

A Systematic Review of the Literature on Digital Transformation: Insights and Implications for Strategy and Organizational Change

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ABSTRACT In this article we provide a systematic review of the extensive yet diverse and fragmented literature on digital transformation (DT), with the goal of clarifying boundary conditions to investigate the phenomenon from the perspective of organizational change. On the basis of 279 articles, we provide a multi-dimensional framework synthesizing what is known about DT and discern two important thematical patterns: DT is moving firms to malleable organizational designs that enable continuous adaptation, and this move is embedded in and driven by digital business ecosystems. From these two patterns, we derive four perspectives on the phenomenon of DT: technology impact, compartmentalized adaptation, systemic shift and holistic co-evolution. Linking our findings and interpretations to existing work, we find that the nature of DT is only partially covered by conventional frameworks on organizational change. On the basis of this analysis, we derive a research agenda and provide managerial implications for strategy and organizational change.

Keywords: digital business ecosystems, digital transformation, organizational change, organizational designs, systematic literature review

INTRODUCTION

Digital transformation (DT) is increasingly establishing itself as a constant theme in contemporary academic and practitioner conversations. A quick search in Google Trends shows that interest skyrocketed from a level of 1 to 100 in the six years between 2013 and 2019. This comes alongside a surge of published articles, conference panels and

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special issues in academic journals. Furthermore, as to its strategic importance (Singh et al., 2020), it has become taken for granted that DT is affecting and challenging managers across industries and contexts (e.g., Andriole, 2017; Benner and Waldfogel, 2020; Correani et al., 2020; Westerman et al., 2014). The challenges around the COVID-19 pandemic have further spurred organizations into action by increasing their awareness of the need to accelerate DT (e.g., McKinsey, 2020; strategy&, 2020).

The extensive and diverse literature on DT, however, suffers from a lacking common agreement on exactly what DT is (Warner and Wäger, 2019), and what it encompasses (Wessel et al., 2020). Systematic reviews or meta-analyses are rare and narrowly focused (e.g., Schallmo et al., 2017), or come from outside of the field of management (e.g., Vial, 2019). Despite this lack of clarity surrounding the phenomenon, a common theme in the current debate is that due to the proliferation of digital technologies – defined as the combination and connectivity of innumerable, dispersed information, communication and computing technologies (Bharadwaj et al., 2013) – contemporary organizations are both affected and need to adapt (e.g., Correani et al., 2020; Verhoef et al., 2019; Weill and Woerner, 2018). Therefore, the phenomenon is naturally connected to the topic of organizational change, viewed as a ‘difference in form, quality, or state over time in an organizational entity’ (Van de Ven and Poole, 1995, p. 512). Thus, we define DT as organizational change that is triggered and shaped by the widespread diffusion of digital technologies. Such a view enables us to potentially explain the phenomenon of DT and its management in business practice by drawing on the robust and diversified knowledge base relating to organizational change and innovation (Poole and Van de Ven, 2004).

At the same time, however, the phenomenon of DT also seems to present an opportunity (and necessity) to advance the existing body of knowledge about organizational change. While prior research studied organizational change in relation to information technology (IT) (Markus and Robey, 1988; Orlikowski, 2000; Volkoff et al., 2007), the latter defined as ‘computer-based technology for the storage, accessing, processing and communication of information’ (Molloy and Schwenk, 1995, p. 283), and created valuable and persistent knowledge, recent observations suggest that DT deviates from these past organizational changes in at least the following ways. First, the technologies involved, such as big data analytics, social media, mobile technology or cloud computing, seem very different from earlier IT (Bharadwaj et al., 2013). Unlike more traditional enterprise systems, they exhibit new properties: they are seen as generative, malleable and combinatorial (Kallinikos et al., 2013). Accordingly, assumptions about material characteristics and their consequences for organizations (e.g., Boudreau and Robey, 2005) may no longer hold. Second, many digital technologies cannot be restricted to the boundaries of specific firms or industries but involve a wider ecosystem and the demand-side. The overarching digital infrastructures that are emerging are open, flexible and ready for use by anyone, not just by companies (Tilson et al., 2010). Thus, the focus of many past studies on change within an organization, e.g., in relation to the adoption and use of enterprise IT systems (e.g., Volkoff et al., 2007), seems insufficient. Third, the consequences of DT – such as the emergence of new digital business models even in non-digital industries – seem to extend beyond those of previous phases of IT-enabled change, which were usually related to the practice level and rather incremental change within firms

(e.g., Orlikowski, 2000). In summary and as indicated by recent works (e.g., Wessel et al., 2020), it seems that the phenomenon of DT differs from past IT-related organizational change and cannot, therefore, be explained entirely using established theoretical models (Markus and Rowe, 2018). Instead, DT seems to have a more intricate and encompassing connection to the topic of organizational change, requiring a broader view of and comparison with the literature on organizational change and innovation (Poole and Van de Ven, 2004).

Due to the uncertainties about the phenomenon, it is currently unclear whether, and if so how knowledge on organizational change can be used to explain DT. In other words, as the boundaries of the phenomenon are unclear, we cannot be sure whether DT is covered by existing knowledge of organizational change. Boundary conditions ‘place limitations on the propositions generated from a theoretical model’ (Whetten, 1989, p. 492). When the empirical reality is changing, for instance due to the emergence of a new phenomenon, the fit with established theoretical models might be altered (Busse et al., 2017). From this perspective, in order to utilize and advance existing knowledge, we need to assess the fit between DT and the established theoretical models in the field of organizational change. Therefore, the following questions become pertinent: How can knowledge about DT be synthesized? What are the characteristics of DT? And, how does DT relate to existing knowledge on organizational change? Finding answers to these questions is important as it would enable a common academic understanding, a precondition for better building on each other’s work and mitigating the risk of riding fashion waves or applying false analogies. Furthermore, linking DT to extant knowledge on organizational change would enable us to give more informed guidance on successfully managing DT in business practice (Andriole, 2017), particularly regarding strategy and organizational change. Accordingly, we aim to clarify the boundary conditions both phenomenologically and inductively (Post et al., 2020). As demonstrated by several role models that have followed this procedure for other topics and delivered substantial contributions to theory in management literature (e.g., Crossan and Apaydin, 2010; Whiteman et al., 2013), one way to achieve this is via a literature review (Post et al., 2020).

For this study, we conducted a systematic review of the existing literature using a sample of 279 peer-reviewed articles. We identified key areas of inquiry and emerging themes, and synthesized the findings into a multi-dimensional framework comprising contextual conditions, mechanisms and outcomes of DT to ‘bring together all parts of the proverbial elephant’ (Crossan and Apaydin, 2010). From this basis, we derived two aggregated thematic patterns concerning the content of change: first, we found that DT leads to a shift towards malleable organizational designs which enable continuous adaptation. Second, this shift is embedded in and driven by digital business ecosystems. By connecting these content patterns with the dimensions of context and process (Pettigrew, 1987), we derived four perspectives on DT: technology impact, compartmentalized adaptation, systemic shift and holistic co-evolution. Next, we discuss the derived thematic patterns and the typology in relation to established theoretical accounts in the literature on organizational change and innovation. Among the multiple schools of thought in the literature (Poole, 2004), the dynamics of change seem to be key to understanding DT. Thus, we relate our findings particularly to the distinction in organizational change literature between episodic and continuous change perspectives, as this distinction is ‘sufficiently

pervasive in recent work and sufficiently central in the conceptualization of change' (Weick and Quinn, 1999, p. 362). Whereas the episodic position relates to infrequent and intentional organizational change (Lewin, 1951; Poole and Van de Ven, 2004; Waeger and Weber, 2019), the continuous position assumes 'ongoing, evolving and cumulative' change (Weick and Quinn, 1999, p. 365). We evaluate the fit between the underlying assumptions of that dichotomy and the phenomenon of DT. Finally, we derive a substantial research agenda on the basis of our analysis of the fit between the phenomenon of DT and the established literature on organizational change and innovation.

While there are multiple ways in which a literature review can make a theoretical contribution, this article aims to contribute via the clarification of boundary conditions, which is seen as critical for the advancement of research around a theory or topic (Post et al., 2020). In particular, our work contributes in the following ways. First, we provide the most comprehensive and up-to-date review of DT from a management perspective, synthesizing and integrating the current state of knowledge into a comprehensive and connective framework, and deriving two thematic patterns that describe the overarching peculiarities of DT. Second, we distil a typology comprising four perspectives on DT that helps to reduce the complexity of the phenomenon by offering structure and clarity. Third, we propose linkages between the phenomenon of DT and established views in management literature on organizational change and innovation and derive important avenues for future research. Overall, our review aims to help scholars to understand the phenomenon DT, encourage them to think differently about the phenomenon, and allow the development of novel and interesting empirical studies in subsequent research (Post et al., 2020). Finally, our work aims to support managers to respond to the strategic challenge of DT (Singh et al., 2020) by revealing important insights on the shifts towards malleable organizational designs and digital business ecosystems that may inform organizational change and strategy practices.

RESEARCH DESIGN

We chose the systematic review (Tranfield et al., 2003) as the methodology for our study and proceeded in three steps: (1) data collection, (2) data analysis, and (3) synthesis (Crossan and Apaydin, 2010). We limited our sources to peer-reviewed journals, as these tend to have high impacts in the field (Podsakoff et al., 2005). We selected the year 2000 as the baseline for our search in order to gain robust insights into recent developments in the understanding of DT. Our initial search was performed in the EBSCO Business Source Complete (BSC) database. We chose this database because it allows researchers access to the full-text content of more than 1,300 peer-reviewed journals in the fields of management and economics (e.g., *Academy of Management Journal* or *Management Science*). It is thus one of the most complete sources of business studies (González-Benito et al., 2013; Zott et al., 2011) commonly used in literature reviews (e.g., Certo et al., 2009; Laplume et al., 2008). The search within the BSC database was performed using the following keywords: 'digital transformation' and 'digital' AND 'transformation'. These keywords resulted in a sample of 416 articles. We next performed a backward-forward search by (1) reviewing the references of the articles that we had identified in the initial

search, and (2) identifying articles that cited the articles in our initial sample (cf. Webster and Watson, 2002). This resulted in a further 453 articles, leading to a total of 869 articles.

We then distilled the most relevant papers by filtering them into three groups (see Crossan and Apaydin, 2010). Articles that were published in one of the 50 journals in the *Financial Times* list (FT50) were allocated to Group 1. The FT50 list contains high quality journals across a range of disciplines, such as the *Journal of Management Studies* or *Organization Science*, and was used as a representative and externally valid sample of top management journals (Biehl et al., 2006; Burgess and Shaw, 2010). This criterion was chosen based on the premise that top journals normally publish high quality papers and has also been applied in other literature review studies (e.g., Crossan and Apaydin, 2010; Kwak and Anbari, 2009). This returned a total of 46 articles. Articles that met our citation-based selection criteria and that were not published in one of the FT50 journals were allocated to Group 2. The 124 articles we assigned to this group had at least 20 citations in the BSC database or in Google Scholar. Finally, to consider citation biases and time lags we placed any recent publications (2016–18) that were not published in one of the FT 50 journals and had fewer than 20 citations in the BSC database or in Google Scholar into Group 3. 109 articles were assigned to this group. This filtering process left us with a total of 279 articles across the three groups.

