosystems.

Since digital innovation often entails the combination of both internal and external assets, organizations are likely to become increasingly interconnected, leading to the emergence of digital ecosystems. Suggested here to be dynamic sociotechnical networks of actors and associated digital technologies that span organizational, product and industry boundaries, digital ecosystems represent a manifestation of the combinatorial and open-ended nature of digital innovation. More specifically, I propose that digital ecosystems comprise the devices, network technologies, digital services and contents that can be used to fulfill a particular use purpose and the actors that either use or supply these technologies. By understanding the role that an organization and its products and services have within the hierarchical structure of a digital ecosystem, research is in a better position for understanding the relationships, dependencies and interactions that are

formative to how digital transformation unfolds, and it may start to explore the ways in which digital transformation may lead to change in digital ecosystems.

Finally, I have suggested that future research may adopt the concept of digital logics to understand and study the particular ways in which organizational actors interpret the past, present and future of organizations and digital ecosystems to take actions that constitute or influence digital transformation over time. Specifically, I propose that future research may benefit from recognizing three types of digital logics, each equipped to understand different actions. While digital organizing logics capture how organizational actors realize change within organizations as a result of, to enable, or to better support the exploitation of digital innovation, digital value logics has been suggested to be the rationales that guide organizations actors in how they design digital products and services and position them in digital ecosystems. As a third type of digital logic, I have suggested that future research may beneficially acknowledge ecosystemic digital value logics to capture how specific digital value logics embedded in particular digital innovations may come to enable and constrain digital transformation processes.

To conclude, I have in this chapter detailed my theorizing of a conceptual framework that addresses the main elements of digital transformation dynamics with three main concepts. By grounding each concept in existing literature and in my appended papers, I have both provided theoretical foundations and empirical illustrations that explain concepts and their relationships in depth with the purpose of making the framework generative of further research on digital transformation processes. I now bring this dissertation to a close by discussing the wider theoretical and the practical implications of my work as well as its limitations.

6. Discussion and conclusion

I have in this dissertation theorized the dynamics of digital transformation. In so doing, I have drawn upon extant theoretical contributions and my own research presented in four appended papers to synthesize a conceptual framework that detail the main theoretical concepts and their relationships in digital transformation processes. In this chapter, I discuss the wider implications that my theorizing has on research as well as on practice. To that end, I first discuss why digital transformation should be considered as a distinct area of theorizing in IS research, and how we as IS researchers may progress this area in the future. Following, I clarify what implications the theorizing done here has for practice, and finally I address limitations in my work and how these create opportunities for future research.

6.1. Digital transformation as a distinct area for theorizing

I have in this dissertation aligned with recent research that has begun to theorize digital transformation as a distinct form of organizational transformation enabled by digital technology (Gimpel et al., 2018; Hinings et al., 2018; Li et al., 2017; Piccinini et al., 2015). In order to support a continued cumulative knowledge generation on this phenomenon, I have detailed its empirical characteristics and how it may be positioned in relation to other subject areas in IS, but also how theorizing digital transformation can come to rely on distinct theoretical foundations within IS research.

IS research has a long tradition in exploring the relationship between technology and organizational change as driven by the design, implementation and use of IT systems in organizations. Within this tradition, IT systems have been dominantly understood as clusters of hardware and software that are designed to inform, automate, co-ordinate and control for the realization of particular organizational objectives. To a large extent, IT systems have been used for process innovation so as to improve the operational efficiency of organizations (Fichman et al., 2014; Swanson, 1994; Yoo et al., 2010). To provide stable operational support, IT systems often remain defined and delineated by the organizational purpose they serve, and while they may change in degrees, they are likely to retain their overall design over time. It has been found that IT systems are more likely to be supportive of than formative to higher level business and corporate strategies (Bharadwaj et al., 2013; Henderson and Venkatraman, 1999; Venkatraman, 1994), that the deep structure of organizations work against IT-enabled change (Besson and Rowe, 2012; Boudreau and Robey, 2005; Silva and Hirschheim, 2007) and that resistance to change increases the closer organizations get to substantially changing their products, services, targeted markets and organizational boundaries with IT (Bharadwaj et al., 2013; Venkatraman, 1994). As a result, it has been argued that IT-enabled organizational transformation is a slow and gradual process that emerges out of the alterations to practices and organizational roles that organizational actors do as they use IT systems,

which over time may lead more fundamental organizational transformation (Barley, 1986; Orlikowski, 1996; Robey and Sahay, 1996). I have therefore described IT-enabled organizational transformation as a process unfolding primarily within organizations that is likely to follow a bottom-up trajectory.

In contrast, I have argued in this dissertation that digital transformation concerns organizational change that is driven by digital innovation as in the use of digital technology for the development of digital products, services and business models, and the positioning and exploitation of these in digital ecosystems. I have drawn upon recent research to conceptualize digital technology as inherently reprogrammable, self-referential and as in a mutually constitutive relationship with LMAs. By synthesizing existing contributions in IS research with my own research, I have shown how these characteristics of digital technology come to bestow upon digital innovation processes and outcomes characteristics of being inherently combinatorial, open-ended and distributed. In the utilization of these characteristics, digital products and services are often designed to be integrated into the products and services of others, they often retain a flexibility that allow them to change in kind over time, and they come to rely on external relationships to distributed technologies and associated human actors. Since it concerns alteration to products, services and business models, and since it often implies breaching organizational boundaries to attain and supply key assets, digital innovation is in a position to be directly formative to higher level business and corporate strategies (Bharadwaj et al., 2013) and likely to imply change to the deep structure of organizations. In all, this has led me to suggest that digital transformation are processes that are inherently embedded in digital ecosystems and likely to follow top-down trajectories in the realization of organizational transformation.

