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# Understanding the Capabilities for Digital Innovations from a Digital Technology Perspective

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## 1    Introduction

Our era is an era of (digital) transformation. Organizations have to prevail in a world that is ever more dominated by digital technologies (Yoo et al. 2012). Nowadays, organizational success depends on the ability to navigate the digital world and master the transformative impact of digital technologies (Kohli and Melville 2018; Lucas et al. 2013). As a consequence, organizations need to deal with innovative digital technologies and undergo a process of organizational change. This process is also referred to as digital transformation (Legner et al. 2017).

However, while digital transformation surely offers a plethora of lucrative new business opportunities, it has also induced significant challenges for organizations. In the era of digital transformation, organizations have to deal with the impact of digital technologies on their strategy (Bharadwaj et al. 2013; Chanias 2017), culture (Piccinini et al. 2015), management roles (Singh and Hess 2017; Tumbas et al. 2017b), or governance structures (Svahn et al. 2017) – to name just a few of the many transformational challenges that followed the advent of digital technologies. Likewise, organizations that want to master the transformative impact of digital technologies need to develop dedicated digital capabilities (Chan and Ahuja 2015; Tan et al. 2015; Tumbas et al. 2017a).

One important digital capability is an organization's capability for digital innovations (Tai et al. 2017; Lyytinen et al. 2016; Nambisan et al. 2017; Wiesböck 2018). The ability to react to changing environments and to innovate has always been considered an important driver of competitive advantage and organizational performance (Barney 1991). Similarly, this makes digital innovations an important driver of organizational success in the digital age and digital innovation management a fundamental managerial challenge in the era of digital transformation (Nambisan et al. 2017).

Accordingly, research on the capabilities for digital innovations has gained momentum over the last years (Kohli and Melville 2018; Nambisan et al. 2017). The information systems (IS) research discipline has approached this topic through the refinement of the information technology (IT) capability concept (Chan and Ahuja 2015; Li and Chan 2016; Fichman et al. 2014; Wiesböck 2018). Broadly speaking, IT capability refers to an organization's ability to handle IT which surely is an important prerequisite for digital innovations. Nevertheless, the ongoing academic discussion on digital innovations calls for dedicated theories and conceptualizations (Kohli and Melville 2018; Nambisan et al. 2017; Yoo et al. 2012) that go beyond an organisation's IT capability (Matt et al. 2015; Wiesböck 2018). As a consequence, the IS research discipline has brought forth various digital capability concepts that focus on different aspects of digital transformation (Levallet and Chan 2018; Karimi and Walter 2015; Freitas Junior et al. 2016; Tumbas et al. 2017a) or explicitly adress digital innovation (Tai et al. 2017; Lyytinen et al. 2016).

The innovation management (IM) research discipline complements this stream of research with its innovation capability concepts. Typically, innovation capabilities capture the different stages or dimensions of innovation processes (Slater et al. 2014). Through their general nature, however, innovation capabilities, at least partly, ignore the idiosyncrasies of digital innovations. What is more, none of the existing concepts addresses the capabilities for digital innovations from a digital technology perspective. However, we strongly believe that such a digital-technology centered perspective on the capabilities for digital innovations would explicitly address two effects – digitalization and digital transformation – that play an essential role in the context of digital innovations (Legner et al. 2017; Wiesböck 2018).

With this study, we want to take a first step in this direction and try to develop a basic understanding of the capabilities for digital innovations (henceforth: digital innovation capabilities (DIC)) from a digital technology perspective. Such a perspective argues that digital innovations are based on digitalization and digital transformation capabilities (Wiesböck 2018). Hence, the aim of this paper is to develop a digital technology-centered theoretical conceptualization of an organization's DIC. This way, we want to answer the following research question: How do an organization's digitalization capabilities and digital transformation capabilities define an organization's digital innovation capabilities?

By choosing a conceptual research approach we follow Nambisan et al. (2017, p. 223)'s call for "novel theorizing on digital innovation" and contribute to the ongoing stream of conceptual research on digital innovations (e.g., Bygstad 2017; Fichman et al. 2014; Hinings et al. 2018; Kohli and Melville 2018; Nambisan et al. 2017; Yoo et al. 2012; Yoo et al. 2010). What is more, conceptual research is especially appropriate in emerging fields of research. This way, conceptual research can provide the theoretical groundwork for later following empirical studies (MacKenzie et al. 2011).

Referring to standard procedure for theorizing and conceptual development in IS and IM research (MacKenzie et al. 2011; Rossiter 2002), we will develop our conceptualization of DIC in a three-step process. First, we will develop a basic first-level conceptualization that is grounded on Wiesböck (2018)'s digital technology-centered model of digital innovations. Then, we will further differentiate this first-level conceptualization into a second-level conceptualization that describes an organization's digitalization capabilities and digital transformation capabilities more in detail. Finally, we will further differentiate our second-level conceptualization into a third-level conceptualization that distinguishes between different digital innovation categories and different digital technology subclasses.

The remainder of this paper is structured as follows: section 2 provides an overview of existing literature and theories on digital innovations and innovation capabilities. The sections 3, 4 and 5 successively develop a digital technology-centered conceptualization of an organization's DIC. Section 6 concludes with a short summary of the results and discusses the implications and limitations of our study.

## 2 Theoretical Background

In this section we provide an overview of existing literature and theory on digital innovations and innovation capabilities. This way, this section serves as the theoretical background for our study and provides the basis for the later following conceptualizations.

### 2.1 Digital Innovations

The prevalence of digital technologies has led to the emergence of a new kind of innovation: digital innovations (Kohli and Melville 2018; Nambisan et al. 2017; Yoo et al. 2010). Especially IS research, but also various other research disciplines such innovation management, strategic management, or organizational economics, have dedicated a lot of effort regarding the nature of digital innovations. Existing theory defines digital innovation as "the creation of […] market offerings, business processes, or models that result from the use of digital technology" (Nambisan et al. 2017, p. 224). Accordingly, the use of digital technologies to create partly or entirely digital outcomes depicts a central element of digital innovations (Kohli and Melville 2018; Nambisan et al. 2017; Yoo et al. 2010). This use of digital technologies makes digital innovations idiosyncratic in several dimensions. Firstly, the use of digital technologies during the innovation process breaks down the boundaries between the different innovation stages. Therefore, digital innovations show a clear tendency to unfold in a non-linear fashion (Nambisan et al. 2017). This goes so far that "with the infusion of digital technologies […] the scope, features, and value of product/service offerings continue to evolve even after the idea has been enacted" (Nambisan 2017, p. 1033). Secondly, the use of digital technologies for innovation purposes fosters the democratization of innovation through idea management platforms, design thinking approaches, and so on (Fichman et al. 2014). This is often accompanied by a shift towards more distributed innovation systems (Lyytinen et al. 2016). Similarly, modern organizations show an increasing tendency towards open innovation approaches that shifts the center of innovation from internal to external resources such as customers or business partners (Saldanha et al. 2017). Thirdly, through their modular architecture, digital technologies allow for a greater variety and flexibility in digital innovation outcomes. However, this may come at the cost of increased complexity and comprehensibility of digital products or services (Nambisan et al. 2017; Yoo et al. 2010).

