

## An Updated Framework of Factors Enabling Digital Transformation

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### Abstract

**Background:** *There is increasing pressure on organizations to undergo digital transformation. The literature provides substantial but unconsolidated knowledge of relevant factors that enable organizations to fully utilize the potential of digital technology transformations. This work revises, expands, and updates a previously published framework of factors that enable digital organizational transformation structured along traditional strategic, tactical, operational, and normative management perspectives.*

**Method:** *Following a design science approach, this paper developed a framework in two steps. The starting point was an initial iteration of the framework developed from a structured literature review; that version of the framework was evaluated based on the results of qualitative interviews that were conducted with experts. A revised framework was generated to take advantage of a more recent literature review; the input of focus groups and qualitative interviews; and a second full design cycle was executed. The revised framework is presented in this paper.*

**Results:** *The revised framework structures nine relevant factors along the traditional management perspectives of strategic, tactical, operational, and normative management, and it integrates feedback from the scientific community and experts from practice.*

**Conclusions:** *The developed framework enables a structured overview of factors relevant for commencing digital transformation initiatives. This clear structure, as well as its close links to traditional operational, tactical, strategic, and normative aspects of management, can support practitioners in preparing their organizations for digital transformation.*

**Keywords:** Digital Transformation, Enabling Factors, Framework, Design Science.

Citation: Rueckel, D., Muehlburger, M. & Koch, S. (2020). An Updated Framework of Factors Enabling Digital Transformation. *Pacific Asia Journal of the Association for Information Systems*, 12(4), 1-26. <https://doi.org/10.17705/1pais.12401>

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## Introduction

Digital technology and developments in its systematic and managerial use have the ability to fundamentally change the world in which organizations operate (Ho & Lee, 2015) as well as the nature of organizations themselves (Andal-Ancion et al., 2003; Fitzgerald et al., 2014; Karagiannaki et al., 2017). These changes are not limited to particular branches or parts of organizations (Holotiuk & Beimborn, 2017); they have the potential to transform organizations and organizational environments as a whole (Heckmann et al., 2016; Merali et al., 2012; Venkatraman, 1994). To harness the potential of technologically initiated changes and stay competitive, organizations need to co-evolve with new technologies. By utilizing digital technology to significantly change internal structures and business models, organizations can create their own advantages within their competitive environments (D'Aveni et al., 2010).

Organizational transformation processes, particularly digital transformation, are key to developing and optimizing organizations, branches, markets, and associated living environments. Managed development and change do not occur automatically; they result from a receptive organizational culture and internal structures and processes coupled with individuals' creativity and enthusiasm for change (Gimpel & Röglinger, 2015; Tichy, 1983). Information technology (IT)-departments stand at the core of the now omnipresent call for the digital transformation of organizations (Andal-Ancion et al., 2003), and this relation puts pressure on organizations to transform their value creation through utilization of digital technologies. While academia attempts to clarify and explain the phenomenon of digital transformation (Verhoef et al., 2019; Vial, 2019), practice-oriented publications indicate that successful digital transformation poses a significant challenge to organizations (Eastman & Sisson, 2016; Sebastian et al., 2017) and look for solutions. Eastman and Sisson (2016) showed that a majority of organizations are aware of the potential offered by new information technologies as well as the need to adapt to them, yet evidence simultaneously indicates that most companies are stuck in traditional business models (Andal-Ancion et al., 2003) and antiquated approaches (Hartl & Hess, 2017). Many companies lack the capability to successfully transform their company structures and business models based on technological trends, as theorized by Venkatraman (1994).

Based on the results of two qualitative field studies, Kahre et al. (2017) observed, "78 percent of U.S. CEOs [chief executive officers] are concerned about the rapid pace of technological change while 48 percent of CIOs [chief information officers] still spend most of their time aligning IT operations with overall corporate objectives [,]" and this observation is supported by other qualitative (Kohli & Johnson, 2011) and quantitative (Fitzgerald et al., 2014) studies. Many companies fail to embrace new digital technology within their business structures, but several studies (Berghaus & Back, 2016; Hess et al., 2016) describe a significant population of companies that would benefit from incorporating technological trends and reshaping their business models or even entire organizations based on improved digital technology (Venkatraman, 1994, 2017), and some companies embracing change make rapid progress, thus reflecting a strong influence on their internal structures and business models (Verhoef et al., 2019).

It remains, however, that a significant number of companies neglect to take advantage of digital transformation opportunities and remain mired in traditional business models and structures (Loebbecke & Picot, 2015). Empirical studies (El Sawy et al., 2016; R. Hansen & Sia, 2015; Rothmann & Koch, 2014) as well as conceptual and theoretical work (Bharadwaj et al., 2013; Martins & Terblanche, 2003; Matt et al., 2015) provide fragmented insights on which factors allow a company to successfully implement digital transformation. The factors that allow companies to successfully integrate digital transformation are available and scattered throughout the literature, but the information is not structured nor holistically organized for further analysis or refinement.

To support future research on the topic of digital transformation, we aim to develop within this paper a revised framework of factors that enable or support digital transformation initiatives within an organization. Following established design science research guidelines (Gregor & Hevner, 2013; Hevner et al., 2004; Peffers et al., 2007), we used a two-step process for developing our framework: First, based on an extensive literature review, we drafted the initial framework and subjected it to evaluation and criticism; second, after gathering empirical data through expert interviews and focus groups, we refined and restructured our framework into its final form before subjecting it to additional comment and evaluation. The applied design science process enabled an engineering approach to set up an artifact that does rest on both the state of the field and empirical data. The use of a structured design science process (Peffers et al., 2007) allows us to iteratively improve the artifact and expand its' degree of coverage of the researched phenomenon in its' evolutionary nature (Gill & Hevner, 2013).