To build on the work presented here and to further progress knowledge generation on digital transformation as a distinct area of theorizing, I suggest that we as IS researchers need to address two main challenges. First, knowledge generation on digital transformation would benefit from a more open discussion on whether it is fruitful to distinguish between IT, digital technology and the processes of transformation associated with each in IS research. While we have yet to see the explicit surfacing of this debate, one may currently distinguish some of the proponents and arguments for making this distinction. For example, we have the discourse on digital innovation that argues for approaching digital technology and innovation as something distinct since it essentially concerns a different scope than IT innovation, and it therefore requires a different form of support from, and comes to have other consequences on, organizations (Fichman et al., 2014; Yoo et al., 2010). Further, it has been argued that digital innovation has inherent characteristics, such as unboundedness and a distributed innovation agency, that require us to question dominant conceptualizations of organizations (Majchrzak et al., 2016) and assumptions that we have relied upon to study and theorize the management of innovation (Nambisan et al., 2017). Moreover, it has also been shown that practitioners tend to make

a distinction between digital technology and IT, as can be seen for example in how CDOs define their own jurisdiction in organizations and how they contrast it with that of CIOs (Haffke et al., 2016; Tumbas et al., 2018). Second, it has been observed elsewhere that IS research has been more willing to study phenomena that involves IT and organizations that are clearly distinguishable with clearly delineated boundaries and that it has been less likely to study phenomena that involves distributed technology that spans organizational boundaries (Sørensen and Landau, 2015). Further, it has also been argued that the IS field has not directed enough attention to the ways in which technology leads to change in wider organizational environments such as industries and markets (Agarwal and Lucas, 2005; Crowston and Myers, 2004; Lucas Jr. et al., 2013). Since digital transformation inherently concerns distributed technology, dissolving organizational boundaries and change to digital business and technology environments, IS research therefore needs to become comfortable with, and find ways to study, technology induced change inside and outside organizations as well as the relationship between them.

6.2. Implications for practice

Indeed, digital transformation has become a key concern to practitioners. This is no least evident in the substantial attention it has recently attracted from IT and management consultancy firms (e.g. Bonnet, 2011; Catlin et al., 2017; Trenchil, 2017; Westerman et al., 2011) and policy makers (e.g. European Commission, n.d.; OECD, 2018; The Swedish Ministry of Enterprise and Innovation, 2017), and the fact that it has surfaced as a key contemporary challenge for IT management professionals (Kappelman et al., 2018). Many practitioners are faced with the opportunities and challenges of digital transformation daily, and to that end, the work presented in this dissertation may be helpful in the following ways.

First, it may be useful in helping organizations to determine if, when and why they should initiate digital transformation. Considering the complex and holistic scope of organizational change associated with digital transformation, it is easy to see that it is likely to be a severely expensive and painful process for most organizations. Hence, no organization should willingly engage in digital transformation for the simple sake of transforming (Andriole, 2017), it should instead be motivated by the identification of clear opportunities and/or challenges. On the other hand, digital business and technology environments tend to change both rapidly and fundamentally in ways that are difficult to foresee and plan for. What thus seems to be required of organizations is in part an ability to keep track of external events and to know which events are relevant, but also a proactive stance that will be beneficial for the organization once it decides to respond to emerging opportunities or threats. To facilitate the development of the former ability, this dissertation has suggested that digital ecosystems provides a way to understand the external business and technology environment that is particularly relevant for organizations in digital transformation. By examining the particular context of use that

an organization is in or seeks to enter, it becomes possible to identify the digital technologies and associated actors most likely to generate change that either opens up new opportunities for value creation and capture or comes to challenge the way value is currently created and captured. For example, the emergence of new digital platforms that are capable of serving a particular use may also provide means to distribute and generate revenues from digital services or content within that use context. Thus, for the aspiring digital module provider, it is important to keep track of digital platforms and understand how they may serve different use contexts. In order to spot emerging threats, it is also important for an organization to become aware of digital platforms or modules that enter and rapidly become central in its digital ecosystem and understand how they leverage the digital ecosystem to create and capture value. As primarily addressed in Paper 4, digital ecosystem entrants with new digital value logics may rapidly become threats that are very difficult to respond to with old value logics, and they may thus put other organizations in a position where digital transformation is vital. In order to be prepared for such situations, organizations may assume a more proactive stance to digital transformation by reviewing the digital organizing logic of the organization, and if needed, to alter or try to make it more flexible. The first step to this could be to review how actors within the organization perceive the organization, what it does and how, and to get a sense of what would be seen as legitimate change to the purpose and means of the organization. If the organizing logic that emerges from this seems limited and rigid, one can expect that only limited change to products, services and processes will be seen as legitimate, and that more fundamental organizational transformation will likely be met with resistance.

Second, it has been elsewhere suggested (Matt et al., 2015) and here repeated that since digital transformation is a process motivated and driven by opportunities and challenges presented by dynamic digital business and technology environments, organizations will likely need to alter the paths they stake out in digital transformation. However, for organizational actors, it may not be clear exactly how to determine why and when such adjustments are necessary. To that end, the concept of digital ecosystems could assist organizations in identifying latent or existing relationships to external actors and technologies that are likely to be the locus of new resources or competitive moves that can motivate the alteration of intended digital transformation paths. This includes paying attention to other organizations and their products and services, but also to the customers, or end-users, that occupy a particular digital ecosystem. Since it is often ultimately for end-users that products and services are provided in exchange for monetary compensation, it is important for organizations to remain vigilant to changes in their behaviors and preferences as potential indications of that one's own products, services and business model may need to be revised.