Coming from an IS perspective, Wiesböck (2018) theorize digital innovations as a combination of two effects (digitalization 1 and digital transformation) and three basic artifacts (innovative digital technologies, innovative digital solutions, and innovative digital business concepts). Digitalization concerns the identification, adoption, adaption, development, and management of innovative digital technologies (Legner et al. 2017; Wiesböck 2018). Digital transformation concerns the transformative impact of digital

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[1] Which is something different than the process of digitization, i.e., the conversion of analog information into digital format (Legner et al. 2017; Yoo et al. 2010).

technologies on organizations (Legner et al. 2017; Wiesböck 2018). Digital technologies capture the emergence of modern so-called SMAC technologies – social, mobile, analytics, and cloud computing (Legner et al. 2017). Digital solutions refer to the fact that digital innovations are univerally based on the innovative (re)use IT components (Yoo et al. 2012; Fichman et al. 2014). Digital business concepts mirror the fact that the emergence of digital technologies has led to the emergence of novel business solutions and business concepts based on novel IT solutions (Kohli and Melville 2018; Nambisan et al. 2017). Figure 1 (Wiesböck 2018) shows this digital technology-centered conceptualization of digital innovations.

Following their model of digital innovations, the innovative use of abstract digital technologies allows organizations to develop specific innovative digital solutions. For example, companies in our days are changing their management IS based on in-memory databases and based on new technologies for the interaction between humans and machines. Such innovative digital solutions, then again, trigger the development of innovative digital business concepts that complement the underlying digital solutions. In our example, the company is changing their controlling processes based on modified solutions management IS solutions – for example, they can now discuss scenarios in board meetings.
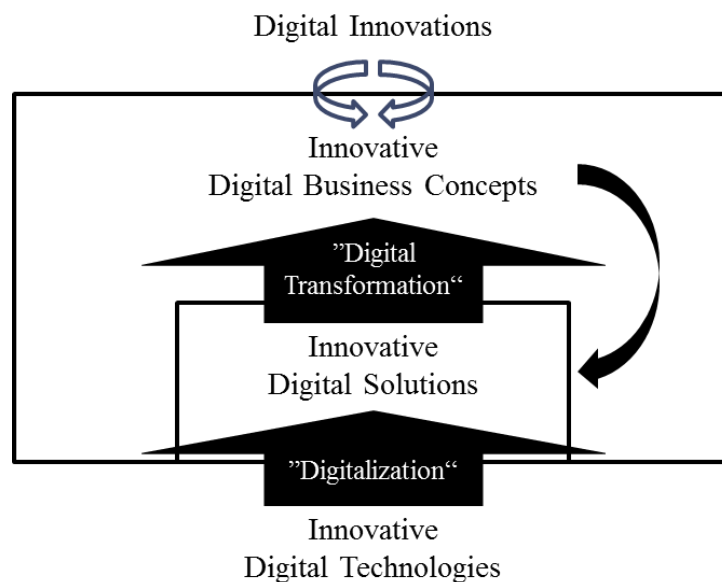


*Figure 1 Digital technology-centered model of digital innovations (Wiesböck 2018)*

## 2.2 Innovation Capabilities

Beginning with Schumpeter's influential works in the 1930s, innovation depicts one of the major challenges for organizations and is seen as a critical element how organizations can achieve and sustain competitive advantage (Grant 1996; McGrath et al. 1995; Schumpeter 1934; Teece 2010). Following the resource based view of the firm (RBV), organizations need

to develop superior innovation capabilities in order to realize superior innovation performance (Calantone et al. 2002; Grant 1996; Slater et al. 2014). Accordingly, the concept of innovation capabilities has been thoroughly theorized and empirically investigated over the last decades (Terziovski 2010).

In general, innovation capabilities can be understood as an organization's ability to transform resources, knowledge, and ideas into new organizational solutions that fundamentally differ from already existing ones (Damanpour 1991; Joshi et al. 2010; Lawson and Samson 2001). This idea is also true in the era of digital transformation and manifests, for instance, in the fundamental role of digital innovations in digital strategies (Barrett et al. 2015; Bharadwaj et al. 2013) and the ongoing academic discussion on digital innovation management (Kohli and Melville 2018; Nambisan et al. 2017). However, with the advent of digital technologies the rules for innovation changed dramatically and calls for dedicated theories on digital innovations started to emerge (Nambisan et al. 2017). Hence, researchers have begun to investigate the capabilities that underlie digital innovations. For instance, Tai et al. (2017) conceptualize DIC as an organization's ability to conduct innovative IS activities along three dimensions: functional IS, business technology, and business administration. Dong and Wu (2015) argue that an organization's ability to strategically use social media technologies leads to digitally enabled innovation capabilities. Moreover, according to Nwankpa and Datta (2017), an organization's ability to invest in innovative emerging technologies influences its ability to pursue digital innovations. In addition, the ability to create and manage digital platforms (Karimi and Walter 2015), to assimilate and diffuse innovations (Roberts et al. 2016), to attract and train digital talents (Wang et al. 2013), or to manage innovation ecosystems (Kim et al. 2017) has been associated positively with digital innovations.

IT capabilities depict another important determinant of innovation success in general and digital innovation success in particular (Bharadwaj 2000; Kohli and Melville 2018; Chan and Ahuja 2015; Wiesböck 2018; Mauerhoefer et al. 2017). To begin with, organizations need to be able to manage digital infrastructures. Furthermore, organizations need to be able to create and run digital solutions – which, among others, involves superior IT planning, IT management, or IT implementation skills – and have to be able to align their IT and business organizations. Moreover, organizations need to be able to realize the necessary conditions that facilitate digital innovations in the form of specific structures, resources, culture, or governance mechanisms. And finally, organizations need to be able to create and run digital business concepts that complement digital solutions.