Our analysis followed the structuring content analysis approach of Mayring (2000, 2014). We chose this approach because it allows the systematic and theory-guided reduction of a large amount of text data from any type of communication down to its essence by classifying the material into unifying categories, and also because it is a well-known and established analysis process (e.g., Breitenmoser and Bader, 2016; Engert and Baumgartner, 2016; Fastenrath and Braun, 2018). For this approach, Mayring (2000, 2014) advises carrying out the following five steps: (1) develop a category system according to the research questions, (2) code relevant passages in the text in accordance with the category system, (3) revise the previously developed classification framework, (4) code the text according to the revised category system, and (5) interpret and discuss the final results. Accordingly, we first deductively derived the basic structuring dimensions from the literature. More specifically, we adopted Pawson and Tilley's (1997) generic contextual conditions-mechanisms-outcome structure, which allowed us to analyse our collected data without preconceptions or prior assumptions. We selected this structure for three specific reasons. First, as is explained in more detail later on, it allowed us to cater to all four of the dimensions of organizational change, or 'issues common to all change efforts' (p. 293), named by Armenakis and Bedeian (1999), i.e., *content*, *context*, *process* and *outcomes* (see explanation below). Second, this approach has been applied multiple times in case studies in the context of DT and digital innovation (e.g., Henfridsson and Bygstad, 2013; Huang et al., 2017). For instance, Henfridsson and Yoo (2013) used it to describe trajectory shifts of automotive incumbents entering the era of digital innovation. Third, the structure is generic enough to scope out the field (Crossan and Apaydin, 2010) and serve as a foundation for analysing the broad and diverse literature on DT. The rather simplistic categories of the framework are building blocks that allow complex analysis and interpretation of the findings (see discussion section). Thus, the initial categories were contextual conditions, mechanisms and outcomes, representing the issues of *context*,

process and *outcomes* (see Armenakis and Bedeian, 1999). To also cater to the issue of *content* (see Armenakis and Bedeian, 1999), we subsequently distilled the key findings and constructs from each article (Mayring, 2014) that provided the material for further analysis and allocated them to the categories.

In order to illustrate the categories, we provide some exemplary findings in the following. An example of contextual conditions is the emergence and diffusion of cloud computing, as it is described as shaping and driving DT (e.g., Benlian et al., 2018). In the category mechanisms we identified, for example, process models to describe and explain how small and medium enterprises drive DT in their companies (Li et al., 2017). Finally, the description of the novel institutional building blocks and infrastructures that emerge through DT can be seen as an exemplary insight regarding the outcomes of the phenomenon (e.g., Hinings et al., 2018).

After conducting a trial run-though comprising about 10 per cent of the material, we refined the initial category system by subdividing the existing categories (Mayring, 2014). For instance, the category contextual conditions was divided into the sub-categories of material, organizational and environmental antecedents. After applying the categories and sub-categories to about half the material, we again revised the category system by splitting up the sub-categories 'into individual features or values' (Mayring, 2014, p. 95). For example, environmental antecedents were found to contain country characteristics, industry characteristics and consumer characteristics. Thus, the divisions at the lowest level of the hierarchical category system reflect very specific *key areas* of inquiry. Eventually, we categorized all of the material according to the final category system. This process was performed following an iterative procedure of re-examining the articles and discussion, which allowed us to achieve agreement among all authors (see Karhunen et al., 2018). First, two authors performed the allocations independently. Then the same authors cross-checked each other's results and discussed any discrepancies. If, for example, discrepancies were just based on misunderstandings, the allocations were unified immediately. In a next step, the allocations were scrutinized by two other authors in isolation. Finally, the prevailing discrepancies were discussed and unified by all four authors until agreements were reached on the allocations of all the articles. After the final category system was derived, in order to make the analysis more meaningful and actionable, the authors allocated labels to each key area. Based on a review of the factors within the key areas, the authors first developed labels individually and then compared, discussed and decided on them collectively. These labels refer to the *key themes* in the respective key area, indicating the particular direction of change. For example, in the key area 'product' we found that 'smart, connected and customizable products' was a suitable theme. In the following section, we describe the findings of our review in detail.

FINDINGS

As Figure 1 illustrates, the rise in interest in DT has been fast and recent. The number of publications dealing with DT has risen substantially over time. Indeed, 50 per cent of the 279 articles in the consideration set were published in the last five years. Figure 1 shows the cumulative number of articles on DT published between 2000 and 2018 within our sample.

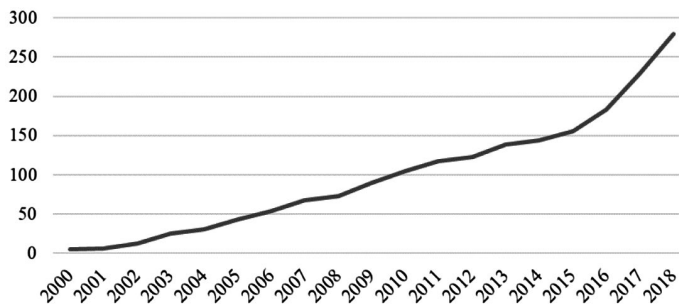


Figure 1. Articles on digital transformation published over time

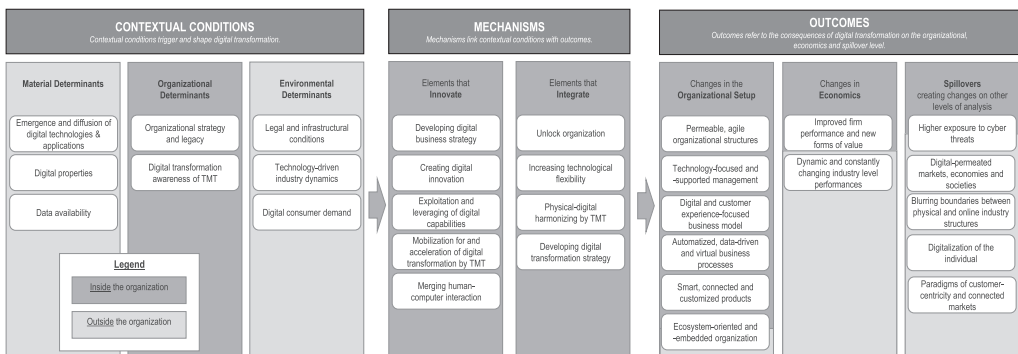


Figure 2. Multi-dimensional framework of digital transformation

In the following, we synthesize the findings of our review into both a research matrix (Appendix I, II and III) and a comprehensive, multi-dimensional framework of DT (Figure 2). The matrices organize our findings and link together the review's different insights into a coherent whole, while the multi-dimensional framework condenses the matrices into an overarching structure and provides a practical tool for scholars and practitioners to analyse DT. The matrices comprise the three aforementioned categories – contextual conditions, mechanisms and outcomes. In the following we consecutively describe each category, its respective sub-categories, and the key themes of each sub-category. The sub-categories and key themes are illustrated in *italics* (e.g., *organizational strategy and legacy*, part of the sub-category *organizational determinants*).

Contextual Conditions

Contextual conditions define the onset of DT (Henfridsson and Yoo, 2013). Our review found *material*, *organizational* and *environmental* antecedents which trigger and shape DT (see Wessel et al., 2020).

Clearly, the *emergence and diffusion* of a variety of *digital technologies and applications* have triggered and shaped DT as *material antecedents*. We found that so-called SMACIT technologies (social, mobile, analytics, cloud, and Internet of Things) (e.g., Sebastian et al.,

2017) especially shape DT due to their specific characteristics, referred to as *digital properties*, most importantly their reprogrammability, homogenization of data, and self-referential nature (Yoo, 2010). Concurrently, the emergence and diffusion of digital technologies has led to an increased *data availability*, which in turn has increased the importance for organizations of machine learning and data analytics (Weichert, 2017).

When digital technologies enter organizations, they interact with *organizational antecedents*, particularly organizational and managerial characteristics. Organizational characteristics encompass *organizational strategy and legacy*, such as the historical pathway of an organization (e.g., Devadoss and Pan, 2007), as well as an organization's resources, processes, values and culture (e.g., Dewan et al., 2003). Managerial characteristics, on the other hand, rely on the *digital transformation awareness of TMT* to initiate DT. This can, for example, be expressed by a positive attitude towards change and technology (e.g., Dery et al., 2017).

Obviously, material and organizational antecedents are embedded in and interact with *environmental antecedents* – particularly country characteristics, industry characteristics and consumer characteristics. These include the *legal and infrastructural conditions* of a country, such as regulatory frameworks and interventions (e.g., Cortet et al., 2016), but also *technology-driven industry dynamics*, including, among other things, the changing technological landscape of an industry (e.g., Alos-Simo et al., 2017). Furthermore, consumer characteristics, particularly *digital consumer demand*, shape DT. Consumers increasingly rely on digital technologies in their daily routines and personal interactions (e.g., Brynjolfsson et al., 2013), and expect ubiquitous access to virtual resources (e.g., Benlian et al., 2018).

Mechanisms

Following Hedström and Swedberg (1998), input and output variables are in general linked via mechanisms. We identified two main mechanisms used by organizations to conceive and bring about DT: *innovation* and *integration* (Daniel and Wilson, 2003; Henfridsson and Yoo, 2013). Mechanisms of *innovation* involve the application of resources, processes and capabilities that are new to the organization, while *integration* includes the alignment of these with existing resources, processes and capabilities (Ranganathan et al., 2003).

For *innovation* mechanisms, we found that DT involves novelty in both strategic and operational regards. For instance, *developing a digital business strategy* is a key activity linked to strategy. It includes both business and technological aspects (Dhar and Sundararajan, 2007), transcends organizational boundaries (Bharadwaj et al., 2013), and is based on data insights (Sia et al., 2016). *Mobilization for and acceleration of digital transformation by TMTs* is another critical activity at the strategic level, and is used, among other things, to attract a new generation of workers (e.g., Matzler et al., 2018) and to establish digital mindsets (e.g., Hansen et al., 2011). With a more operational focus but embedded in the strategic orientation, the *exploitation and leveraging of digital capabilities* is important for organizations, mainly regarding online informational capabilities (Barua et al., 2004), big data analytics capabilities (e.g., Hausladen and Zipf, 2018) and digital platform capabilities (e.g., Karimi and Walter, 2015). Building on such technologies not only internally, but with the goal of *creating digital innovation*, including the development of novel products, processes or

business models (e.g., Hinings et al., 2018), is vital. This also includes *merging human-machine interaction* as a core activity to establish value-adding and sustainable synergies between technology and humans (Bajer, 2017).

Integration mechanisms are crucial for aligning these new elements with existing ones within an organization. First, *developing a digital transformation strategy* that ‘serves as a central concept to integrate the entire coordination, prioritization, and implementation of digital transformations within a firm’ (Matt et al., 2015, p. 339) is key to marshalling this integration in the course of DT. Executions of such plans involve activities to *unlock organizations*, for example by developing dynamic capabilities (e.g., Karimi and Walter, 2015) and enhanced organizational learning abilities (e.g., Schuchmann and Seufert, 2015). On the more technical side, organizations need an *increasing technological flexibility*. This can, for example, be achieved by a collaborative and agile enterprise architecture (e.g., Zimmermann et al., 2016). Lastly, integration involves *physical-digital harmonizing by TMT*, including, for example, the promotion of cross-functional cooperation (e.g., Larkin, 2017) and the use of coordination mechanisms to assimilate digital technologies within the organization (e.g., Chatterjee et al., 2002).

Outcomes

DT is associated with a variety of outcomes (Henfridsson and Yoo, 2013), the final category of our multi-dimensional framework. These outcomes relate to the gestalt of the organization itself, the environmental surroundings in which the organization is embedded, and the resulting economic consequences. Accordingly, we differentiate between *organizational setups*, *economics* and *spill-overs*.