In all, the work presented in this dissertation points to that, in order to successfully manage digital transformation, organizations may need to develop overarching structures that span wider in time and scope than single digital innovation projects. What may

here call digital transformation units can be assigned responsibility over tasks that are key to managing digital transformation, including to plan and coordinate sequential digital innovation and manage the intended and unintended cumulative effects that digital innovation may produce over time. Another important task for this unit could be to continuously scan relevant digital ecosystems for potential opportunities and threats (c.f. Nylén and Holmström, 2015). Specifically, this would include identifying potential resources and assets that may fuel digital transformation efforts, identifying existing or latent ecosystem members that may become competitive threats, and if relevant, it could also imply the identification and analysis of digital ecosystems that one is currently not a member of in order to discover untapped opportunities.

6.3. Limitations and suggestions for future research

As with all research, the work presented here has limitations that stem from conceptual development and its empirical grounding that open opportunities for future theorizing efforts. Although I have strived for conceptual clarification, there are still issues left to solve concerning the concepts associated with digital transformation and their relationships. One of the issues revolves around where digital transformation should be located both empirically and in the wider theoretical context of IS research. For example, policy makers tend to apply digital transformation for describing change at the societal, industry, or national level (European Commission, n.d.; OECD, 2018), and IS research has also located it in society at large, industries, markets, fields as well as organizations (Agarwal et al., 2010; Henriette et al., 2016; Hinings et al., 2018; Piccinini et al., 2015). Since the boundaries between the products, services, business models and innovation processes of organizations are increasingly fading in a digital business and technology landscape, it becomes increasingly difficult to separate change within and without organizations, and that digital transformation therefore could, or even should, be considered as the sum of all change driven by the use of digital technology makes empirical sense. Yet when theorizing it within IS, its positioning and relationships to other concepts becomes more important. This has been a concern in my own work as well, as can be seen in how I define and use the concept of digital transformation in paper 4, paper 1 and in this introductory section. In paper 4 we draw on Hinings et al (2018) and accordingly refer to digital transformation as occurring at the level of organizations, ecosystems, fields and industries, yet both in this introductory section and in paper 1, digital transformation concerns processes located at the organizational level. While these efforts reflect my own interim struggles to make sense of theory and practice (Weick, 1995), I encourage future research to carry on the struggle through conceptual and empirical efforts that may bring further clarity to this issue. Indeed, concerns with conceptual clarification is not limited to the particular discourse on digital transformation, as the more established discourse on digital innovation has also been argued to suffer from a lack of a shared and coherent theoretical vocabulary (Nambisan, 2018). If future research should converge on the relationship between digital innovation and digital

transformation as I have suggested here, the latter may serve to envelop the former, and the former may be seen as a constitutive element of the latter, and through theorizing them in this way, we may better distinguish and clarify them both.

Through introducing the concept of digital ecosystems into a conceptual framework for understanding digital transformation, I address a form of agency that I have found described in existing research on digital transformation and also encountered in my own empirical studies that is external to organizations yet still important to why and how they change over time through digital transformation. Being distributed outside of focal organizations, this agency is at times difficult to exactly pinpoint, yet particularly if seen as structured by LMA, digital ecosystems provide means to explain relationships, dependencies and interactions between distributed organizations and technologies that are helpful for understanding it. However, considering the characteristics and underlying mechanisms that have been emphasized by recent research as distinct to environments characterized by digital technology and digital innovation (e.g. Kallinikos et al., 2013), digital ecosystems may fall short in describing the relationship between organizations and their technology and business environments fully. In particular, a coherent way to conceptualize the underlying process and mechanisms that continuously expand the available design space for digital innovation (Lyytinen and Rose, 2003), including extensive digitization and increasing access to digital data, exponential improvements in computing capabilities, and the convergence of industries, markets, products, and services (Tilson et al., 2010; Yoo et al., 2012b), is still lacking. In search of such a concept, digitalization as suggested by Tilson et al (2010) bears promise.

It is also important to note that my theorizing is limited by the empirical cases I have investigated. Indeed, none of the papers can be said to fully reflect digital transformation as I have described it here in the introductory section, but rather, they have enabled me to focus on addressing particular key aspects of digital transformation. By providing a conceptual framework on digital transformation dynamics, my aim is to both support and encourage future studies to take a holistic grasp of digital transformation processes. However, considering the temporal scale and overall complexity of digital transformation, it is certainly more feasible to theorize specific aspects of digital transformation based on empirical studies that cover shorter time periods. Yet as long as our theorizing efforts remain considerate to the theoretical context of digital transformation, we can remain confident in cumulative contributions to ultimately provide a more complete understanding.