On a more general level, recent studies have pointed out the idiosyncrasies of digital innovations (Nambisan et al. 2017; Yoo et al. 2012) and argued for dedicated digital capability concepts ( Levallet and Chan 2018; Tumbas et al. 2017a; Freitas Junior et al. 2016). Accordingly, digital innovations require dedicated capabilities that deliberately address the tasks and activities related to the development and management of digital innovations

(Wiesböck 2018). Such capabilities refer to an organization's ability to create novel digital products and services, organizational processes and structures, or business models through the innovative use of digital technologies (Nambisan et al. 2017; Wiesböck 2018).

## 3 First-Level Conceptualization of Digital Innovation Capabilities

In this section, we will develop a basic first-level conceptualization of an organization's DIC. Therefore, we will argue that digital innovations require two complementary digital capabilities: digitalization capabilities and digital transformation capabilities. This way, we build up on Wiesböck (2018)'s digital technology-centered model of digital innovations (Figure 1).

Following Wiesböck (2018)'s model, digital innovations involve two effects that are induced by digital technologies: digitalization and digital transformation. Digitalization, on the one side, concerns the identification, adoption, adaption, development, and management of innovative digital technologies (Legner et al. 2017). Organizations need to be able to handle digitalization in order to develop specific digital solutions that are based on abstract digital technologies (Wiesböck 2018). Digital transformation, on the other side, concerns how organizations unleash the transformative impact of digital technologies (Legner et al. 2017; Wiesböck 2018). In the context of digital innovations, organizations need to complement digital solutions with digital business concepts (Wiesböck 2018). Therefore, we argue that an organization's DIC is characterized by how it is able to handle these two effects.

What is more, the three basic artifacts of digital innovations (digital technologies, digital solutions, and digital business concepts) follow a logical evolutionary path (Wiesböck 2018). To begin with, organizations need to identify innovative digital technologies based on which they can then develop innovative digital solutions. Then, organizations need to complement their innovative digital solutions with innovative digital business concepts. The transition from an abstract digital technology to a concrete digital solution characterizes an organization's digitalization (Legner et al. 2017; Wiesböck 2018). The transition from a digital solution to a digital business concept characterizes an organization's digital transformation (Legner et al. 2017; Wiesböck 2018). Accordingly, organizations need to be able to handle both the transition from abstract digital technologies to concrete digital solutions (i.e., digitalization) and the transition from digital solutions to digital business concepts (i.e., digital transformation). Thus, coming from an IS perspective, an organization's DIC can be defined as its ability to handle digitalization and digital transformation processes that accompany the use of innovative digital technologies. Accordingly, an organization's DIC is characterized by two complementary digital capabilities: digitalization capabilities and digital transformation capabilities. Figure 2 shows this digital technology-centered first-level conceptualization.
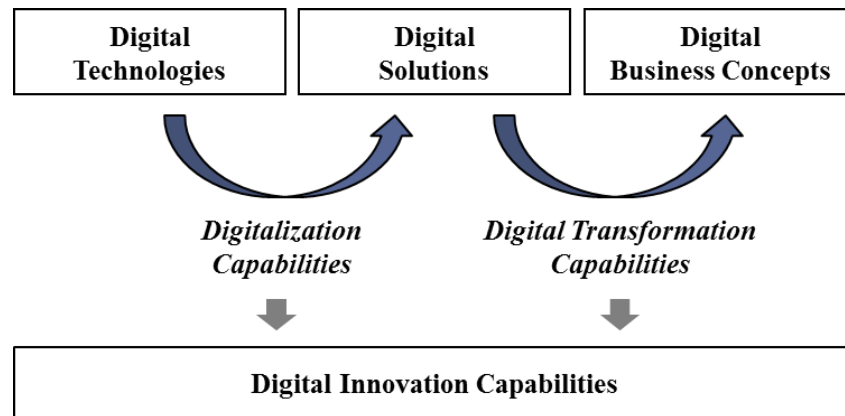
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*Figure 2 First-level conceptualization of an organization's digital innovation capabilities*

## 4    Second-Level Conceptualization of Digital Innovation Capabilities

In the previous section we introduced a first-level conceptualization of an organization's DIC (Figure 2). In the following subsections, we will first discuss each of the two complementary capabilities – digitization and digital transformation capabilities – more in detail (4.1 and 4.2, respectively) and then, based on these thoughts, develop a second-level conceptualization of an organization's DIC (4.3).

### 4.1  Digitalization Capabilities

Digitalization capabilities describe an organization's ability to implement digital solutions based on digital technologies (i.e., handle the process of digitalization). This involves several organizational aspects (Wiesböck 2018). To begin with, organizations need to be able to create and run digital solutions. The evolution from an abstract digital technology to a specific digital solution requires the ability to manage digital technologies. This includes the identification and selection of promising innovative digital technologies (Fichman et al. 2014; Kohli and Melville 2018; Nambisan et al. 2017), a strategic vision on how to use digital technologies as a basis for digital innovations (Carlo et al. 2012; Fichman et al. 2014; Freitas Junior et al. 2016; Kohli and Melville 2018; Lu and Ramamurthy 2011), and the adoption and adaptation of digital technologies to specific needs and situations (Kohli and Melville 2018; Lu and Ramamurthy 2011; Nwankpa and Datta 2017; Wiesböck 2018). Moreover, organizations need to be able to realize technical systems and embed them in existing systems and structures (Bharadwaj 2000; Kohli and Melville 2018; Wiesböck 2018). And finally, they need to be able operate, maintain, and advance digital solutions. Both the realization and embedding and the usage, maintenance and advancement of digital solutions requires the ability to use digital tools, to combine digital and physical resources, and to manage the IT function in general (i.e., IT planning, IT design, IT budgeting, IT project management etc.) (Bharadwaj et al. 1999; Mauerhoefer et al. 2017; Nambisan et al. 2017; Sambamurthy et al. 2003; Wiesböck 2018).