Outcomes relating to *organizational setups* refer to the configuration of the constituents of the firm (Kanungo et al., 2001) and how organizations change in the course of DT. DT has consequences for organizations, from the way they engage with external stakeholders to their internal processes, down to each individual product. To start with, we found that a focus on open innovation and crowdsourcing leads to more *ecosystem-oriented and -embedded organizations* (Berman and Marshall, 2014). This shift continues in the intra-organizational structuring: organizations develop *permeable, agile organizational structures*, and in doing so become agile, adaptable and boundaryless, as manifested in organizational forms such as Holacracy (e.g., Schwer and Hitz, 2018). In addition, management styles change towards *technology-focused and -supported management*. This is evidenced by the increased use of artificial intelligence support and decision support systems (e.g., Kolbjørnsrud et al., 2016). In a similar vein, *digital and customer experience-focused business models* gain importance. This involves both the creation of completely new business models (e.g., Dutra et al., 2018) and the modification of existing business models (e.g., Berman, 2012). Finally, DT in organizations culminates in the outcome of *automatized, data-driven and virtual business processes* through an enhanced use of digital technologies and software for performing tasks (e.g., Dery et al., 2017), as well as the development of *smart, connected and customized products* (e.g., Porter and Heppelman, 2015).

With regard to *economics*, DT may result in *improved firm performance and new forms of value*, caused by an improved service quality (e.g., Bouwman et al., 2011) or cost reductions (e.g., Agarwal et al., 2010). Furthermore, DT has been found to lead to *dynamic and*

constantly changing industry level performance due to changing goods prices (e.g., Bockstedt et al., 2006) or market reactions and turbulences (e.g., Daniel and Wilson, 2003).

Finally, DT also has effects that go beyond the direct control of organizations and affect the environments in which organizations are embedded and which they need to adapt to. These *spill-overs* – divided into paradigms, systems, industry, information security and individual effects – form the environment with which firms interact to remain legitimate and successful. We found that DT leads to *paradigms of customer-centricity and connected markets*, reflected in shifts towards an end-to-end commerce focus, mass customization (Weichert, 2017) or user centrality (e.g., Altukhova et al., 2018). Similarly, DT drives *digital-permeated markets, economies and societies* as information and communication technologies increasingly mediate interactions among consumers, within firms, and between firms and their customers (e.g., Tilson et al., 2010). DT thereby causes a *blurring of the boundaries between physical and online industry structures*, including the convergence of physical products and digital services, merging the physical world with online content, and creating an omnichannel environment for the customer (e.g., Brynjolfsson et al., 2013). These effects also lead to a *higher exposure to cyber threats*, including both cyber war threats and data security vulnerability (e.g., Dang-Pham et al., 2017), as well as the resulting need to ensure network and data security (Haggerty, 2017). Finally, we found that firms need to account for the *digitalization of the individual*. As a result, individuals such as customers or workers (Gregory et al., 2018) have and expect, among other things, an increased spatial and temporal flexibility (e.g., Schwarzmüller et al., 2018) and enhanced access to choices and information (e.g., Berman, 2012).

DISCUSSION OF FINDINGS

Although our findings portray DT as complex and diversified, we can abstract directions concerning the content of organizational change (Armenakis and Bedeian, 1999). From the synthesis of what is known about DT we can derive two distinct, yet interrelated, thematic patterns that help us better understand the peculiarities of DT. In particular, we observe the move towards malleable organizational designs that are embedded in and driven by digital business ecosystems. We elaborate and interpret each of these patterns in the following.

Towards Malleable Organizational Designs

From the multiple organizational facets that are subject to change within the course of DT, we can identify a move towards malleable organizational designs. Organizational designs manifest key tenets of a firm's organization activities and can be described as 'configuration[s] of the formal organizational arrangements, including the formal structures, processes, and systems that make up an organization' (Nadler and Tushman, 1997, p. 48). A malleable organizational design can be understood as one that is easily influenced and can be easily changed. The malleable organizational designs that are brought about by DT build on digital technologies and agile structures to adapt rapidly to environmental opportunities and threats. Relentlessly changing organizations have been identified in software industries (Brown and Eisenhardt, 1997). In particular, Huang

et al. (2017) say, in summary, that digital firms adapt rapidly though the mechanisms of data-driven operation (e.g., fine-grained monitoring and user profiling based on digital technologies), swift transformation (e.g., fast redefinition of core markets, identities and activities) and instant release (e.g., dynamic innovation of digital offerings based on customer feedback). Our findings also suggest that contemporary firms undertake a general move to configure their organizations so as to enable and support such mechanisms. The organizational setup category of our findings indicates such a conclusion. For instance, data-driven operations and decision making are underpinned by automatized, data-driven and virtual business processes, as well as technology-focused and -supported management. Furthermore, permeable, agile organizational structures support swift transformation. Finally, the outcomes of digital and customer experience-focused digital business models and of smart connected and customized products can be related to the mechanism of instant release, as these are dynamically adaptable and scalable market offerings.

Firms support the move towards a malleable organizational design in several ways. First, as is visible from the innovation mechanisms in our framework, they gather the necessary new knowledge and capabilities. For instance, by engaging in digital innovation, new digital business models are established that allow for instant release. By building on new digital capabilities and human-machine interaction, data-driven operations can be achieved. Developing a digital business strategy, digital acceleration and digital mobilization help to unfreeze the organization for swift transformation. Second, the integration mechanisms of our framework show that firms fuse this new knowledge and capabilities with what already exists in their organization. Here digital firms and non-digital firms diverge, as the latter have to deal with a pre-existing organizational design, requiring a digital transformation strategy and physical-digital harmonizing, while digital firms are regularly built from scratch (Tumbas et al., 2017). Nevertheless, as the mechanisms of unlocking organizations and increasing technological flexibility indicate, a general move towards greater adaptability is evident. An important observation here is that the goal of this adaptability is strongly connected to being in tune with the firm's environment. This can be seen in the outcome of ecosystem-oriented and -embedded organizations.

To summarize, we observe a shift towards malleable organizational designs that enable firms to adapt continuously to their environments. The idea of continuously adaptable organizations is not new (e.g., Weick and Quinn, 1999). However, in the context of DT, it seems much easier for firms, across contexts and not just in software industries, to actually realize such a state. For instance, the accessibility of large volumes of data and the technologies to analyse them to detect environmental changes, as well as the ability to adapt activities that are based on flexible digital technologies, possibly automatically, allow ongoing changes on the basis of environmental feedback or emerging opportunities. At the same time, however, it also becomes progressively harder to differentiate where change is coming from and whether it is unfolding within or across firm boundaries. In particular, digital technologies afford instant release. Such technologies, being generative in nature, allow for continuous innovation, which is often brought about by external parties, such as customers or developers (Parker et al., 2017). Furthermore, a large part of the technological set up may lie outside the control of a particular firm and may evolve unpredictably, at the will of external actors, such as tech giants or digital

start-ups. Data-driven operations and decisions tune the firm to environmental feedback, for instance from customers, by utilizing the potential of AI and machine learning to automatically detect and react to changes. Swift transformation requires firms to alter their positioning and capabilities according to new, dynamically emerging and dissolving opportunities. Thus, in the course of DT, the continuous adaptation enabled by malleable organizational designs contributes to a holistic confluence of environmental turbulence, IT systems and organizational capabilities. This is termed ‘digital ecodynamics’, a phenomenon that ‘has no separations among its three core elements, but it is the wholeness of the fused interactions among the three elements’ (El Sawy et al., 2010, p. 837). Accordingly, this holistic confluence differs from traditional views that differentiated organizational change as triggered by technology, organizational agency or social interaction (Markus and Robey, 1988). While these aspects continue to be relevant in and of themselves (e.g., Boudreau and Robey, 2005), they also become inseparably interwoven in the context of DT. Furthermore, as key pervasive technologies become increasingly infrastructural and widely accessible for firms (Tilson et al., 2010), and as external actors become more and more central to delivering important capabilities, the interactions of organizations with and their embeddedness in their environments becomes increasingly complex and intense. Thus, a broader view, one that goes beyond organizational design, is required to expand our understanding of DT.

Towards Digital Business Ecosystems

Drawing upon the manifold changes that our review has revealed with regards to antecedents and outcomes, in conjunction with the emergence of malleable organizational designs that dynamically tune firms to their environments, we can identify a move towards digital business ecosystems as the second thematic pattern of DT. Business ecosystems are often seen as underpinning the value creation and capture of firms, representing ‘the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize’ (Adner, 2017, p. 42). As they shape firm decisions about where and how to compete, business ecosystems are an essential topic for strategy (Jacobides et al., 2018). In recent decades, we have seen numerous companies moving away from hierarchical integrated supply chains and towards these more fragmented networks of strategic partnerships with external entities (Bitran et al., 2007). However, in the course of DT, we contend that through the holistic confluence comprising material, organizational and further environmental dimensions (El Sawy et al., 2010), so-called *digital* business ecosystems, which in the past were only a topic of interest for IT and software industries, are becoming more and more inseparable from regular business ecosystems and increasingly relevant across sectors as digital technologies diffuse through industries and society. Digital business ecosystems define business environments ‘shaped by a network of interdependencies specifically generated through digital technologies’ (Kopalle et al., 2020, pp. 114–15). A key differential factor that sets digital business ecosystems apart is their turbulent nature (El Sawy and Perreira, 2013). Generally, turbulence can be understood as ‘the conditions of unpredictability in the environment because of rapid changes in customer needs, emerging technologies, and competitive actions’ (Pavlou and El Sawy, 2010, p. 444). In the context of business ecosystems, this turbulence becomes

visible especially through the vast number and heterogeneity of interdependent partners that shape competition (e.g., Jacobides et al., 2018), the widespread diffusion and adoption of interconnected generative technologies (e.g., Kopalle et al., 2020), and the constantly changing customer preferences (e.g., Downes and Nunes, 2013). Our findings emphasize the relevance of these factors, and thus a general move towards digital business ecosystems. For instance, we identified that DT is triggered and shaped by a plethora of diverse digital technologies and applications, such as blockchain technologies, AI and the Internet of Things. Also, consumers are increasingly embedding technology within their daily routines and personal interactions, which has profound implications for their demands and expectations towards the offerings of and the communications with firms. Both developments contribute to increased dynamics within industries, in which firms must now compete with an increasing number of competitors, from numerous industries and in some instances with completely different business models, as well as with a rising number of start-ups. In the outcomes category, we can see, among other things, a shift towards connected markets in which the participants are involved in numerous exchange networks that are easily formed, grown, and dissolved again. This can mainly be attributed to the ubiquity of the Internet and other related technologies on which these networks heavily rely, leading overall to digitally permeated markets. Furthermore, we observed the convergence of previously separate industries as heterogeneous actors from different industries increasingly operate and compete within the same markets due to the affordances of digital technologies, which bring together previously disconnected user experiences (for example broadband Internet, phone and TV services) (Yoo et al., 2012).

Due to the increasing turbulence, digital business ecosystems are ‘changing the rules of the game in many industries through disruptions of business models’ (Pagani, 2013, p. 617). They fundamentally build upon widely shared digital technology that is generative and adaptable (Tilson et al., 2010) and are in a state of constant change (El Sawy and Perreira, 2013). This renders them to be complex adaptive systems, where change is a constant, initiated and driven from multiple directions and can unfold unpredictably (Tanriverdi et al., 2010). The resulting non-linearity and equifinality may make these ecosystems better understood from configurational theory (El Sawy et al., 2010; Meyer et al., 1993). This perspective complements established theories on process and variance theories when trying to identify logical structures of change (Markus and Robey, 1988; Orlikowski, 2000).