References

- Adomavicius, G., Bockstedt, J.C., Gupta, A., Kauffman, R.J., 2008. Making Sense of Technology Trends in the Information Technology Landscape: A Design Science Approach. *MIS Quarterly* 32, 779–809. <https://doi.org/10.2307/25148872>
- Agarwal, R., Gao, G. (Gordon), DesRoches, C., Jha, A.K., 2010. Research Commentary —The Digital Transformation of Healthcare: Current Status and the Road Ahead. *Information Systems Research* 21, 796–809. <https://doi.org/10.1287/isre.1100.0327>
- Agarwal, R., Lucas, H.C., 2005. The Information Systems Identity Crisis: Focusing on High-Visibility and High-Impact Research. *MIS Quarterly* 29, 381–398. <https://doi.org/10.2307/25148689>
- Aldrich, H., Ruef, M., 2006. *Organizations Evolving*, 2nd edition. ed. SAGE Publications Ltd, London, UK.
- Alexander, D.T., Lyytinen, K., 2017. Organizing Successfully for Big Data to Transform Organizations, in: *Proceedings of the Twenty-Third Americas Conference on Information Systems (AMCIS)*. Boston, MA, p. 10.
- Alter, S., 2003. SIDESTEPPING THE IT ARTIFACT, SCRAPPING THE IS SILO, AND LAYING CLAIM TO “SYSTEMS IN ORGANIZATIONS.” *Communications of the Association for Information Systems* 12, 494–526.
- Andal-Ancion, A., Cartwright, P.A., Yip, G.S., 2003. The Digital Transformation of Traditional Businesses. *MIT Sloan Management Review* 44, 34–41.
- Andriole, S.J., 2017. Five Myths About Digital Transformation. *MIT Sloan Management Review* 58, 20–22.
- Avgerou, C., 2000. Information systems: what sort of science is it? *Omega* 28, 567–579. [https://doi.org/10.1016/S0305-0483\(99\)00072-9](https://doi.org/10.1016/S0305-0483(99)00072-9)
- Baldwin, C.Y., Clark, K.B., 1997. Managing in an Age of Modularity. *Harvard Business Review* 75, 84–93.
- Barley, S.R., 1986. Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments. *Administrative Science Quarterly* 31, 78–108. <https://doi.org/10.2307/2392767>
- Benbasat, I., Zmud, R.W., 2003. The Identity Crisis within the Is Discipline: Defining and Communicating the Discipline’s Core Properties. *MIS Quarterly* 27, 183–194. <https://doi.org/10.2307/30036527>
- Berman, S.J., 2012. Digital transformation: opportunities to create new business models. *Strategy & Leadership* 40, 16–24. <https://doi.org/10.1108/10878571211209314>
- Besson, P., Rowe, F., 2012. Strategizing information systems-enabled organizational transformation: A transdisciplinary review and new directions. *The Journal of Strategic Information Systems* 21, 103–124. <https://doi.org/10.1016/j.jsis.2012.05.001>
- Bharadwaj, A., El Sawy, O.A., Pavlou, P.A., Venkatraman, N., 2013. Digital Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly* 37, 471–482. <https://doi.org/10.25300/MISQ/2013/37:2.3>
- Bonnet, D., 2011. Transform to the Power of Digital: Digital Transformation as a Driver of Corporate Performance. *Digital Transformation Review* 1, 14–29.

- Boudreau, M.-C., Robey, D., 2005. Enacting Integrated Information Technology: A Human Agency Perspective. *Organization Science* 16, 3–18. <https://doi.org/10.1287/orsc.1040.0103>
- Catlin, T., Lorenz, J.-T., Sternfels, B., Willmott, P., 2017. A roadmap for a digital transformation | McKinsey [WWW Document]. Mckinsey.com. URL <https://www.mckinsey.com/industries/financial-services/our-insights/a-roadmap-for-a-digital-transformation> (accessed 10.3.18).
- CGI, 2016. Digital transformation [WWW Document]. cgi.com. URL <https://www.cgi.com/en/digital-transformation> (accessed 10.2.18).
- Chan, Y.E., Huff, S.L., Barclay, D.W., Copeland, D.G., 1997. Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment. *Information Systems Research* 8, 125–150.
- Crowston, K., Myers, M.D., 2004. Information technology and the transformation of industries: three research perspectives. *The Journal of Strategic Information Systems* 13, 5–28. <https://doi.org/10.1016/j.jsis.2004.02.001>
- de Reuver, M., Sørensen, C., Basole, R.C., 2017. The Digital Platform: A Research Agenda. *Journal of Information Technology*.
- Eaton, B., Elauf-Calderwood, S., Sørensen, C., Yoo, Y., 2015. Distributed Tuning of Boundary Resources: The Case of Apple’s iOS Service System. *MIS Quarterly* 39, 217–243.
- European Commission, n.d. Digital transformation [WWW Document]. European Commission. URL /growth/industry/policy/digital-transformation_en (accessed 9.4.18).
- Fichman, R., 2004. Going Beyond the Dominant Paradigm for Information Technology Innovation Research: Emerging Concepts and Methods. *Journal of the Association for Information Systems* 5, 314–355. <https://doi.org/10.17705/1jais.00054>
- Fichman, R.G., Dos Santos, B.L., Zheng, Z. (Eric), 2014. Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. *MIS Quarterly* 38, 329–343.
- Fitzgerald, M., Kruschwitz, N., Bonnet, D., Welch, M., 2013. Embracing Digital Technology: A New Strategic Imperative, MIT Sloan Management Review Research Report.
- Flyvbjerg, B., 2006. Five Misunderstandings About Case-Study Research. *Qualitative Inquiry* 12, 219–245. <https://doi.org/10.1177/1077800405284363>
- Fujitsu, 2018. Global Digital Transformation Survey Report 2018. Fujitsu.
- Gawer, A., Phillips, N., 2013. Institutional Work as Logics Shift: The Case of Intel’s Transformation to Platform Leader. *Organization Studies* 34, 1035–1071.
- Gersick, C.J.G., 1991. Revolutionary Change Theories: A Multilevel Exploration of the Punctuated Equilibrium Paradigm. *The Academy of Management Review* 16, 10–36. <https://doi.org/10.2307/258605>
- Gerster, D., 2017. Digital Transformation and IT: Current State of Research, in: *Proceedings of the Pacific Asia Conference on Information Systems (PACIS)*. Langkawi.
- Ghazawneh, A., Henfridsson, O., 2013. Balancing platform control and external contribution in third-party development: the boundary resources model. *Information Systems Journal* 23, 173–192. <https://doi.org/10.1111/j.1365-2575.2012.00406.x>