Besides the creation and the operation of digital solutions, organizations need the ability to adapt their existing IT infrastructure and to create new digital infrastructures according to the requirements of digital technologies and digital solutions (Henfridsson and Bygstad 2013; Hess and Barthel 2017; Wiesböck 2018). Digital innovations require flexible, adaptable, scalable, and compatible IT infrastructures that allow the integration of external parties (e.g., customers, service providers, suppliers) in the innovation process (Fichman et al. 2014; Lyytinen et al. 2016; Nambisan et al. 2017) and support the special characteristics of digital technologies such as generativity (Bygstad 2017; Fichman et al. 2014; Henfridsson and Bygstad 2013; Yoo et al. 2010), modularity (Fichman et al. 2014), or convergence (Lyytinen et al. 2016; Yoo et al. 2012). However, they have to be able to manage both the adaptation of their existing IT infrastructures and the development of novel digital infrastructures in order to accommodate digital innovations while, at the same time, securing the stability and functionality of their existing IT systems and applications (Bygstad 2017) – a challenge oftentimes referred to as IT ambidexterity (Gregory et al. 2015; Lee et al. 2015) or bimodal IT (Gartner 2015; Horlach et al. 2016).

What is more, digital innovations – similar to all organizational processes that involve IT resources (Bharadwaj 2000; Lu and Ramamurthy 2011; Nwankpa and Datta 2017) – require a strategic view on the usage and role of IT within organizations (Matt et al. 2015). In the era of digital transformation, organizations need to "rethink the role of IT strategy, from that of a functional-level strategy – aligned but essentially always subordinate to business strategy – to a fusion between IT strategy and business strategy" (Bharadwaj et al. 2013, p. 472) in order to address the effects of digital technologies on organizational functioning. This means that organizations need to be able to formulate an adequate IT strategy that accounts for the specific requirements of digital innovations. And in addition, organizations need to be able to align their IT strategies with their general digital transformation strategies (Bharadwaj et al. 2013; Matt et al. 2015; Yeow et al. 2017).

### 4.2 Digital Transformation Capabilities

Digital transformation capabilities describe an organization's ability to implement digital business concepts that complement digital solutions (i.e., handle the process of digital transformation). Similar to the process of digitalization, this concerns several organizational aspects (Wiesböck 2018). Firstly, organizations need to be able to create and run digital solutions. This demands that organizations are able to identify business opportunities that can result from the use of digital technologies (Cohen and Levinthal 1990; Fichman et al. 2014; Kohli and Melville 2018; Saraf et al. 2013). Then, similar to digital solutions, organizations need to be able to realize digital business concepts and embed them into existing business and operating structures (e.g., revenue models or business models) (Kohli and Melville 2018; Wiesböck 2018). Finally, organizations need to be able to operate, maintain, and advance digital business concepts (Wiesböck 2018) in order to exploit value

from digital innovations (Fichman et al. 2014; Kohli and Melville 2018). This step includes the adoption and diffusion of the digital business concept within and beyond the organization (i.e., clients, customers, service providers etc.) (Fichman et al. 2014; Kohli and Melville 2018; Wei et al. 2015).

In addition, organizations need to provide an inner-organizational environment that accommodates digital transformation (Hess and Barthel 2017; Kohli and Melville 2018; Wiesböck 2018). Therefore, organizations need to approach the digital transformation of their innovation practices (Hess and Barthel 2017), organizational culture (Hartl and Hess 2017; Piccinini et al. 2015), governance structures (Chanias 2017; Svahn et al. 2017), management roles (Singh and Hess 2017; Tumbas et al. 2017b), and, more comprehensively, organizational forms (e.g., through the set-up of dedicated digital business units or organization-wide digital innovation practices) (Hess et al. 2016; Wiesböck 2018).

Lastly, in order to strategically approach the use of digital technologies for innovation purposes, organizations need to develop and implement a pertinent digital transformation strategy and align it with their IT and other organizational strategies (Bharadwaj et al. 2013; Hess et al. 2009; Matt et al. 2015; Yeow et al. 2017). Such a digital transformation strategy supports companies in governing the transformations that result from the use of digital technologies (Matt et al. 2015).

### 4.3  Digital Innovation Capabilities

In the two previous subsections (4.1 and 4.2), we further differentiated our first-level conceptualization of DIC (Figure 2). Below, we will consolidate this into a second-level conceptualization of DIC.

In our view both digital capabilities (digitalization capabilities and digital transformation capabilities) are represented by three symmetric dimensions: evolution, (infra-)structure, and strategy. The first dimension (evolution) concerns the evolution of digital innovations. Organizations need to be able to create and run digital solutions and digital business concepts, respectively. This involves a multi-step process (Fichman et al. 2014; Kohli and Melville 2018) including the identification, realization, and embedding, as well as the usage, maintenance and advancement of digital solutions and digital business concepts. Moreover, this refers to both the management of single digital innovation projects as well as the management of an organization's entire digital innovation project portfolio. The second dimension ((infra-)structure) refers to the accompanying impact of digital innovations on IT infrastructures and organizational structures (such as governance, culture and so on). Organizations need to be able to adapt their structures accordingly in order to accommodate digital innovations (Chanias 2017; Hess and Barthel 2017; Wiesböck 2018). This also includes the adaptation of an organization's human capital basis, the development of innovation promoting structures, and the initiation of the necessary cultural change (Hartl and Hess

2017; Hess and Barthel 2017; Hess et al. 2016; Piccinini et al. 2015). The third dimension (strategy) relates to the underlying IT and digital transformation strategies that capture the strategic impact of digital innovations. Organizations need to be able to formulate IT and digital transformation strategies and align them with other organizational strategies.