As a further result of their turbulent nature, digital business ecosystems also diverge from regular business ecosystems with regard to their constituents. Following the definition of Adner (2017), regular business ecosystems are, characterized by, among other things, a set of partners with ‘defined positions and activity flows among them’ (p. 42), based on a collectively pursued value proposition. Within digital business ecosystems, however, the value propositions pursued can change radically in a short period of time (Yoo et al., 2012). Thus, the participants within digital business ecosystems, their positions, and their roles are subject to constant change. Furthermore, firms co-create and co-capture value with a large variety of heterogeneous actors, extending beyond traditional suppliers and customers and ranging from individuals to start-up communities, tech-giants and societal actors (El Sawy and Perreira, 2013). A whole new level of interconnectedness and interdependence emerges and steadily increases because of the

low entry barriers to practically everyone. Thus, it is becoming increasingly complex to maintain an overview of the value propositions pursued and the participants within digital business ecosystems, and to determine their positions and the activity flows among them. Change transfers and radiates across levels that can and, in the past, have often been viewed separately (Markus and Robey, 1988; Volkoff et al., 2007), as individuals, organizations and societies are concurrently affected and are connected through a nested hierarchy-like structure. This emphasizes the value of multi-level perspectives (Burton-Jones and Gallivan, 2007).

A Typology of Perspectives on Digital Transformation

The two aggregated thematic patterns of DT (i.e., towards malleable organizational designs and digital business ecosystems) summarize the content of DT, which focuses on ‘the substance of contemporary organizational change’ (Armenakis and Bedeian, 1999, p. 295). Following literature from the field of organizational change (e.g., Pettigrew, 2012; Sminia and de Rond, 2012), it is necessary to consider the content in conjunction with the context and process dimensions.

The context dimension typically describes the forces or conditions existing in an organization’s environment (Armenakis and Bedeian, 1999). Traditionally, scholars in the field of organizational change distinguished between inner contexts (i.e., structures, corporate cultures and political context within firms) and outer contexts (i.e., the social, economic, political and competitive environment of a firm) (Pettigrew, 1987). The phenomenon of DT, however, seems to complicate this differentiation because firms’ boundaries are increasingly blurred, making it hard to clearly separate whether factors are related to the inner or outer contexts (El Sawy et al., 2010). Furthermore, the change towards a malleable organizational design is embedded in and driven by digital business ecosystems and cannot be considered in isolation from this. Thus, while the conventional division of the context dimension into internal and external contexts is problematic for the investigation of DT, our findings indicate that it is useful to differentiate with regard to the contextual scope that is examined (see, Gubbi et al., 2015). The contextual scope can be rather narrow if the focus is on the relationship between specific elements from digital business ecosystems and particular aspects of the organizational design. For example, Kolbjørnsrud et al. (2017) focus in their study on the impact of AI on the nature of work and the execution of processes in organizations. Conversely, the contextual scope can be rather broad if the holistic confluence of multiple technological, organizational and environmental elements in digital business ecosystems, as well as their interactions with organizational design as a whole, is considered. For example, Downes and Nunes (2013) describe the transformational impact of digital technologies combined with constantly changing customer preferences and a more competitive environment on entire organizations and their actions. The metaphor of an optical lens (Van de Ven and Hargrave, 2004), which either ‘zooms in’ and focuses on specific aspects and changes related to contextual conditions and outcomes of DT or ‘zooms out’ to observe the phenomenon in a broader context, can be used here to describe the *contextual scope* in relation to digital business ecosystems and malleable organizational designs. The *contextual scope* can vary along a continuum, from being ‘narrow’ in scope, typically focusing on specific elements

related to digital business ecosystems and their relation to organizational designs, to being 'broad' in scope and examining both thematic patterns of DT in a more holistic way.

The process of change dimension refers to 'the action, reactions, and interactions from the various interested parties as they seek to move the firm from its present to its future state' (Pettigrew, 1987, pp. 657–8). When considering this dimension, researchers on organizational change typically focus on intra-organizational actors and actions (e.g., Armenakis and Bedeian, 1999; Sminia and de Rond, 2012). However, as we discussed previously, change processes in the course of DT are driven not only by organizational actors, but by a confluence of organizational, technological and environmental forces in digital business ecosystems (El Sawy et al., 2010). Our findings indicate variation in the extent to which studies focus on intra-organizational processes of change, i.e., the mechanisms in Figure 2. Some studies in our consideration set put more emphasis on change processes driven by developments outside of a firm's direct area of control, such as the increasing diffusion of AI, robotics and the Internet, and described their effect on organizational design, without dealing in detail with the intra-organizational change involved to bring about these effects (e.g., Evans, 2017). Conversely, we identified studies which clearly focused on these intra-organizational innovation and integration aspects as drivers towards malleable organizational designs by, for example, describing strategies and steps on how organizations can guide their DT endeavours (e.g., Li et al., 2017). Therefore, according to our findings and to consider the process of change, we refer to the *intra-organizational process* dimension as the extent to which intra-organizational processes of change are accounted for in studies on DT. This dimension can vary along a continuum from a 'weak focus' to a 'strong focus' on intra-organizational change processes, depending on the emphasis placed on an organization's innovation and integration mechanisms as drivers towards malleable organization designs and digital business ecosystems.

By juxtaposing the two dimensions of contextual scope and intra-organizational change process based on our definitions, a two-by-two typology that delineates four distinct perspectives on DT emerges (see Figure 3). These four perspectives are technology impact, compartmentalized adaptation, systemic shift and holistic co-evolution. Each perspective provides an internally consistent account of DT. It should be stressed that each and every perspective assumes organizational change in association with the widespread diffusion of digital technologies. In the following, we describe each of these perspectives.

The *technology impact perspective* on DT combines a weak focus on intra-organizational change processes with a narrow contextual scope. Such studies describe direct technology impacts, typically focusing on a particular technology or system and describing its peculiarities and specific implications for organizations. For example, Dutra et al. (2018) describe how the diffusion of the blockchain technology leads to the development of new business models across several industries. Such studies also describe indirect technology impacts, which are expressed through changing digital customer demands or new regulations and standards that result from the diffusion of new digital technologies. For example, Gallaughier and Ransbotham (2010) describe how social media changes the customers' behaviour and their interactions with firms. The main strength of studies that follow this perspective is that they reveal important insights into what is really new about digital technologies and innovations, and that they clarify partial contributions to

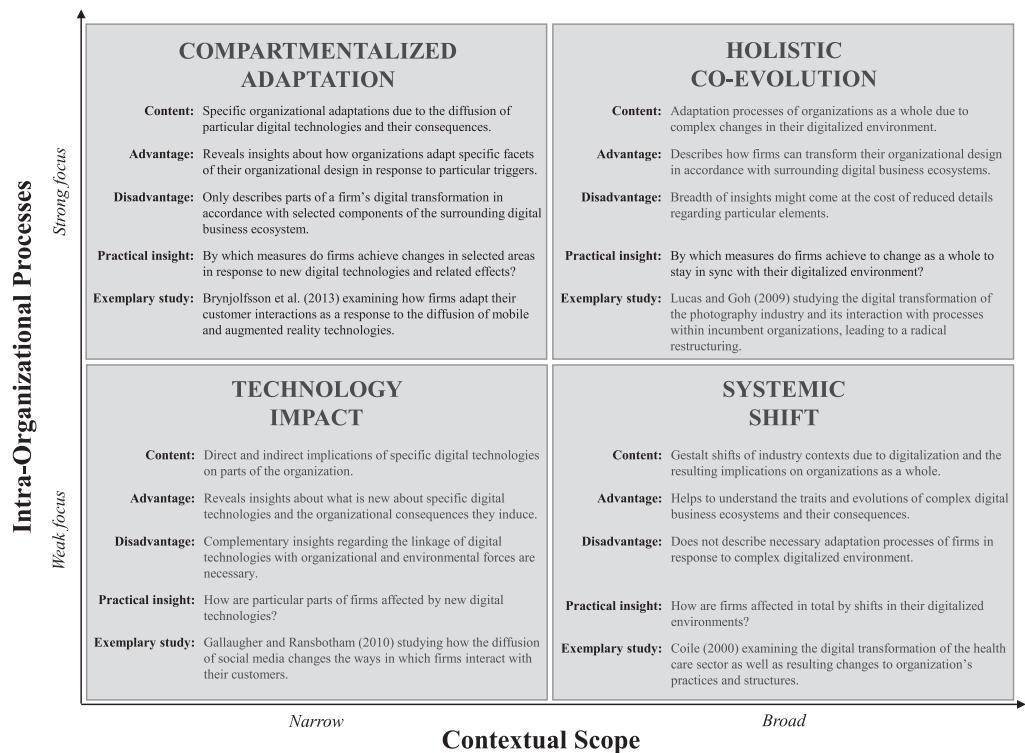


Figure 3. Typology of digital transformation perspectives

the overall shifts in organizations and business environments described above. However, this perspective has its weaknesses. As we have discussed, specific forces, such as new technologies in DT, are often interwoven with further organizational or environmental forces. Therefore, knowledge yielded by studies following this perspective must be complemented by insights into how the forces they focus on – such as new technologies – might be intertwined with other aspects, such as customer or employee behaviour, and how they together might trigger and shape DT. In the same sense, insights about particular outcomes – such as increased business process efficiency through the use of AI – must be related to potential higher-level spill-overs such as exposure to cyber threats. In general, these studies do not provide insights about how organizations arrive at malleable organizational designs but reveal particular forces from digital business ecosystems that alter certain parts of organizations.

The *compartmentalized adaptation* perspective on DT combines a strong focus on intra-organizational change processes with a narrow contextual scope (i.e., concentrating on particular technologies, systems or change drivers and specific outcomes). Such work is important in tracing how organizations adapt to particular technologies or innovations in a discrete context. For example, Brynjolfsson et al. (2013) describe how online and offline retailers can successfully take advantage of developments related to mobile and augmented reality technologies to improve their interactions with their customers. Similarly, Li et al. (2017) derive a process model explaining how small and medium-sized

enterprises with inadequate capabilities and limited resources can drive their DT, which is enabled by developments in the field of e-commerce. Here, we can learn, for instance, how organizations evolve in response to particular triggers towards data-driven operations and decision-making. However, the weaknesses of this perspective should also be pointed out. Employing such a perspective allows only particular facets of a firm's DT to be described. This aspect can lead to somewhat dangerous oversimplifications. For instance, one might explain the success of a firm in managing change associated with a specific technology, while concurrently observing the overall downturn of the firm or industry as a whole due to the widespread diffusion of digital technologies across society. In summary, this perspective provides insights on how firms partially adapt their organizations to specific developments in their digital business ecosystems.

The *systemic shift* perspective on DT is employed by studies that have a weak focus on intra-organizational change processes, as with the technology impact perspective, but combine it with a rather broad contextual scope. Such work thereby describes how conditions within digital business ecosystems interact with organizational designs as a whole. For instance, in the context of healthcare, Coile (2000) describes how entering the information economy alters technological opportunities and consumer and provider demands, as well as resulting in changes to healthcare organizations' practices and structures. Similarly, Jiang and Katsamakas (2010) illustrate the DT of the book industry, enabled by the Internet and e-book technology, leading to new ways of consumers purchasing books and sellers delivering their products, as well as transforming structures and competitive forces in the book market. Hence, studies following this perspective help us to understand the peculiarities and evolutions of digital business ecosystems as a whole and their impacts on organizational designs. However, the systemic shift perspective does not describe how organizations achieve adaptations to and interactions with their respective business environments.