- Gimpel, H., Hosseini, S., Huber, R.X.R., Probst, L., Röglinger, M., Faisst, U., 2018. Structuring Digital Transformation: A Framework of Action Fields and its Application at ZEISS. *Journal of Information Technology Theory and Application* 19, 31–54.
- Goes, P., 2015. Big Data - Analytics Engine for Digital Transformation: Where is IS?, in: *Proceedings of the Twenty-First Americas Conference on Information Systems (AMCIS)*. Puerto Rico, p. 5.
- Gregor, S., 2006. The Nature of Theory in Information Systems. *MIS Quarterly* 30, 611–642. <https://doi.org/10.2307/25148742>
- Gregory, R.W., Keil, M., Muntermann, J., Mähring, M., 2015. Paradoxes and the Nature of Ambidexterity in IT Transformation Programs. *Information Systems Research* 26, 57–80. <https://doi.org/10.1287/isre.2014.0554>
- Guthrie, R.A., 2003. The IS Core - V: Defining the IS Core. *Communications of the Association for Information Systems* 12. <https://doi.org/10.17705/1CAIS.01235>
- Haffke, I., Kalgovas, B., Benlian, A., 2016. The Role of the CIO and the CDO in an Organization's Digital Transformation, in: *Proceedings of the Thirty-Seventh International Conference on Information Systems (ICIS)*. Dublin, p. 21.
- Hansen, A.M., Kraemmergaard, P., Mathiassen, L., 2011. Rapid Adaptation in Digital Transformation: A Participatory Process for Engaging IS and Business Leaders. *MIS Quarterly Executive* 10, 175–185.
- Hartl, E., Hess, T., 2017. The Role of Cultural Values for Digital Transformation: Insights from a Delphi Study, in: *Proceedings of the Twenty-Third Americas Conference on Information Systems (AMCIS)*. Boston, MA, p. 10.
- Heilig, L., Schwarze, S., Voß, S., 2017. An Analysis of Digital Transformation in the History and Future of Modern Ports, in: *Proceedings of the 50th Hawaii International Conference on System Sciences (HICSS-50)*. Waikoloa, HI, USA, pp. 1341–1350.
- Henderson, J.C., Venkatraman, N., 1999. Strategic alignment : a model for organizational transformation via information technology. *IBM Systems Journal* 38, 472–484.
- Henfridsson, O., Nandhakumar, J., Scarbrough, H., Panourgias, N., 2018. Recombination in the open-ended value landscape of digital innovation. *Information and Organization* 28, 89–100. <https://doi.org/10.1016/j.infoandorg.2018.03.001>
- Henriette, E., Feki, M., Boughzala, I., 2016. Digital Transformation Challenges, in: *MCIS 2016 Proceedings*. Presented at the Mediterranean Conference on Information Systems (MCIS).
- Hinings, B., Gegenhuber, T., Greenwood, R., 2018. Digital Innovation and Transformation: An Institutional Perspective. *Information and Organization* 28, 52–61.
- Holmström, J., 2018. Recombination in digital innovation: Challenges, opportunities, and the importance of a theoretical framework. *Information and Organization* 28, 107–110. <https://doi.org/10.1016/j.infoandorg.2018.04.002>
- Holmström, J., 2005. Theorizing in IS Research: What Came Before and What Comes Next? *Scandinavian Journal of Information Systems* 17, 167–174.
- Huang, J., Henfridsson, O., Liu, M.J., Newell, S., 2017. Growing on Steroids: Rapidly Scaling the User Base of Digital Ventures Through Digital Innovaton. *MIS Quarterly* 41, 301–314.
- Iansiti, M., Lakhani, K.R., 2014. Digital Ubiquity: How Connections, Sensors, and Data Are Revolutionizing Business. *Harvard Business Review* 92, 90–99.