Following Wiesböck (2018), there is an additional transverse dimension that characterizes an organization's DIC: the ability to foster IT business partnerships. Each of the different aspects related to an organization's digitalization and digital transformation demands that organizations closely align the needs, requirements, perspectives, and work practices of their IT, business, and digital organizations and encourage cross-unit cooperation (Bharadwaj et al. 2013; Bharadwaj 2000; Chanias 2017; Lu and Ramamurthy 2011; Queiroz 2017; Wiesböck 2018). Thus, we argue that the three symmetric dimensions of an organization's DIC (evolution, (infra-)structure, strategy) are complemented a fourth transverse dimension: IT business partnerships – the ability to foster cooperation among its IT and business organization. Figure 3 depicts this second-level conceptualization of an organization's DIC.
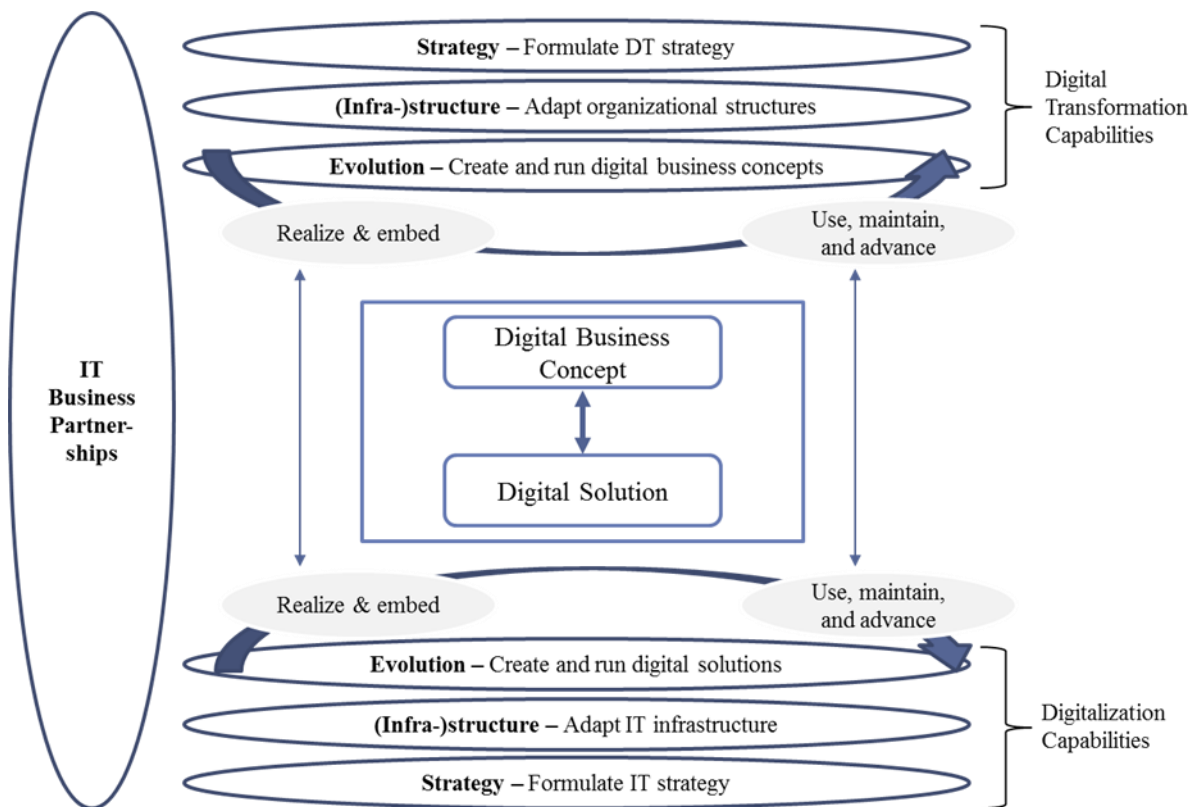


*Figure 3 Second-level conceptualization of an organization's digital innovation capabilities*

Each of the four dimensions concerns the management and integration of digital technologies into organizational functioning. Thus, our second-level conceptualization of DIC (Figure 3) captures a central element of digital innovations: the effects of digital technologies on organizations (i.e., digitalization and digital transformation). In our view, such a digital technology-centered conceptualization of DIC is appropriate for two reasons. For one, the advent of digital technologies is generally held responsible for the emergence of digital innovations (Fichman et al. 2014; Nambisan et al. 2017). For another, digital technologies

are generally seen as the catalyst for organizational change in the era of digital transformation (Kohli and Melville 2018; Lucas et al. 2013). What is more, the aggregation level of our conceptualization of an organization's digitalization, digital transformation, and digital innovation capabilities, respectively, is in line with other capability concepts in the context of IT-based innovations such as IT capabilities (Bharadwaj 2000; Lu and Ramamurthy 2011) or other DIC concepts (Tai et al. 2017).

## 5   Third-Level Conceptualization of Digital Innovation Capabilities

At the current level, our second-level conceptualization (Figure 3) neglects one important aspect: in reality, organizations need to develop different concrete manifestations of DIC depending on their specific situations and digital innovation use cases. There are various reasons why such a third-level conceptualization of an organization's DIC is necessary. Past research has shown that, among other factors, different organizational governance structures (Bygstad 2017), different cultures (Piccinini et al. 2015), different levels of IT tool usage in innovation projects (Mauerhoefer et al. 2017), or different digital business intensities to (Nwankpa and Datta 2017) may influence an organization's innovation practices and innovation success. In our view, two important arguments that call for a third-level conceptualization of DIC are (i) the different digital innovation categories that depict the focus of an organization's digital innovation efforts (Nambisan et al. 2017; Fichman et al. 2014) and (ii) the different subclasses of digital technologies that provide the basis for digital innovation outcomes (Wiesboeck, 2018; Bygstad 2017). In the following two subsections (5.1 and 5.2, respectively), we will discuss this more in detail.

### 5.1  Different Digital Innovation Categories

Generally, digital innovations can be classified into three categories (Nambisan et al. 2017; Fichman et al. 2014): digital product and service innovations[2], digital business process innovations, and digital business model innovations. Organizations can use digital technologies either to develop novel digital products and services (Lyytinen et al. 2016; Nambisan et al. 2017), to digitalize their business processes and organizational structures (Nambisan et al. 2017), or to operate digital revenue and business models (Nambisan et al. 2017).

Each of the three categories is based on an innovative digital technology and includes the processes of digitalization (i.e., the transition from digital technology to digital solution) and digital transformation (i.e., from digital solution to digital business concept). However, each of the three categories demand different manifestations of the capabilities depicted in section

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[2] For the sake of simplicity, the development of novel products and services is often summarized as product innovations (Fichman et al. 2014).

4 (Figure 3). Organizations have to consider this and develop suitable capabilities according to their specific digital innovation use cases.

For instance, while an organization's capacities for product design and product testing play a crucial role for digital product innovations, digital process innovations may require sufficient skills and know-how regarding process mining or process automation. Likewise, while digital product and digital business model innovations (such as smartphone applications or music streaming services, respectively) might require the ability to implement online payment models, digital business process innovations (such as telematics-based insurance pricing) could demand the ability process real-time data. But also the same category of digital innovations may demand different subsets of DIC. While the development of new smartphone applications (i.e., digital product innovations) will, among other things, require the ability to program android-based software, the development of virtual reality content (another form of digital product innovations) may demand the ability to program CAVE-based software, for instance. Organizations have to reflect these considerations in the digital innovation efforts.