Finally, the *holistic co-evolution* perspective on DT combines a strong focus on intra-organizational change processes with a rather broad contextual scope. This perspective reveals how firms react to complex changes in their environment. For example, Lucas and Goh (2009), drawing on the case of Kodak, describe how the firm was affected by several technological and demand-side developments and struggled to adapt internally, which ultimately led to economic downturns and the radical restructuring of the company. Similarly, Sia et al. (2016) describe how banks are transforming their culture and leadership styles while building agile and scalable digital infrastructures. In this process, they continuously navigate a dynamic digital landscape in which digital technologies such as smartphones emerge, are rapidly adopted, and thus lead to considerable changes in customer behaviour and expectations. Works following this perspective contribute to research on DT by yielding insights into how organizations transform their organizational design in accordance with the surrounding evolving digital business ecosystems. However, this perspective is quite difficult to put into practice as there is a plethora of aspects that could be examined, both concerning organizational design and digital business ecosystems. Furthermore, examining DT from such a holistic perspective could come at the cost of reduced detail concerning particular elements as, for example, peculiarities of specific digital technologies cannot be examined and considered to the same extent as with the technology impact perspective.

It is important to note that the two dimensions of the typology represent continuums, not discrete boundaries. That is, the four types and their associated attributes presented are general archetypes. One should be aware that ‘a way of seeing is a way of not seeing’ (Poggie, 1965, p. 294). As expressed by Van de Ven and Hargrave (2004, p. 293), ‘seeing the strengths in other perspectives to address the weaknesses in another is crucial for addressing theoretical tensions’. Following this thought, considerable value lies in combining different perspectives. For instance, a study following the holistic co-evolution perspective might illustrate the ‘big picture’ and reveal aspects which seem to be of particular importance, which could then be combined with a technology impact type study in which these aspects are examined in greater detail.

IMPLICATIONS

Digital Transformation and the Nature of Change

According to Poole (2004) the nature of change ‘defines how one divides the field of organizational change and innovation theories. Taking a position on the nature of change requires the theorist to focus on some aspects of change and innovation and to divert attention from others’ (p. 4). While there are multiple frameworks that differentiate organizational change in this way, our findings reveal a special connection to the distinction between episodic and continuous change (Weick and Quinn, 1999), most notably because the dynamics of change denotes a common theme in both the aforementioned thematic patterns. That is, malleable organizational design places a premium on constant adaptation and change in correspondence to the environment (Huang et al., 2017), and the digital business ecosystems in which organizations are embedded are characterized by their ever-evolving and turbulent nature (El Sawy et al., 2010). Accordingly, to clarify boundary conditions to investigate DT from the perspective of organizational change, it seems promising to contrast our findings with the characteristics of episodic and continuous change, particularly with respect to the ‘different metaphors of the organization, analytical frameworks, theories of intervention, and roles attributed to change agents’ (Poole, 2004, p. 5).

First, the extant literature differentiates continuous and episodic change by the respective *metaphor of the organization*. In the episodic paradigm, organizations are seen as inertia-prone and infrequently changing, while in the continuous paradigm they are perceived as constantly adapting structures (Weick and Quinn, 1999). With the introduction of digital technologies, being flexible and reprogrammable (Yoo et al., 2010), material sources of inertia tend to erode. In addition, data-driven operations and decisions might, at the very least, mitigate cognitive sources of inertia (Besson and Rowe, 2012). This dynamic is also evident in our findings: in the contextual conditions part of our multi-dimensional framework (see Figure 2) we still identify established structures and processes as well as path dependency as antecedents; in the integration mechanisms part we see already a high importance of technical as well as organizational adaptability. And in the outcomes, we identify a strong focus on agile, continuously adaptable structures. This suggests that the move towards a malleable organizational design can involve overcoming inertia.

With regard to the *analytic framework* characteristics (Poole, 2004), episodic change literature takes macro-level perspectives and sees change as punctuated by occasional external events, affecting internal deep structures and leading to revolutionary change involving replacement to reach a new equilibrium. Continuous change, in contrast, utilizing micro-level perspectives, focuses more on endless local, smaller adaptations emerging from improvisations in internal practice that may aggregate over time (Weick and Quinn, 1999). With regard to DT, we identified that the phenomenon is triggered and shaped largely by external factors, such as a novel digital technology (Warner and Wäger, 2019) or new digital competitors (Garud et al., 2020), but not all of these factors evolve as a typical external jolt. To provide an example along the multi-dimensional framework: while we see new technologies constantly emerging in large varieties, change is also driven substantially by interactions with customers gradually evolving digitalized expectations as an important part of the contextual conditions. For innovative mechanisms, we find evidence for both structurational effects emerging from practice and technology use as well as fundamental change programs. Last, when looking at the outcomes, we identified that practically every sphere of an organization can but not necessarily has to be affected, illustrating that firms attempt to achieve or remain fit with the contextual conditions, leading to new socio-organizational configurations (Avgerou, 2001), which may require incremental to fundamental adaptations depending on the context. Following this example and in the spirit of Van de Ven and Hargrave (2004), we conclude that how DT unfolds in a particular setting is really ‘an empirical question’ and hence leaves the specific characteristics of the analytical framework in limbo. Having said that, our results also indicate that for DT, there might as well be deviations from the regular templates of continuous and episodic change (Weick and Quinn, 1999). This is particularly the case due to the new complexity stemming from the increasing interconnectedness of various and dispersed actors in digital business ecosystems. In the words of El Sawy and Perreira (2013, p. 2), ‘[u]nlike other business environments, digital business ecosystems can never be expected to revert to any kind of “equilibrium” after disruptions change things; turbulence implies that cause-and-effect may cascade in unpredictable ways to alter the structure or health of the ecosystem, or end it entirely’. Thus, while DT is associated with disruptions, known from episodic change conceptions, these are no longer infrequent and do not end in a new era of stability. Besides, resulting from the increased interconnectedness, local adaptations in internal as well as external practice may aggregate to change beyond firm boundaries and require organizations to co-evolve with a dynamically changing global topography (Tanriverdi et al., 2010). In sum, this indicates that DT requires macro and micro perspectives and focusing global triggers and local improvisations simultaneously.

With regard to the respective *intervention theory*, episodic change assumes change evolving by phases of unfreezing, changing and refreezing in a planned and intentional manner, while the continuous perspective follows a freeze, rebalance, unfreeze logic where change exists irrespective of intention (Weick and Quinn, 1999). For DT, we find that unfreezing is a substantial part in the integration mechanisms. Furthermore, the malleable organizational design towards which firms are evolving puts a premium on continuous adaptation. Again, as can be seen in the innovation mechanisms, no matter how incremental or fundamental the respective change is, we can diagnose a higher importance of digital

technologies afterwards. Due to the specific nature of digital technologies (Kallinikos et al., 2013), particularly the generativity they induce inside and beyond organizations (Yoo et al., 2012), we contend that even episodic phases of DT trigger continuous changes. This is also underscored by the fact that firms are increasingly embedded in and interwoven with digital business ecosystems that are inherently turbulent (El Sawy and Perreira, 2013). Due to this nature, change becomes a constant, irrespective of the intentions of a participating organization. Put differently, in the context of DT, the idea of refreezing, as the final step in the schematic Lewinian change processes of episodic change (Weick and Quinn, 1999), is challenged and may culminate in a state of constant unfreezing.

Finally, concerning the *change agent*, episodic change assumes a change agent that needs to radically alter mind-sets within the organization to create change (Weick and Quinn, 1999). In the continuous perspective, change agents redirect change that is already underway and focus on unblocking improvisation and learning (Poole, 2004). With regard to DT, the mechanisms we found in our analysis point to the importance of both types of agentic behaviour: innovation, which goes along with developing mind-sets and overcoming inertia, and integration, which we found to be related with unlocking the organization. However, again, when we look at the outcomes of DT and the higher level of flexibility the malleable organizational design implies, we see change agents following the continuous paradigm as a new constant. Though, especially in the beginning of DT and due to the unpredictable evolution of digital business ecosystems in later phases, change agents from the perspective of episodic change will also be necessary.

Taking the aforementioned reflections together – i.e., an erosion of inertia, an amalgamation of micro/local and macro/global, infinite unfreezing, and an emphasis on unblocking change agents – we submit that overall DT leads to a shift towards continuous change. This shift can be triggered and occasionally punctuated by episodic bursts when the malleability of the organizational design does not allow to react to organizational, material or social variations (Weick and Quinn, 1999). What is unique to DT and going beyond the boundaries of established perspectives on organizational change is that, due to the traits of digital technologies underlying the new organizational design and digital business ecosystems, even these episodic episodes lead to new phases of continuous change in organizations, which may endure for a comparably long time.

A Research Agenda for Digital Transformation

In what follows, we provide several avenues for future research by combining the insights yielded by our systematic review of DT in relation to the nature of change (see previous section) with the perspectives of our typology (Figure 3). In particular, we emphasize two separate pathways of future research for each perspective, namely phenomenological and theoretical advancement. First, to advance *phenomenologically*, future research should investigate DT by utilizing established lenses. This path profits from the established theoretical models as a robust basis from which to better understand and explain the phenomenon. It is important to use especially those theoretical accounts that match the boundaries of the respective DT perspective. Our review revealed that conceptions of continuous change are generally suitable, with some constraints. We, therefore, discuss in the following how theories that are classified as belonging to the continuous change

realm (Poole, 2004; Weick and Quinn, 1999) might be utilized with regard to each of the four DT perspectives. Furthermore, theories that combine elements of both continuous and episodic change (Poole, 2004) seem particularly valuable.

Second, where the boundaries of the phenomenon of DT exceed established theoretical models, it offers a chance to advance *theoretically* by generating new models or adapting existing ones. For the latter, we see two broad avenues for future work. First, while we find that continuous change perspectives generally fit the phenomenon of DT well, we also identified some variations in this fit, particularly with regard to taking into account the actions of external actors, and when also employing macro perspectives. Second, while we strongly associate DT with a shift towards continuous change, we also concluded that this shift might be triggered and shaped by episodic bursts. Episodic change perspectives might thus be valuable, with the adaption of not assuming an end-state or freezing period. These variations offer an opportunity for theoretical advancements along the lines of our DT typology. It is important to note that a detailed review of each of the aforementioned theories is beyond the scope of this study, although the analysis of their basic tenets in the light of DT generates valuable stimulants for future research. Research questions that emerge from our ensuing discussion are summarized in Table 1.