- Imenda, S., 2014. Is There a Conceptual Difference between Theoretical and Conceptual Frameworks? *Journal of Social Sciences* 38, 185–195. <https://doi.org/10.1080/09718923.2014.11893249>
- Jacobides, M.G., Cennamo, C., Gawer, A., 2018. Towards a theory of ecosystems. *Strategic Management Journal* 39, 2255–2276. <https://doi.org/10.1002/smj.2904>
- Jones, M.R., Karsten, H., 2008. Giddens's Structuration Theory and Information Systems Research. *MIS Quarterly* 32, 127–157. <https://doi.org/10.2307/25148831>
- Kallinikos, J., Aaltonen, A., Marton, A., 2013. The Ambivalent Ontology of Digital Artifacts. *Mis Quarterly* 37.
- Kappelman, L., Johnson, V., Torres, R., Maurer, C., McLean, E., 2018. A study of information systems issues, practices, and leadership in Europe. *European Journal of Information Systems* 1–17. <https://doi.org/10.1080/0960085X.2018.1497929>
- Karimi, J., Walter, Z., 2015. The Role of Dynamic Capabilities in Responding to Digital Disruption: A Factor-Based Study of the Newspaper Industry. *Journal of Management Information Systems* 32, 39–81. <https://doi.org/10.1080/07421222.2015.1029380>
- Keen, P.G.W., 1981. Information Systems and Organizational Change. *Communications of the ACM* 24, 10.
- Klein, H.K., Myers, M.D., 1999. A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly* 23, 67–93. <https://doi.org/10.2307/249410>
- Kling, R., 1999. What is Social Informatics and Why Does it Matter? *D-Lib Magazine* 5. <https://doi.org/10.1045/january99-kling>
- Kutzner, K., Schoormann, T., Knackstedt, R., 2018. Digital Transformation in Information Systems Research: A Taxonomy-Based Approach to Structure the Field, in: *Proceedings of the 26th European Conference on Information Systems (ECIS)*. Portsmouth, UK.
- Langley, A., 1999. Strategies for Theorizing from Process Data. *The Academy of Management Review* 24, 691–710. <https://doi.org/10.2307/259349>
- Langley, A., Smallman, C., Tsoukas, H., Van de Ven, A.H., 2013. Process Studies of Change in Organization and Management: Unveiling Temporality, Activity, and Flow. *Academy of Management Journal* 56, 1–13. <https://doi.org/10.5465/amj.2013.4001>
- Langley, A., Tsoukas, H., 2017a. Process Thinking, Process Theorizing and Process Researching, in: Langley, A., Tsoukas, H. (Eds.), *The SAGE Handbook of Process Organization Studies*. SAGE, pp. 45–74.
- Langley, A., Tsoukas, H., 2017b. Process Thinking, Process Theorizing and Process Researching, in: *The SAGE Handbook of Process Organization Studies*. SAGE, pp. 45–74.
- Langlois, R.N., Robertson, P.L., 1992. Networks and innovation in a modular system: Lessons from the microcomputer and stereo component industries. *Research Policy* 21, 297–313. [https://doi.org/10.1016/0048-7333\(92\)90030-8](https://doi.org/10.1016/0048-7333(92)90030-8)
- Lanzolla, G., Lorenz, A., Miron-Spektor, E., Schilling, M., Solinas, G., Tucci, C., 2018. Digital Transformation: What Is New If Anything? *Academy of Management Discoveries* 4, 378–387. <https://doi.org/10.5465/amd.2018.0103>

- Leonardi, P.M., Barley, S.R., 2010. What's Under Construction Here? Social Action, Materiality, and Power in Constructivist Studies of Technology and Organizing. *The Academy of Management Annals* 4, 1–51. <https://doi.org/10.1080/19416521003654160>
- Li, L., Su, F., Zhang, W., Mao, J.-Y., 2017. Digital transformation by SME entrepreneurs: A capability perspective. *Information Systems Journal* 1–29. <https://doi.org/10.1111/isj.12153>
- Lindgren, R., Eriksson, O., Lyytinen, K., 2015. Managing identity tensions during mobile ecosystem evolution. *Journal of Information Technology* 30, 229–244. <https://doi.org/10.1057/jit.2015.8>
- Lucas, H.C., Goh, J.M., 2009. Disruptive technology: How Kodak missed the digital photography revolution. *The Journal of Strategic Information Systems* 18, 46–55. <https://doi.org/10.1016/j.jsis.2009.01.002>
- Lucas Jr., H.C., Agarwal, R., Clemons, E.K., El Sawy, O.A., Weber, B., 2013. Impactful Research on Transformational Information Technology: An Opportunity to Inform New Audiences. *MIS Quarterly* 37, 371–382.
- Lyytinen, K., King, J.L., 2004. Nothing At The Center?: Academic Legitimacy in the Information Systems Field 12. *Journal of the Association for Information Systems* 5, 220–246.
- Lyytinen, K., Newman, M., 2008. Explaining information systems change: a punctuated socio-technical change model. *European Journal of Information Systems* 17, 589–613. <https://doi.org/10.1057/ejis.2008.50>
- Lyytinen, K., Rose, G.M., 2003. The Disruptive Nature of Information Technology Innovations: The Case of Internet Computing in Systems Development Organizations. *MIS Quarterly* 27, 557–596.
- Majchrzak, A., Markus, M.L., Wareham, J., 2016. Designing for Digital Transformation: Lessons for Information Systems Research from the Study of ICT and Societal Challenges. *MIS Quarterly* 40, 267–277. <https://doi.org/10.25300/MISQ/2016/40:2.03>
- Mangematin, V., Sapsed, J., Schüßler, E., 2014. Disassembly and reassembly: An introduction to the Special Issue on digital technology and creative industries. *Technological Forecasting and Social Change* 83, 1–9. <https://doi.org/10.1016/j.techfore.2014.01.002>
- Markus, M.L., 2004. Technochange management: using IT to drive organizational change. *Journal of Information Technology* 19, 4–20. <https://doi.org/10.1057/palgrave.jit.2000002>
- Markus, M.L., Robey, D., 1988a. Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science* 34, 583–598. <https://doi.org/10.2307/2632080>
- Markus, M.L., Robey, D., 1988b. Information Technology and Organizational Change: Causal Structure in Theory and Research. *Management Science* 34, 583–598. <https://doi.org/10.2307/2632080>
- Matt, C., Hess, T., Benlian, A., 2015. Digital Transformation Strategies. *Bus Inf Syst Eng* 57, 339–343. <https://doi.org/10.1007/s12599-015-0401-5>
- Nambisan, S., 2018. Architecture vs. Ecosystem Perspectives: Reflections on Digital Innovation. *Information and Organization* 28, 104–106.