## 5.2 Different Digital Technology Subclasses

IS research refers to digital technologies as an umbrella term for different technologies such as social media, internet-of-things, big data, mobile, computing, or cloud computing (Legner et al. 2017). Accordingly, digital technologies can be distinguished into different subclasses. These different digital technology subclasses, then again – similar to our foregoing thoughts on the interplay of the different digital innovation categories and an organization's DIC – demand different capabilities along the four dimensions of an organization's DIC.

For example, organizations that want to rely on social media channels to carry out open innovation practices need to be able to appropriately use social media technologies (Dong and Wu 2015), whereas organizations that want to exploit software-as-a-service offerings need to be able to handle could technologies (Benlian and Hess 2011). While the use of social media technologies for innovation purposes, among others, requires the ability to integrate user-generated content into the innovation process (Dong and Wu 2015), the use of cloud technologies in order to provide software-as-service offerings requires, for instance, the ability to host the necessary software infrastructure or the ability to develop adequate software (Benlian and Hess 2011). Accordingly, the concrete manifestations of an organization's DIC also depend on the actual digital technology that underlies the desired digital innovation outcome.

What is more, the same digital technology can act as the cornerstone for different subclasses of digital solutions and digital business concepts – and therefore demand different subsets of digitalization and digital transformation capabilities. For instance, RFID technologies can act as the technological basis for both wearables (i.e., digital product innovations) and automated inventory management processes (i.e., digital business process innovations).

## 6    Conclusion

### 6.1  Summary of Results

The aim of this paper was to develop a basic understanding of the capabilities that underlie digital innovations from a digital technology perspective. Building up on existing theory on digital innovations that points out the importance of digitalization and digital transformation capabilities in the context of digital innovations (Wiesböck 2018), we asked: How do an organization's digitalization capabilities and digital transformation capabilities define an organization's digital innovation capabilities? To answer this research question we took on a conceptual research approach and followed a three-step process to conceptualize an organization's DIC from a digital technology perspective.

First, we argued that an organization's DIC concern the management of two effects related to the emergence of digital technologies: digitalization and digital transformation. Organizations need the necessary capabilities to handle both the transition from digital technologies to digital solutions (i.e., digitalization) and the transition from digital solutions to digital business concepts (i.e., digital transformation) if they want to achieve superior digital innovation results. Therefore, an organization's DIC are composed of two complementary capabilities: digitalization capabilities and digital transformation capabilities. Figure 2 summarizes this first central result of our paper: a first-level conceptualization of DIC.

Second, we argued that digitalization and digital transformation capabilities manifest along four dimensions: evolution, (infra-)structure, strategy, and IT business partnerships. The evolutionary dimension describes an organization's ability to create and run digital innovations. The structural dimension captures the ability to adapt existing structures according to the requirements of digital innovations. The strategic dimension depicts the ability to implement the necessary strategic guidelines for digital innovations. The partnership dimension captures the ability to foster cooperation and coordination between the IT, business, and digital organizational departments. This second-level conceptualization of DIC (Figure 3) represents the second central result of our paper.

Finally, we argued that in reality organizations need to consider the existence of different categories of digital innovations and different digital technology subclasses. In many cases, the different digital technology subclasses and the different digital innovation categories demand different manifestations of DIC. This third-level conceptualization of DIC depicts the third central result of our paper.

### 6.2  Theoretical Implications

Principally, studies on the management of digital innovations can be allocated at the interface between the IS and IM research domain. Accordingly, with our study we want to offer

theoretical contributions to both the IS and the IM research discipline. In our view, we advance existing research on digital innovations as follows.

Firstly, our conceptualization of an organization's DIC (in particular, Figures 2 and 3) contribute to existing theory on digital innovations and their underlying organizational antecedents. With our study we follow up on the recent discussion that, besides superior IT capabilities, digital innovations also require dedicated digital capability concepts (Levallet and Chan 2018; Nambisan et al. 2017; Tumbas et al. 2017a; Wiesböck 2018) and argue that such digital capabilities are based on an organization's ability to deal with digital technologies (and manifest in the form of digitalization and digital transformation capabilities). Secondly, with our capability-based perspective on digital technologies and digital innovations, we deepen the general understanding of the effects of digital technologies on organizations (i.e., digitization and digital transformation). Thirdly, our conceptual development of DIC can be seen as further testing of the existing theories on digital innovations that provide the basis for our thoughts (Weber 2012) and acts as an important first step towards subsequent scale development processes and empirical investigations of DIC (MacKenzie et al. 2011). Finally, we contribute to the general literature on innovation capabilities. We argue that, in the era of digital transformation, innovation requires a dedicated form of innovation capabilities and elaborate on the specifics underlying these capabilities.

### 6.3 Practical Implications

Our paper also has valuable practical implications. In general, we highlight the importance of digital technologies for organizational success in the era of digital transformation. In particular, our conceptualization of DIC allows managers to identify the necessary capabilities for digital innovation success. This way managers are able to pinpoint needs for action within their organizations and accordingly adjust their organization's human resource management. Specifically, we emphasize the relevance of the four dimensions represented in Figure 3. Mangers who want to improve their digital innovation efforts could assess their organizations along these four dimensions and act accordingly (i.e., invest in the further development of the respective capability dimensions). What is more, we pointed out that different forms of digital innovations and different forms of digital technologies may demand different forms of DIC. Managers should reflect this in their organization's digital innovation efforts.

### 6.4 Limitations

Nevertheless, our study is not without limitations. Principally, our digital technology-centered perspective neglects other possible perspectives on digital innovations such as value creation- or customer-centered approaches. Such different approaches might lead to different conceptualizations of an organization's DIC. Furthermore, our conceptualization of DIC may be complemented by other (digital) capabilities or other organizational

characteristics (e.g., governance structures, cultural issues or specific industry types) that affect an organization's digital innovation success. In this regard, more theory is needed on the interplay of DIC with other organizational factors that influence digital innovation success. Finally, since our paper is a theoretical work, it does not provide empirical evidence. Therefore, we encourage future research to validate our theoretical concepts in an empirical setting.

# References

Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage." Journal of Management, 17(1), 99-120.

Barrett, M./Davidson, E./Prabhu, J./Vargo, S. L. 2015. "Service Innovation in the Digital Age: Key Contributions and Future Directions." MIS Quarterly, 39(1), 135-154.

Benlian, A./Hess, T. 2011. "Opportunities and Risks of Software-as-a-Service: Findings from a Survey of IT Executives." Decision Support Systems, 52(1), 232-246.