When employing the DT perspective of *technology impact*, continuous theories of institutional diffusion (Van de Ven and Hargrave, 2004) might be very helpful. In particular, they may be used to investigate how new institutional building blocks, such as new software and digital practices, become taken for granted and widely reshape organizational working arrangements across traditional industry boundaries (Hinings et al., 2018; Kim et al., 2004). In a similar vein, new digitalized customer expectations or social practices, as an indirect effect of new technology, might lead to adaptations in business models or product designs across contexts (Correani et al., 2020; Warner and Wäger, 2019; Yoo, 2010). Furthermore, technology structuration theories (Orlikowski, 2000) might be valuable for tracing the consequences of interactions with digital technologies in relation to organizational change. However, such theories should be adapted to account for the changing impact that external actors, drawing on divergent values, rules and resources from outside the organization, might have on the firm when interacting through shared digital technology. For instance, heterogeneous and dispersed external software developers have been found to alter the value creation structures of focal companies (Parker et al., 2017), while other consequences concerning organizational change remain unexplored. Also, from an episodic perspective, theories about technological discontinuities (Anderson and Tushman, 1990) can be helpful to assess the potential impacts of new digital technology on organizations. However, when using such lenses, it is important to incorporate the specific traits of digital technologies. The generativity and flexibility of these technologies might lead to multiple and different pathways at the same time, making conventional distinctions such as competence enhancing vs. destroying technologies problematic. Here, creative accumulation theory (Bergek et al., 2013) seems very promising as it allows revolutionary and evolutionary technology consequences to be explained, and thereby reconciles thoughts from both the episodic and the continuous perspectives.

When employing the DT perspective of *compartmentalized adaptation*, continuous theories of interpersonal interaction and socialization (Woodman and Dewett, 2004) can be helpful for investigating both how established organizational actors learn new digital

Table 1. Research agenda

<i>DT perspective</i>	<i>Phenomenological advancement</i>	<i>Theoretical advancement</i>
Technology impact	<ul style="list-style-type: none"> How do emerging digital technologies (e.g., distributed ledger technologies, virtual and augmented reality, quantum computing or AI) influence particular elements of inter- and intra-organizational structuring? [Institutional diffusion theory] How do digitalized customer preferences and social practices shape the design of business models and products across contexts? [Institutional diffusion theory] What are the different pathways that new digital technologies (such as virtual or augmented reality) take in terms of complementing and substituting established competences? [Creative accumulation theory] 	<ul style="list-style-type: none"> How can we explain if and how practices of external actors (such as developers or consumers) alter organizational structures on the basis of shared digital technologies using technology structuration theory? How can theories of technological discontinuities such as those differentiating competency-enhancing vs. competency-destroying or modular vs. architectural innovation be adapted to account for digital properties such as generativity and convergence? How do implications for organizational change shift?
Compart-mentalized adaptation	<ul style="list-style-type: none"> How can trainings help existing organizational members to learn new digital behaviors and utilize new digital technology? [Interpersonal interaction and socialization theory] Is training and socialization possible and adequate for digital natives and new digital talent in the course of DT? [Interpersonal interaction and socialization theory] Can socialization be programmed into robots and AI-based systems? [Interpersonal interaction and socialization theory] How can organizations develop particular learning programs that account for continuous, yet occasionally punctuated change? [Cyclical change theory] 	<ul style="list-style-type: none"> How do we need to adapt our understanding of organizational learning when learning is more and more data-based, automated and externally driven? How can we extend punctuated equilibrium theory to account for continuous adaptive organizations in turbulent digital business ecosystems that do not stabilize after disruptions? How do we need to adapt our understanding of dynamic capabilities when ordinary and dynamic capabilities merge due to the increased use of flexible and reprogrammable digital technologies?

Table 1. (Continued)

<i>DT perspective</i>	<i>Phenomenological advancement</i>	<i>Theoretical advancement</i>
Systemic shift	<ul style="list-style-type: none"> How do new digital organizational forms (such as platform-enabled peer-to-peer networks) emerge and become institutionalized across contexts? [Population and community ecology theory] How do digital entrants enter competition and/or cooperation with established firms and which effects result for the latter? [Population and community ecology theory] Over time, can we observe more homogeneity in organizational forms through the interactions of initially heterogeneous players within digital business ecosystems? [Population and community ecology theory] How do behaviors of dispersed actors, connected through shared digital technologies, radiate throughout ecosystems and organizations? [Complex adaptive systems theory] 	<ul style="list-style-type: none"> Can we adapt contingency theories to account for the holistic confluence of technological, environmental and organizational factors in DT? Can contingency theories profit from configurational thinking? How do we need to adapt our understanding of collective action to capture the specifics of turbulent digital business ecosystems?
Holistic co-evolution	<ul style="list-style-type: none"> How do internal change initiatives (e.g., by institutional entrepreneurs) of particular organizations radiate throughout digital business ecosystems and shape their gestalt? [Institutional design theory] How and why does embeddedness in evolving digital business ecosystems alter organizational cultures? How do existing cultures and the move towards malleable organizational designs interact? [Culture change theory] How do changes in digital business ecosystems alter power relations (e.g., between different functions or units) and value commitments inside of firms? [Neo-institutional theory] How and why can conflicting views, both inside organizations and within digital business ecosystems, be reconciled? [Dialectics theory] 	<ul style="list-style-type: none"> How can we extend institutional adaptation theories to account for the turbulent nature of digital business ecosystems and the resulting dynamics in environmental demands? How can we adapt theories of strategic choice to account for the characteristics of digital business ecosystems and the resulting consequences for managerial agency? How do well-known relationships between institutional upheaval and organizational change hold when organizational design becomes malleable in the course of DT?

Table 1. (Continued)

<i>DT perspective</i>	<i>Phenomenological advancement</i>	<i>Theoretical advancement</i>
General	<ul style="list-style-type: none"> • Which configurations of innovation and integration mechanisms in DT yield high firm performance? • How do DT-induced changes in the organizational setup influence firm performance? • How does organizational change in association with DT affect employee satisfaction, commitment and organizational identification? 	<ul style="list-style-type: none"> • How can new theories, inductively derived in the context of DT, explain organizational change? • How does DT relate to the distinction of theories of change vs. theories of changing? • Can we explain DT using the motors of change typology?

behaviours in a particular setting (such as doctors interacting with robots) and how new actors such as hired digital talent might resist socialization and bring forth change in incumbent firms. It is also interesting to investigate how such theoretical relations play out when new actors are non-human, such as robots or AI-based systems. In a similar vein, one might ask if theories relating to organizational learning (Vera et al., 2011) need to be adapted to the new realities of DT, where learning is more and more data-driven, potentially automatized and tuned to the external environment. Thus, while data-driven operations have the potential to detect and correct errors independently (so-called ‘single loop learning’), with the rise of AI, this might also radiate to higher levels of learning. As indicated by Huang et al. (2017), swift transformation is also related to ‘double loop’ learning (i.e., changing routines in order to correct detected errors) or even ‘deutero learning’ (described as learning to learn). This data-based automation and AI might question human agency in organizational learning. Relatedly, questions regarding the idea of dynamic capabilities (Teece, 1997) arise. As revealed by the innovation mechanisms in our framework, firms are incorporating more and more digital technologies into their operational capabilities. As for the particular dynamic nature of these digital operational capabilities (Kallinikos et al., 2013), the difference between ordinary and dynamic capabilities might vanish, as capabilities based on digital technology are very easily adaptable. Future research might investigate whether DT leads to the seemingly contradictory result that firms adapt faster than ever on the basis of flexible ordinary capabilities, while the need for dynamic capabilities in the traditional sense shrinks. We also concluded that DT can be triggered and shaped by episodic bursts such as emerging new technologies. Punctuated equilibrium theory (Romanelli and Tushman, 1994) seems a promising avenue for investigating this. However, as a move towards digitalization is equal to a move towards more dynamics, there might not be a new phase of stability or equilibrium. The same applies to theories of planned change. Future research should investigate how such accounts must be adapted to connect episodic bursts with ongoing dynamics. A promising avenue for this is the approaches that synthesize linear approaches of organizational development with cyclical change theories (Marshak, 1993).

When employing the DT perspective of *systemic shift*, continuous views from population and community ecologies (Baum and Rao, 2004) seem adequate for investigating how new digital organizational forms (Hinings et al., 2018) emerge and become institutionalized across fields and ecosystems. Similarly, it seems interesting to investigate how competition and cooperation among digital start-ups and incumbent firms relate to organizational structures. Besides, DT also creates questions regarding necessary adaptations in contingency thinking (Lawrence and Lorsch, 1967). As we have discussed, in DT, we observe a confluence of organizational, technical and environmental factors (El Sawy et al., 2010), making it difficult to separate one from the other or to delineate clear relationships to assess the meaning of context for the development and efficacy of change. Furthermore, theories of collective action (Van de Ven and Hargrave, 2004) seem promising given the importance of digital business ecosystems. However, future research should scrutinize necessary adaptations because collective action is no longer a punctual event, but a constant, never-ending process in digital business ecosystems which involves ever-changing groups of actors. A particularly interesting lens in this regard is

complex adaptive systems theory (Tanriverdi et al., 2010), which combines episodic and continuous elements.

When employing the DT perspective of *holistic co-evolution*, theories of institutional design (Van de Ven and Hargrave, 2004) can be very helpful for learning how organizational actions and actors are interacting with the surrounding digital business ecosystem. For instance, the internal change processes of an organization from a pipeline towards a platform company may significantly shape and be shaped by the business environments, partner networks, etc. (Gawer and Philips, 2013). Furthermore, using the lens of culture change (Hatch, 2004), future research should investigate how the increasing embeddedness in global, cross-industry and large scale digital business ecosystems involving intense and ongoing interactions with heterogeneous actors (Yoo et al., 2012) leads to dynamics in organizational culture. For instance, do industrial-age incumbents become more Silicon Valley-like the more they build upon the pervasive digital technology created by tech giants? Here, it seems interesting to see if strong cultures can serve as a connective tissue holding the dynamics of malleable organizational designs and turbulent digital business ecosystems together (Weick and Quinn, 1999). Furthermore, the two thematic patterns question key assumptions of strategic choice theory such as the ability of managers to shape the environment and the goal of superior positioning (Child, 1972) when organizations become more and more influenced by factors outside their control and competitive advantage is increasingly fleeting (El Sawy and Perreira, 2013). Similarly, theories of institutional adaptation (Van de Ven and Hargrave, 2004) seem promising for investigating how firms adapt internally to cope with new legitimacy requirements in a digitalizing world. However, what happens when these requirements not only do not emerge punctually, but also evolve constantly (Newman, 2000)? Neo-institutional perspectives (Greenwood and Hinings, 1996), combining continuous and episodic elements, can be of particular value for investigating such co-evolution of organizations and their digitalized environments.

Finally, apart from the focus on the four DT perspectives from our typology, several more general avenues for future research emerge. First, in the spirit of Armenakis and Bedeian (1999), it is important to assess certain criterion variables, such as performance and employee satisfaction, to investigate the efficacy of change efforts. In this context, configurational approaches (Meyer et al., 1993), such as fuzzy set qualitative comparative analysis, should also be considered to account for the multiplicity and interwovenness of the elements involved in DT (El Sawy et al., 2010). Second, the theories we analysed and discussed above originate from the pre-digital era. As our analysis has revealed, while certain accounts seem to fit DI well, others should be adapted. However, we also think that the phenomenon of DT offers opportunities for inductive theory generation, for instance using grounded theory approaches (Glaser and Strauss, 1967). Furthermore, our analysis of the organizational change literature was tightly coupled to the distinction of episodic vs. continuous change. However, there are other distinctions, such as those between theories of change vs. theories of changing (see Poole, 2004) and the typology of motors of change developed by Van de Ven and Poole (1995). Here, based on our findings, it seems reasonable that dialectical perspectives, combining a multiple entity view with a constructive change perspective, might be particularly helpful for studying

DT, for instance with regard to synthesizing divergent interests both within organizations and digital business ecosystems.