- Nambisan, S., Lyytinen, K., Majchrzak, A., Song, M., 2017. Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS Quarterly* 41, 223–238.
- Nwankpa, J.K., Roumani, Y., 2016. IT Capability and Digital Transformation: A Firm Performance Perspective, in: *Proceedings of the Thirty-Seventh International Conference on Information Systems (ICIS)*. Dublin, Ireland, p. 16.
- Nylén, D., Holmström, J., 2015. Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. *Business Horizons* 58, 57–67. <https://doi.org/10.1016/j.bushor.2014.09.001>
- OECD, 2018. Achieving Inclusive Growth in the Face of Digital Transformation and the Future of Work (OECD report to G-20 Finance Ministers).
- OECD, 2017. OECD Digital Economy Outlook 2017. OECD Publishing, Paris.
- Orlikowski, W.J., 1996. Improvising Organizational Transformation Over Time: A Situated Change Perspective. *Information Systems Research* 7, 63–92.
- Orlikowski, W.J., 1992a. The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science* 3, 398–427. <https://doi.org/10.2307/2635280>
- Orlikowski, W.J., 1992b. The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science* 3, 398–427. <https://doi.org/10.2307/2635280>
- Orlikowski, W.J., Barley, S.R., 2001. Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn from Each Other? *MIS Quarterly* 25, 145–165. <https://doi.org/10.2307/3250927>
- Pagani, M., 2013. Digital Business Strategy and Value Creation: Framing the Dynamic Cycle of Control Points. *MIS Quarterly* 37, 617–632. <https://doi.org/10.25300/MISQ/2013/37.2.13>
- Parker, G., Van Alstyne, M., Choudary, S.P., 2016. Platform Revolution: How Networked Markets are Transforming the Economy - and how to Make Them Work for You. W. W. Norton & Company, New York.
- Pettigrew, A.M., 1990. Longitudinal Field Research on Change: Theory and Practice. *Organization Science* 1, 267–292. <https://doi.org/10.1287/orsc.1.3.267>
- Pettigrew, A.M., 1987. CONTEXT AND ACTION IN THE TRANSFORMATION OF THE FIRM. *Journal of Management Studies* 24, 649–670. <https://doi.org/10.1111/j.1467-6486.1987.tb00467.x>
- Piccinini, E., Hanelt, A., Gregory, R., Kolbe, L., 2015. Transforming Industrial Business: The Impact of Digital Transformation on Automotive Organizations, in: *Proceedings of the Thirty-Sixth International Conference on Information Systems (ICIS)*. Presented at the International Conference on Information Systems, Fort Worth, p. 20.
- Poole, M.S., Ven, A.H.V. de, Dooley, K., Holmes, M.E., 2000. *Organizational Change and Innovation Processes: Theory and Methods for Research*. Oxford University Press.
- Purohit, S., 2016. Consulting in the Time of Digital Transformation, Infosys Insights. Infosys.
- Regeringskansliet, R. och, 2017. Action on digital transformation [WWW Document]. Regeringskansliet. URL <https://www.government.se/press-releases/2017/06/action-on-digital-transformation/> (accessed 9.3.18).
- Rigby, D., K., 2014. digital-physical mashups. *Harvard Business Review* 92, 84–92.

- Robey, D., Boudreau, M.-C., 1999. Accounting for the Contradictory Organizational Consequences of Information Technology: Theoretical Directions and Methodological Implications. *Information Systems Research* 10, 167–185. <https://doi.org/10.1287/isre.10.2.167>
- Robey, D., Sahay, S., 1996. Transforming Work Through Information Technology: A Comparative Case Study of Geographic Information Systems in County Government. *INFORMATION SYSTEMS RESEARCH* 7, 19.
- Sambamurthy, V., Zmud, R.W., 2000. Research Commentary: The Organizing Logic for an Enterprise's IT Activities in the Digital Era—A Prognosis of Practice and a Call for Research. *Information Systems Research* 11, 105–114. <https://doi.org/10.1287/isre.11.2.105.11780>
- Sanchez, R., Mahoney, J.T., 1996. Modularity, Flexibility, and Knowledge Management in Product and Organization Design. *Strategic Management Journal* 17, 63–76.
- Sarker, S., Lee, A.S., 1999. IT-enabled organizational transformation: a case study of BPR failure at TELECO. *Journal of Strategic Information Systems* 21.
- Schilling, M.A., 2000. Toward a General Modular Systems Theory and Its Application to Interfirm Product Modularity. *The Academy of Management Review* 25, 312–334. <https://doi.org/10.2307/259016>
- Schmid, A.M., Recker, J., 2017. The Socio-Technical Dimension of Inertia in Digital Transformations, in: *Proceedings of the 50th Hawaii International Conference on System Sciences (HICSS-50)*. Waikoloa, HI, USA, p. 10.
- Sebastian, I.M., Ross, J.W., Beath, C., Mocker, M., Moloney, K.G., Fonstad, N.O., 2017. How Big Old Companies Navigate Digital Transformation. *MIS Quarterly Executive* 16.
- Selander, L., Henfridsson, O., Svahn, F., 2013. Capability Search and Redeem across Digital Ecosystems. *J Inf Technol* 28, 183–197.
- Silva, Hirschheim, 2007. Fighting against Windmills: Strategic Information Systems and Organizational Deep Structures. *MIS Quarterly* 31, 327. <https://doi.org/10.2307/25148794>
- Skog, D.A., Wimelius, H., Sandberg, J., 2018. Digital Disruption. *Business & Information Systems Engineering* 60, 431–437. <https://doi.org/10.1007/s12599-018-0550-4>
- Sørensen, C., de Reuver, M., Basole, R.C., 2015. Mobile platforms and ecosystems. *Journal of Information Technology* 30, 195–197. <https://doi.org/10.1057/jit.2015.22>
- Sørensen, C., Landau, J.S., 2015. Academic agility in digital innovation research: The case of mobile ICT publications within information systems 2000–2014. *The Journal of Strategic Information Systems* 24, 158–170. <https://doi.org/10.1016/j.jsis.2015.07.001>
- Svahn, F., 2012. *Digital Product Innovation: Building Generative Capability through Architectural Frames (Doctoral Dissertation)*. Umeå University, Umeå.
- Svahn, F., Mathiassen, L., Lindgren, R., 2017. Embracing Digital Innovation in Incumbent Firms: How Volvo Cars Managed Competing Concerns. *MIS Quarterly* 41, 239–253. <https://doi.org/10.25300/MISQ/2017/41.1.12>
- Swanson, E.B., 1994. Information Systems Innovation among Organizations. *Management Science* 40, 1069–1092.
- Tan, F.T.C., Hedman, J., Xiao, X., 2017. Beyond ‘Moneyball’ to Analytics Leadership in Sports: An Ecological Analysis of FC Bayern Munich's Digital