Bharadwaj, A./El Sawy, O. A./Pavlou, P. A./Venkatraman, N. 2013. "Digital Business Strategy: Toward a Next Generation of Insights." MIS Quarterly, 37(2), 471-482.

Bharadwaj, A. S. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation." MIS Quarterly, 24(1), 169-196.

Bharadwaj, A. S./Sambamurthy, V./Zmud, R. W. 1999. "IT Capabilities: Theoretical Perspectives and Empirical Operationalization." ICIS 1999 Proceedings: Association for Information Systems.

Bygstad, B. 2017. "Generative Innovation: A Comparison of Lightweight and Heavyweight IT." Journal of Information Technology, 32(2), 180-193.

Calantone, R. J./Cavusgil, S. T./Zhao, Y. 2002. "Learning Orientation, Firm Innovation Capability, and Firm Performance." Industrial Marketing Management, 31(6), 515-524.

Carlo, J. L./Lyytinen, K./Rose, G. M. 2012. "A Knowledge-Based Model of Radical Innovation in Small Software Firms." MIS Quarterly, 36(3), 865-895.

Chan, Y./Ahuja, S. 2015. "Digital Ecodynamics in Small Firms: Using Information Technology to Compete." Proceedings of the 36th International Conference on Information Systems, Fort Worth, USA.

Chanias, S. 2017. "Mastering Digital Transformation: The Path of a Financial Service Provider Towards a Digital Transformation Strategy." Proceedings of the 25th European Conference on Information Systemes, Guimaraes, Portugal.

Cohen, W. M./Levinthal, D. A. 1990. "Absorptive Capacity: A New Perspective on Learning and Innovation." Administrative Science Quarterly, 35(1), 128-152.

Damanpour, F. 1991. "Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators." Academy of Management Journal, 34(3), 555-590.

Dong, J. Q./Wu, W. 2015. "Business Value of Social Media Technologies: Evidence from Online User Innovation Communities." Journal of Strategic Information Systems, 24(2), 113-127.

Fichman, R. G./Dos Santos, B. L./Zheng, Z. 2014. "Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum." MIS Quarterly, 38(2), 329-343.

Freitas Junior, J. C./Maçada, A. C./Brinkhues, R./Montesdioca, G. 2016. "Digital Capabilities as Driver to Digital Business Performance." Proceedings of the 22nd Americas Conference on Information Systems, San Diego, USA.

Gartner. 2015. "IT Glossary - Bimodal IT." Retrieved 27/05/2018, from https://www.gartner.com/it-glossary/bimodal

Grant, R. M. 1996. "Toward a Knowledge- based Theory of the Firm." Strategic Management Journal, 17(Special Issue), 109-122.

Gregory, R. W./Keil, M./Muntermann, J./Mähring, M. 2015. "Paradoxes and the Nature of Ambidexterity in IT Transformation Programs." Information Systems Research, 26(1), 57-80.

Hartl, E./Hess, T. 2017. "The Role of Cultural Values for Digital Transformation: Insights from a Delphi Study." Proceedings of the 23rd Americas Conference on Information Systems, Boston, USA.

Henfridsson, O./Bygstad, B. 2013. "The Generative Mechanisms of Digital Infrastructure Evolution." MIS Quarterly, 37(3), 907-931.

Hess, T./Barthel, P. 2017. "Wieviel Digitale Transformation Steckt Im Informationsmanagement? Zum Zusammenspiel Eines Etablierten Und Eines Neuen Managementkonzepts." HMD Praxis der Wirtschaftsinformatik, 54(3), 313-323.

Hess, T./Matt, C./Benlian, A./Wiesböck, F. 2016. "Options for Formulating a Digital Transformation Strategy." MIS Quarterly Executive, 15(2), 123-139.

Hess, T./Vetter, J./Dörr, J./Kink, N. 2009. "Studies in Information Systems." Journal of Information Technology and Management, 23, 23-47.

Hinings, B./Gegenhuber, T./Greenwood, R. 2018. "Digital Innovation and Transformation: An Institutional Perspective." Information and Organization, 28(1), 52-61.

Horlach, B./Drews, P./Schirmer, I. 2016. "Bimodal IT: Business-IT Alignment in the Age of Digital Transformation." Proccedings of the Multikonferenz Wirtschaftsinformatik 2016, Illmenau, Germany.

Joshi, K. D./Chi, L./Datta, A./Han, S. 2010. "Changing the Competitive Landscape: Continuous Innovation through IT-Enabled Knowledge Capabilities." Information Systems Research, 21(3), 472-495.

Karimi, J./Walter, Z. 2015. "The Role of Dynamic Capabilities in Responding to Digital Disruption: A Factor-Based Study of the Newspaper Industry." Journal of Management Information Systems, 32(1), 39-81.

Kim, D. D./Tan, B./Tan, F. T. C./Ondrus, J./Oh, J. 2017. "IS Capabilities in the Development of an Innovation Ecosystem: A Case Study of the Hallyu (Korean Wave) Phenomenon." Proceedings of the 38th International Conference on Information Systems, Seoul, South Korea.

Kohli, R./Melville, N. P. 2018. "Digital Innovation: A Review and Synthesis." Information Systems Journal, 28(1), 1-24.

Lawson, B./Samson, D. 2001. "Developing Innovation Capability in Organizations: A Dynamic Capabilities Approach." International Journal of Innovation Management, 5(3), 377-400.

Lee, O./Sambamurthy, V./Lim, K. H./Wei, K. K. 2015. "How Does IT Ambidexterity Impact Organizational Agility?" Information Systems Research, 26(2), 398-417.

Legner, C./Eymann, T./Hess, T./Matt, C./Böhmann, T./Drews, P./Mädche, A./Urbach, N./Ahlemann, F. 2017. „Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community." Business & Information Systems Engineering, 59(6), 301-308.

Levallet, N./Chan, Y. E. 2018. "Role of Digital Capabilities in Unleashing the Power of Managerial Improvisation." MIS Quarterly Executive, 17(1), 1-21.

Li, T./Chan, Y. E. 2016. "Developing an Instrument to Measure Firm-wide Dynamic IT Capability." Proceedings of the 37th International Conference on Information Systems, Dublin, Ireland.

Lu, Y./Ramamurthy, K. 2011. "Understanding the Link between Information Technology Capability and Organizational Agility: An Empirical Examination." MIS Quarterly, 35(4), 931-954.