Limitations

Our study has limitations, which can be allocated to the steps of our research process. First, in data collection, since our study used one particular database, some papers may have been overlooked, especially those in practitioner outlets. Second, in data analysis, the filters applied may have omitted some relevant studies due to our choices in the cut-off decisions (e.g., regarding the timeframes). Furthermore, the process of coding the articles was performed by hand, and so could be subject to subjectivity, although we aimed to prevent this by relying on multiple coders and several rounds of scrutinizing the coding. Third, regarding synthesis, we admit that there might be valuable alternatives to an 'input-process-output'-like model (see Edmondson and Mcmanus, 2007) as a meta-structure. In light of these limitations, we encourage other researchers to extend and refine our findings by drawing on different sources or analytical approaches. Fourth, regarding the discussion, we based our thoughts on the episodic vs. continuous change distinction, as we identified its value for understanding DT. However, as described above, it is important to note that there are other frameworks that differentiate change conceptions (Poole, 2004), notably the motors of change developed by Van de Ven and Poole (1995). The relationship of such frameworks to DT should be scrutinized and investigated in the future.

Managerial Implications

Next to the aforementioned implications for research, this study also provides valuable insights into managerial practice with respect to organizational change and strategy. While DT had already become a high priority on leadership agendas in recent years, some scholars criticized that respective changes are often only executed under crisis conditions (e.g., Hinings et al., 2018). We can witness this phenomenon for example in the current COVID-19 pandemic that simultaneously highlights the potential as well as the necessity of malleable organizational designs: regulatory measures to contain the spread of the virus such as lockdowns and limited person-to-person contacts are forcing new digital ways of collaboration (e.g., through tools such as Zoom or Slack), service delivery models (e.g., through the adoption of AI and robotic process automation), and customer relationship management (e.g., through harnessing digital channels) (KMPG, 2020; McKinsey, 2020; strategy&, 2020). Furthermore, the changes and challenges brought to the fore by the COVID-19 pandemic illustrate the turbulent nature of digital business ecosystems in which organizations are embedded. They also illustrate the benefits of new ecosystem-oriented collaboration models, for example through establishing digital platforms and joining new or existing ecosystems to deliver innovative digital products and services and to meet surging online-order demand (McKinsey, 2020; strategy&, 2020). Hence, the ideas and topics related to DT such as automatized, data-driven and virtual business processes or ecosystem-oriented and embedded organizations are not simply academic, but of high relevance in practice as well since they provide insights into key questions of organizational change and strategy such as how to adapt organizations,

or where and how to compete. In this regard, the multi-dimensional framework of DT provides managers not only with a comprehensive understanding of the phenomenon in and of itself, but can also be used as a high-level checklist in combination with the research matrices (see Appendix).

More importantly, our results also provide managers with valuable insights into the dynamics of DT and in turn suggest important leadership skills required to master these. As we pointed out, DT involves, on the one hand a shift toward malleable organizational designs that enable continuous adaptation and on the other, toward turbulent digital business ecosystems. The findings reveal that this particular change necessitates three important leadership skills: DT awareness, DT acceleration and DT harmonization. Each skill involves specific attributes and capabilities and is linked to the multi-dimensional framework of DT.

First, since contextual conditions are continuously changing, interrupted by sudden bursts, managers need *DT awareness* with regards to strategy processes and contents. Managers need not only to observe and react to changes, but also to be aware of the quantity and variety of data, as well as of emerging digital technologies and their properties. Importantly, as became clear in our review, managers must understand that these elements are rapidly evolving, and must keep in mind that they are intertwined with aspects relating to the respective market, consumer and country characteristics. To account for this complexity in assessing the contextual conditions, managers should pro-actively use support from data-analytics. Current and future DT studies on *technology impact* and *systemic shift* are best suited to informing DT awareness.

Second, related to the innovation mechanisms in the multi-dimensional framework, managers require *DT acceleration* skills in strategy execution. This refers to the intellectual capacity to continuously conceive novel digital processes and products based on the available internal and external resources, as well as the willingness to invest both managerial attention and financial resources in times of episodic bursts. Above all, it is important to understand that fast execution and experimentation to learn in the market are superior to ex-ante planning and analysis due to the dynamic nature of digital business ecosystems and the transience of competitive positions and advantages. This skill can be informed and further developed with studies in the realm of *holistic co-evolution*.

Third, managers require *DT harmonizing* skills with regards to organizational change processes. These are again related to the mechanisms in the multi-dimensional framework, but with a focus on integration. *DT harmonizing* skills comprise capabilities that enable managers to integrate new digital products and processes within the existing organization. This encompasses bringing together and communicating between the 'physical' and the 'digital' business units, recognizing areas of synergies and areas of friction, reconciling differences, and paying attention to cultural aspects by balancing and blending. Here, managers need to develop specific mindfulness, i.e., a perception about what to keep and what to change in the course of DT, which depends on the general opportunities and risks but is also contextualized to the specific industry, as we determined in the nature of change. Inspiration specifically for DT harmonizing can be derived from studies on *compartmentalized adaptation*. We propose that those firms which ensure that the aforementioned three leadership skills are present and sustained in their organization are best prepared to master the challenges of DT.

CONCLUSION

Research and managerial interest in DT is burgeoning. At the same time, however, there still exist considerable uncertainties about what DT is and encompasses. As a result, building on prior knowledge on organizational change to better understand the phenomenon and give informed advice to practice is problematic. Therefore, in this study, we set out to clarify the boundary conditions for investigating DT from the perspective of organizational change by conducting a systematic review, synthesis and abstraction of what is known about DT and relating these insights to the established body of knowledge in the field. We define DT as organizational change triggered and shaped by the widespread diffusion of digital technology. The content of this change, we find, comprises a move towards malleable organizational designs that are embedded in and driven by digital business ecosystems. This content of change can be viewed from four different perspectives, including a technology impact, compartmentalized adaptation, systemic shift and holistic co-evolution perspective. The perspectives vary in their contextual scope and focus on intra-organizational change processes but share the commonality that they associate organizational change with the nature of digital technologies, particularly their pervasiveness and the dynamics they induce. Linking our findings to the established knowledge on organizational change, we diagnose that DT can be best understood as continuous change that can be triggered and shaped by episodic bursts, while the latter are inducing further continuous change. From this understanding we project how established theoretical lenses can be utilized to better understand the phenomenon and how others need to be advanced to account for the specific characteristics of DT. Through this boundary clarification, an agenda for future research as well as important managerial implications for strategy and organizational change arise.

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APPENDIX I

Research Matrix – Contextual Conditions

CONTEXTUAL CONDITIONS	
MATERIAL ANTECEDENTS	ENVIRONMENTAL ANTECEDENTS
<p><i>Emergence and diffusion of digital technologies & applications</i></p> <p>TECHNOLOGIES</p> <ul style="list-style-type: none"> * Internet (e.g., Dewan et al., 2003) * Blockchain technologies (e.g., Dutra et al., 2018) * Mobile technologies (e.g., Berman, 2012) * SMACIT technologies (e.g., Sebastian et al., 2017) * RFID (e.g., Wamba and Chatfield, 2009) * Digital platforms (e.g., Hinings et al., 2018) * Social media (e.g., Oestreicher-Singer and Zalmanson, 2013) * CRM (e.g., Quinton, 2013) * E-Systems (e.g., Bloomfield and Hayes, 2009) * ERP Systems (e.g., Devadoss and Pan, 2007) * AI (e.g., Kolbjørnsrud et al., 2016) * Digital architectures (e.g., Resca et al., 2013) * Cloud computing (e.g., Benlian et al., 2018) * Internet of things (e.g., Dery et al., 2017) * Robotics (e.g., Steinhoff et al., 2018) 	<p><i>Legal and infrastructural conditions</i></p> <p>COUNTRY CHAR.</p> <ul style="list-style-type: none"> * Digital infrastructure & standards (e.g., Tilson et al., 2010) * Regulatory framework (e.g., Cortet et al., 2016) * Regulatory interventions (e.g., Hausladen and Zipf, 2018)
	<p><i>Technology-driven industry dynamics</i></p> <p>INDUSTRY CHAR.</p> <ul style="list-style-type: none"> * Dynamic technological landscape (e.g., Benner, 2007) * Increased industrial transformation clockspeed (e.g., Wamba and Chatfield, 2009) * Constant introduction and diffusion of new digital products (e.g., Andal-Ancion et al., 2003)
	<p><i>Digital consumer demand</i></p> <p>CONSUMER CHARACTERISTICS</p> <ul style="list-style-type: none"> * Industry-specific customer demands (e.g., Oestreicher-Singer and Zalmanson, 2013) * High expectations towards the correct handling of personal information (e.g., Canaday, 2017) * Increased use of self-services (e.g., Lucas and Goh, 2009) * Rising tide of IT consumerization (e.g., Gregory et al., 2018) * Increased demand for digital connectedness (e.g., Benlian et al., 2018) * Adoption of social computing (e.g., Fung et al., 2013) * Embedment of technology in daily routines & personal interactions (e.g., Berman, 2012) * Increased sharing & gathering of online information (e.g., Berman, 2012) * Increased online consumption of content (e.g., Oestreicher-Singer and Zalmanson, 2013)
	<p>LEGEND</p> <p>Vertical labels = Key areas</p> <p>Labels in italics = Key themes</p> <p>Char. = Characteristics</p> <p>Orga. = Organizational</p> <p>TMT = Top management</p> <p>See references for the respective articles</p>
ORGANIZATIONAL ANTECEDENTS	
<p><i>Organizational strategy and legacy</i></p> <p>ORGA. CHAR.</p> <ul style="list-style-type: none"> * Path dependence (e.g., Devadoss and Pan, 2007) * Internal structure & slack (e.g., Zhu et al., 2006) * Existing processes & culture (e.g., Benner, 2007) * Existing resources (e.g., Krotov and Junglas, 2008) 	
<p><i>Digital transformation awareness of TMT</i></p> <p>MANAGERIAL CHAR.</p> <ul style="list-style-type: none"> * Top management awareness of capabilities of technology (e.g., Hansen et al., 2011) * Positive attitude towards change & technology (e.g., Dery et al., 2017) * Mindfulness (e.g., Andriole, 2017) * Perception of market shifts (e.g., Schwer and Hitz, 2018) * Readiness to lead change (e.g., Alos-Simo et al., 2017) 	

(Given the large number of references for the research matrix, the article does not provide detailed references of all papers. Full referencing is available from the authors upon request).