- Transformation, in: Proceedings of the Twenty-Third Americas Conference on Information Systems (AMCIS). Boston, MA, p. 5.
- The Swedish Ministry of Enterprise and Innovation, 2017. For sustainable digital transformation in Sweden - a Digital Strategy (No. N2017.23). Government Offices of Sweden.
- Tilson, D., Lyytinen, K., Sorensen, C., 2010. Research Commentary--Digital Infrastructures: The Missing IS Research Agenda. *Information Systems Research* 21, 748–759. <https://doi.org/10.1287/isre.1100.0318>
- Tiwana, A., Konsynski, B., Bush, A.A., 2010. Research Commentary—Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. *Information Systems Research* 21, 675–687. <https://doi.org/10.1287/isre.1100.0323>
- Trenchil, R., 2017. Illuminating the Digital Journey Ahead. *Cognizanti* 10, 7–12.
- Tumbas, S., Berente, N., vom Brocke, J., 2018. Digital innovation and institutional entrepreneurship: Chief Digital Officer perspectives of their emerging role. *Journal of Information Technology* 33, 188–202. <https://doi.org/10.1057/s41265-018-0055-0>
- Tushman, M.L., Romanelli, E., 1985. Organizational evolution: A metamorphosis model of convergence and reorientation. *Research in Organizational Behavior* 7, 171–222.
- Ulrich, K., 1995. The role of product architecture in the manufacturing firm. *Research Policy* 24, 419–440. [https://doi.org/10.1016/0048-7333\(94\)00775-3](https://doi.org/10.1016/0048-7333(94)00775-3)
- Venkatraman, N., 1994. IT-Enabled Business Transformation: From Automation to Business Scope Redefinition. *Sloan Management Review* 35, 73–87.
- Venkatraman, N., 1989. Strategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement. *Management Science* 35, 942–962. <https://doi.org/10.1287/mnsc.35.8.942>
- Walsham, G., 1995. Interpretive case studies in IS research: nature and method. *European Journal of Information Systems* 15, 74–81.
- Wareham, J., Fox, P.B., Giner, J.L.C., 2014. Technology Ecosystem Governance. *Organization Science* 25, 1195–1215.
- Weick, K.E., 1995. What Theory is Not, Theorizing Is. *Administrative Science Quarterly* 40, 385. <https://doi.org/10.2307/2393789>
- Westerman, G., Bonnet, D., 2015. Revamping Your Business through Digital Transformation. *MIT Sloan Management Review* 56, 10–13.
- Westerman, G., Calm ejane, C., Bonnet, D., Ferraris, P., McAfee, A., 2011. Digital Transformation: a Roadmap for Billion-Dollar Organizations. MIT Center for Digital Business and Capgemini Consulting 1–68.
- Woerner, S.L., Wixom, B.H., 2015. Big data: extending the business strategy toolbox. *Journal of Information Technology* 30, 60–62. <https://doi.org/10.1057/jit.2014.31>
- Yin, R.K., 2013. *Case Study Research: Design and Methods*. SAGE Publications.
- Yin, R.K., 2003. *Case Study Research: Design and Methods*. SAGE Publications, Thousand Oaks, CA.
- Yoo, Y., 2013. The Tables Have Turned: How Can the Information Systems Field Contribute to Technology and Innovation Management Research? *Journal of the Association for Information Systems* 14, 227–236.

- Yoo, Y., Boland, R.J., Lyytinen, K., Majchrzak, A., 2012a. Organizing for Innovation in the Digitized World. *Organization Science* 23, 1398–1408.
- Yoo, Y., Boland, R.J., Lyytinen, K., Majchrzak, A., 2012b. Organizing for Innovation in the Digitized World. *Organization Science* 23, 1398–1408.
- 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, 724–735.
- Zuboff, S., 1985. Automate/informate: The two faces of intelligent technology. *Organizational dynamics* 14, 5–18.