Lucas, H. C./Agarwal, R./Clemons, E. K./El Sawy, O. A./Weber, B. W. 2013. "Impactful Research on Transformational Information Technology: An Opportunity to Inform New Audiences." MIS Quarterly, 37(2), 371-382.

Lyytinen, K./Yoo, Y./Boland Jr, R. J. 2016. "Digital Product Innovation within Four Classes of Innovation Networks." Information Systems Journal, 26(1), 47-75.

MacKenzie, S. B./Podsakoff, P. M./Podsakoff, N. P. 2011. "Construct Measurement and Validation Procedures in MIS and Behavioral Research: Integrating New and Existing Techniques." MIS Quarterly, 35(2), 293-334.

Matt, C./Hess, T./Benlian, A. 2015. "Digital Transformation Strategies." Business and Information Systems Engineering, 57(5), 339-343.

Mauerhoefer, T./Strese, S./Brettel, M. 2017. "The Impact of IT on New Product Development Performance." Journal of Product Innovation Management, 34(6), 719-738.

McGrath, R. G/MacMillan, I. C./Venkataraman, S. 1995. "Defining and Developing Competence: A Strategic Process Paradigm." Strategic Management Journal, 16(4), 251-275.

Nambisan, S. 2017. "Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship." Entrepreneurship Theory and Practice, 41(6), 1029-1055.

Nambisan, S./Lyytinen, K./Majchrzak, A./Song, M. 2017. "Digital Innovation Management: Reinventing Innovation Management Research in a Digital World." MIS Quarterly, 41(1), 223-238.

Nwankpa, J. K./Datta, P. 2017. "Balancing Exploration and Exploitation of IT Resources: The Influence of Digital Business Intensity on Perceived Organizational Performance." European Journal of Information Systems, 26(5), 469-488.

Piccinini, E./Hanelt, A./Gregory, R./Kolbe, L. 2015. "Transforming Industrial Business: The Impact of Digital Transformation on Automotive Organizations." Proceedings of the 36th International Conference on Information Systems, Fort Worth, USA.

Queiroz, M. 2017. "Mixed Results in Strategic IT Alignment Research: A Synthesis and Empirical Study." European Journal of Information Systems, 26(1), 21-36.

Roberts, N./Campbell, D. E./Vijayasarathy, L. R. 2016. "Using Information Systems to Sense Opportunities for Innovation: Integrating Postadoptive Use Behaviors with the Dynamic Managerial Capability Perspective." Journal of Management Information Systems, 33(1), 45-69.

Rossiter, J. R. 2002. "The C-Oar-Se Procedure for Scale Development in Marketing." International Journal of Research in Marketing, 19(4), 305-335.

Saldanha, T./Mithas, S./Krishnan, M. S. 2017. "Leveraging Customer Involvement for Fueling Innovation: The Role of Relational and Analytical Information Processing Capabilities." MIS Quarterly, 41(1), 367-396.

Sambamurthy, V./Bharadwaj, A./Grover, V. 2003. "Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms." MIS Quarterly, 27(2), 237-263.

Saraf, N./Liang, H./Xue, Y./Hu, Q. 2013. "How Does Organisational Absorptive Aapacity Matter in the Assimilation of Enterprise Information Systems?" Information Systems Journal, 23(3), 245-267.

Schumpeter, J. 1934. "Capitalism, Socialism, and Democracy." New York: Harper & Row.

Singh, A./Hess, T. 2017. "How Chief Digital Officers Promote the Digital Transformation of Their Companies." MIS Quarterly Executive, 16(1), 1-18.

Slater, S. F./Mohr, J. J./Sengupta, S. 2014. "Radical Product Innovation Capability: Literature Review, Synthesis, and Illustrative Research Propositions." Journal of Product Innovation Management, 31(3), 552-566.

Svahn, F./Mathiassen, L./Lindgren, R. 2017. "Embracing Digital Innovation in Incumbent Firms: How Volvo Cars Managed Competing Concerns. MIS Quarterly," 41(1), 239-253.

Tai, J. C./Wang, E. T./Wang, K. 2017. "Investigating the Impact of IT Ambidexterity on Digital Innovation Capability." Proceedings of the 21st Pacific Asia Conference on Information Systems, Langkawi, Malaysia.

Tan, B./Pan, S. L./Lu, X./Huang, L. 2015. "The Role of IS Capabilities in the Development of Multi-Sided Platforms: The Digital Ecosystem Strategy of Alibaba. Com." Journal of the Association for Information Systems, 16(4), 248-280.

Teece, D. J. 2010. "Business Models, Business Strategy and Innovation." Long Range Planning, 43(2-3), 172-194.

Terziovski, M. 2010. "Innovation Practice and Its Performance Implications in Small and Medium Enterprises (Smes) in the Manufacturing Sector: A Resource Based View." Strategic Management Journal, 31(8), 892-902.

Tumbas, S./Berente, N./vom Brocke, J. 2017a. "Digital Capabilities for Buffering Tensions of Structure, Space, and Time During Entrepreneurial Growth." Proceedings of the 38th International Conference on Information Systems, Seoul, South Korea.

Tumbas, S./Berente, N./vom Brocke, J. 2017b. "Three Types of Chief Digital Officers and the Reasons Organizations Adopt the Role." MIS Quarterly Executive, 16(2), 121-134.

Wang, Q. E./Myers, M. D./Sundaram, D. 2013. "Digital natives and digital immigrants." Business & Information Systems Engineering, 5(6), 409-419.

Weber, R. 2012. "Evaluating and Developing Theories in the Information Systems Discipline." Journal of the Association for Information Systems, 13(1), 1-30.

Wei, J./Lowry, P. B./Seedorf, S. 2015. "The Assimilation of RFID Technology by Chinese Companies: A Technology Diffusion Perspective." Information & Management, 52(6), 628-642.

Wiesböck, F. 2018. "Thinking Outside of the IT Capability Box. Proceedings of the 24th Americas Conference on Information Systems." New Orleans, USA.

Yeow, A./Soh, C./Hansen, R. 2017. "Aligning with New Digital Strategy: A Dynamic Capabilities Approach." The Journal of Strategic Information Systems, 27(1), 43-58.

Yoo, Y./Boland Jr, R. J./Lyytinen, K./Majchrzak, A. 2012. "Organizing for Innovation in the Digitized World." Organization Science, 23(5), 1398-1408.

Yoo, Y./Henfridsson, O./Lyytinen, K. 2010. "Research Commentary - The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research." Information Systems Research, 21(4), 724-735