APPENDIX II

Research Matrix – Mechanisms

MECHANISMS	
INNOVATE	INTEGRATE
<p><i>Developing digital business strategy</i></p> <p>BUSINESS STRATEGY</p> <ul style="list-style-type: none"> * Based on data insights (e.g., Sia et al., 2016) * Transcends organizational boundaries (e.g., Bharadwaj et al., 2013) * Focuses on customer engagement or digitized solutions (e.g., Sebastian et al., 2017) * Business & technology centric (e.g., Dhar and Sundararajan, 2007) 	<p><i>Unlocking organization</i></p> <p>ORGA. ADAPTABILITY</p> <ul style="list-style-type: none"> * Establishing dynamic capabilities (e.g., Karimi and Walter, 2015) * Building abilities to bring products to market quickly (e.g., Dubelaar et al., 2005) * Developing continuously enhanced corporate learning & innovation abilities (e.g., Wamba and Chatfield, 2009) * Handling ambidexterity (e.g., Bergek et al., 2013) * Building abilities to adapt quickly to changing digital environments & customer needs (e.g., Benner, 2007)
<p><i>Creating digital innovation</i></p> <p>INNOVATION</p> <ul style="list-style-type: none"> * Combining internal & external innovations (e.g., Gomber et al., 2018) * Pursuing distributed, layered & combinatorial innovations (e.g., Yoo et al., 2010) * Encompassing product, process, & business model innovations (e.g., Hinings et al., 2018) * Importance of compatibility between digital innovations & existing processes (e.g., Zhu et al., 2006) 	<p><i>Increasing technological flexibility</i></p> <p>TECH. ADAPTABILITY</p> <ul style="list-style-type: none"> * Building a collaborative & agile enterprise architecture (e.g., Bouwman et al., 2011) * Ensuring a moderate complexity of IT networks (e.g., Haggerty, 2017) * Building a corporate digital infrastructure (e.g., Li et al., 2017) * Assuring technological interoperability (e.g., Sebastian et al., 2017) * Building an operational backbone (e.g., Hinings et al., 2018) * Establishing agile & scalable digital operations (e.g., Sia et al., 2016) * Integrating enterprise applications (e.g., Janssen and Cresswell, 2005)
<p><i>Exploiting and leveraging of digital capabilities</i></p> <p>TECH. CAPA.</p> <ul style="list-style-type: none"> * Online informational capabilities (e.g., Barua et al., 2004) * Big data analytics capabilities (e.g., Hausladen and Zipf, 2018) * Digital platform capabilities (e.g., Karimi and Walter, 2015) 	<p><i>Physical-digital harmonizing by TMT</i></p> <p>MAN. INTEGRATIVE CAPABILITIES</p> <ul style="list-style-type: none"> * Promoting cross-functional cooperation (e.g., Bloomfield and Hayes, 2009) * Using coordination mechanisms to assimilate digital technologies (e.g., Chatterjee et al., 2002) * Combining digital technologies with managerial resources, organizational structures & new working practices (e.g., Westerman et al., 2014)
<p><i>Mobilization for and acceleration of digital transformation by TMT</i></p> <p>MANAGERIAL INNOVATIVE CAPABILITIES</p> <ul style="list-style-type: none"> * Stakeholder enablement for digital business (e.g., Zhu et al., 2006) * Attracting & integrating a new generation of workers (e.g., Amladi, 2017) * Establishing digital competences & mindsets (e.g., Gale and Aarons, 2018) * Ensuring top management championship/participation (e.g., Andriole, 2017) * Ensuring strategic investment rationale (e.g., Chatterjee et al., 2002) * Guiding & steering the process of organizational transformation (e.g., Hansen et al., 2011) * Ensuring budget availability (e.g., Agarwal et al., 2010) * Creating an organizational culture of collaboration & innovation (e.g., Dery et al., 2017) * Ensuring strategic fit between internal resources/capabilities & external environments (e.g., Benner, 2007) * Promoting exploration & experimentation through digital technologies (e.g., Haffke et al., 2017) 	<p><i>Developing digital transformation strategy</i></p> <p>TRANSFORMATION STRATEGY</p> <ul style="list-style-type: none"> * Describing pathways of business model transformation (e.g., Berman, 2012) * Analysing/discovering related digital business models (e.g., Remane et al., 2017) * Formulating & executing digital transformation endeavours (e.g., Westerman et al., 2014) * Driving digital transformation with external capabilities & resources (e.g., Li et al., 2017) * Describing stages of digital transformation endeavours (e.g., Matzler et al., 2018) * Considering factors related to technologies, value creation, structure, & financials (e.g., Matt et al., 2015)
<p><i>Merging human-machine interaction</i></p> <p>HCI</p> <ul style="list-style-type: none"> * Facilitating learning & development through HCI (e.g., Vey et al., 2017) * Establishing synergy between technology & humans (e.g., Bajer, 2017) * Establishing bi-directional interactions (e.g., Marshall and Lambert, 2018) * Understanding & embracing change induced by technology use in practice (e.g., Devadoss and Pan, 2007) 	<p>LEGEND</p> <p>Vertical labels = Key areas Labels in italics = Key themes Capa. = Capabilities HCI = Human Computer Interaction Man. = Managerial Orga. = Organizational Tech. = Technological See references for the respective articles</p>

APPENDIX III

Research Matrix – Outcomes

OUTCOMES	
ORGANIZATIONAL SETUP	ECONOMICS
<p><i>Ecosystem-oriented and -embedded organization</i></p> <p>EXTRA-ORGANIZATIONAL TIES</p> <ul style="list-style-type: none"> * Redefined mediation strategies (e.g., Andal-Ancion et al., 2003) * Web-based supply chain management/partner relationship management (e.g., Barua et al., 2004) * Dynamic digital ecosystems/value co-creation (e.g., Pagani, 2013) * Increased use of open innovation/crowdsourcing approaches (e.g., Berman and Marshall, 2014) 	<p><i>Improved firm performance and new forms of value</i></p> <p>FIRM LEVEL PERFORMANCE</p> <ul style="list-style-type: none"> * Increased firm performance (e.g., Matt et al., 2015) * Reduced costs (e.g., Agarwal et al., 2010) * Increased value creation (e.g., Hoßbach et al., 2016) * New forms of value creation and capture (e.g., Bharadwaj et al., 2013) * Improved service quality (e.g., Bouwman et al., 2011) * Higher competitive advantage (e.g., Kaushal et al., 2003) * Increased operational efficiency (e.g., Weill and Woerner, 2018) * Higher customer satisfaction (e.g., Gale and Aarons, 2018)
<p><i>Permeable, agile organizational structures</i></p> <p>INTRA-ORGANIZATIONAL STRUCTURING</p> <ul style="list-style-type: none"> * Altered role of IT function towards bimodal IT & service-centricity (e.g., Haffke et al., 2017) * Change of identity & representation (e.g., Powell et al., 2016) * Joining up hitherto separate departments/cross-functional partnerships (e.g., Bloomfield and Hayes, 2009) * Higher involuntary CIO turnover rates (e.g., Gerth and Peppard, 2016) * Digitally-enabled arrangements of practices & structures (e.g., Hinings et al., 2018) * Agile, adaptable, & boundaryless forms of organization, e.g., Holacracy (e.g., Scherer and Hiltz, 2018) * Market- and customer-oriented organization structures (e.g., Bajer, 2017) * Digitally enabled organizational communication (e.g., Dery et al., 2017) 	<p><i>Dynamic and constantly changing industry level performances</i></p> <p>INDUSTRY LEVEL PERFORMANCE</p> <ul style="list-style-type: none"> * Dynamic prices (e.g., Jiang and Katsamakos, 2010) * Increased volatility of market shares (e.g., Viswanathan, 2005) * New economic mechanisms (e.g., Lang and Zhao 2000) * Changing stock market identity (e.g., Benner, 2007) * Increased market reactions and turbulences (e.g., Lichtenhaler., 2017)
	SPILLOVERS
<p><i>Technology-focused and -supported management</i></p> <p>MANAGEMENT STYLES & ROLES</p> <ul style="list-style-type: none"> * Increased use of artificial intelligence support/decision support systems (e.g., Kolbjørnsrud et al., 2016) * New role of CDO (e.g., Weill and Woerner, 2018) * New ways of strategic planning & decision making (e.g., Evans, 2017) * Change of CIO role (e.g., Gerth and Peppard, 2016) * New digital transformation leadership types (e.g., Nograss, 2011) 	<p><i>Paradigms of customer-centricity and connected markets</i></p> <p>PARADIGMS</p> <ul style="list-style-type: none"> * New fabric of decision making & delivery of services (e.g., Evans, 2017) * Higher focus on end-to-end commerce & mass customisation (e.g., Weichert, 2017) * Increased user/customer-centricity (e.g., Westerman et al., 2014) * Higher focus on open innovation/community centered (e.g., Oestreich-Singer and Zalmanson, 2013) * Shift towards connected markets (e.g., Reddy and Reinartz, 2017) * Increased diffusion of shared value innovations (e.g., Pagani, 2013)
<p><i>Digital and customer experience-focused business model</i></p> <p>BUSINESS MODEL</p> <ul style="list-style-type: none"> * Renovated and modified business models (e.g., Berman, 2012) * Creation of new business models (e.g., Weichert, 2017) * Reshaped customer value propositions (e.g., Westerman et al., 2014) * Increased focus on digital customer experience (e.g., Sebastian et al., 2017) * Agile changing business models (e.g., Zimmermann et al., 2016) 	<p><i>Digital-permeated markets, economies and societies</i></p> <p>SYSTEMS</p> <ul style="list-style-type: none"> * Digitalized markets & hierarchies (e.g., Kathan et al., 2016) * Digitalized socio-technical interactions & relations (e.g., Tilson et al., 2010) * Increased country development (e.g., Boas et al., 2005) * Digitalized democracy (e.g., Fung et al., 2013) * Improved societal well-being (e.g., Graham and Nikolova, 2013) * Higher economic growth (e.g., Katz et al., 2013) * Rise of sharing economies (e.g., Kathan et al., 2016)
<p><i>Automatized, data-driven and virtual business processes</i></p> <p>PROCESS</p> <ul style="list-style-type: none"> * Reduction of errors (e.g., Bouwman et al., 2011) * High degree of automation (e.g., Westerman and Bonnet, 2015) * Radical improvement of processes (e.g., Agarwal et al., 2010) * Virtualization of processes (e.g., Karimi and Walter, 2015) * Delivery of services (e.g., from HR, marketing) via digital technologies (e.g., Brynjolfsson et al., 2013) * Enhanced use of digital technologies & software for performing tasks (e.g., Benlian et al., 2018) 	<p><i>Blurring of the boundaries between physical and online industry structures</i></p> <p>INDUSTRY</p> <ul style="list-style-type: none"> * Merged physical & digital contents (e.g., Brynjolfsson et al., 2013) * Disruption of existing market places/industries (e.g., Downes and Nunes, 2013) * Digitalized industry structures (e.g., Agarwal et al., 2010) * Enhanced interactions between companies & consumers through multiple touch points (e.g., Brynjolfsson et al., 2013) * Digitalized customer interfaces (e.g., Gandhi and Gervet, 2016)
<p><i>Smart, connected and customized products</i></p> <p>PRODUCT</p> <ul style="list-style-type: none"> * Digitalized products (e.g., Porter and Heppelmann, 2015) * Altered product architecture (e.g., Yoo et al., 2012) * Highly customizable products (e.g., Dewan et al., 2003) 	<p><i>Higher exposure to cyber threats</i></p> <p>INFORM. SECURITY</p> <ul style="list-style-type: none"> * Exposure to cyber war threats (e.g., Canaday, 2017) * Exposure to data security vulnerability (e.g., Dang-Pham et al., 2017) * Need to ensure network & data security (e.g., Haggerty, 2017)
<p>LEGEND Vertical labels = Key areas Labels in italics = Key themes Inform. = Information See references for the respective articles</p>	<p><i>Digitalization of the individual</i></p> <p>INDIVIDUAL</p> <ul style="list-style-type: none"> * Enhanced choices/informedness (e.g., Berman, 2012) * Strengthened civic involvement (e.g., Fung et al., 2013) * Improved well-being (e.g., Roberts, 2016) * New forms of communication (e.g., Zheng et al., 2016) * Rise of digital natives (e.g., Berman and Marshall, 2014) * Better understanding & resolving of complex human problems (e.g., Ashwell, 2017) * Transformation from passive to active consumers (e.g., Berman, 2012) * Increased spatial & temporal flexibility (e.g., Benlian et al., 2018) * New job possibilities (e.g., Bajer, 2017)