The paper is structured as follows: After discussing the phenomenon of digital transformation and the state of the field, we outline the applied methodology and design science research (DSR) process used. We then describe and evaluate the designed frameworks and revisions. This section is followed by a discussion of the results, and the paper concludes with a reflection on ideas for future research.

## Literature Review

Digitization, digitalization, and digital transformation have become common phrases in science and business (Verhoef et al., 2019). "Digital transformation" is often seen as a pervasive phase describing a holistic change targeting the development of new (digital) business models; the closely related "digitalization" summarizes attempts to alter existing organizational structures and processes utilizing information technologies, and "digitization" is described as the basic process of transforming analog data and information into its digital manifestation (Krumay et al., 2019; Legner et al., 2017; Verhoef et al., 2019).

These phrases seem rather clearly defined and differentiated in practice, but semantic borders are blurred in the scientific literature (Vial, 2019). This ambiguity results not only from disagreement but also from the multidisciplinary nature of digital transformation (Verhoef et al., 2019) which prevents digital transformation from being defined in a straightforward manner (Krumay et al., 2019). Vial's (2019) analysis of these definitions resulted in three observations: First, digital transformation is an organizational topic; second, definitions vary based on the types of technologies involved and the place where transformation occurs, and third, definitions show that information technologies are crucial for digital transformation. The multidisciplinary nature of research interests in this topic implicitly underscores the strategic role and importance of digital transformation for companies' markets and economies as whole.

Early works describing IT-induced changes in a company as digital transformation were published in the 2000s (Andal-Ancion et al., 2003; Lanzolla & Anderson, 2008), but Venkatraman (1994) introduced the phrase "IT-enabled business transformation" ten years earlier. However, the main body of knowledge contributed to the research area began appearing in the 2010s. Aside from management literature (Kane et al., 2015), topical publications can also be found in information systems (IS) journals (Kohli & Johnson, 2011) or the system sciences (Horlacher & Hess, 2016) community. Following the strategic imperative (Fitzgerald et al., 2014), the term digital transformation strategy was introduced by (Matt et al., 2015).

Within the initial paper, Matt et al. (2015) defined three main research opportunities:

- The elements and patterns of success in digital transformation strategies,
- Procedural aspects and responsibilities connected to digital transformation strategies, and
- The integration of digital transformation strategies into firms (Matt et al., 2015).

Research progress has been made in each of these topics (Berghaus & Back, 2016; Chaniias & Hess, 2016; Hess et al., 2016). Questions regarding the procedural aspects and responsibilities are still a focal area, mainly related to the necessity for and the possible responsibilities of a chief digital officer (CDO) (Horlacher & Hess, 2016; Riedl et al., 2017; Walchshofer & Riedl, 2017).

Another related term is “digital business strategy” (DBS), which pertains to how companies can take full advantage of technological developments. DBS is an early field of study that broke with the paradigm of business–IT alignment (Bharadwaj et al., 2013; Mithas et al., 2013). The main thrust of DBS is that it views digital technology as a prerequisite for innovation and competitiveness, and therefore, it aims to integrate digital technologies into the highest levels of organizational strategy instead of subordinating it to the lower strategic priority levels (Kahre et al., 2017). A variety of publications focusing on internal and external contexts as well as the contents of DBS were identified in a recent review by Kahre et al. (2017), which also identified the main knowledge gaps concerning how DBS can be implemented within companies (Kahre et al., 2017).

Recently, two extensive literature reviews on digital transformation have provided further structured insights into digital transformation (Verhoef et al., 2019; Vial, 2019). The first literature review by Vial (2019) developed a definition of digital transformation (DT) that viewed the concept as based on a rigid process and thus defined it as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies.” Besides, the author thereby contributes to the discussion on a possible difference between information technology enabled business transformation and digital transformation, as also discussed by Wessel et al. (2020). In regard to the understanding of digital transformation this paper follows the definition proposed by Vial (2019) thereby understanding DT as an evolution of IT-enabled business transformation. Following this evolutionary perspective, utilization of the terms “digital technology” and “information technology” within this work reflects this evolution and does not indicate a conceptual differentiation between underlying technologies. Vial (2019) further developed a framework for structuring the results from 282 works into eight DT “building blocks.” At the core of the framework are the methods in which an organization’s value creation paths are enabled or improved by the use of digital technologies. The increasing use of digital technologies fuels disruption and triggers strategic responses within an organization, which also relies on employing digital technologies to resolve the disruptions and implement the responses. Both positive and negative structural changes within an organization may result from the use of DT. DT enables changes in an organization’s value creation paths; it fuels disruption and triggers strategic responses within an organization that often require additional DT for resolution.

For this work, we were specifically interested in research identifying the building blocks of structural change based on DT. For example, based on the results of 59 studies, Vial (2019) identified four clusters of relevant organizational changes:

- General organizational structure,
- Organizational culture,
- Leadership, and

- Employee roles and skills.

Changes in general organizational structure focus on enabling an organization to be flexible and adaptable through different DT approaches, which mainly focus on increasing cross-functional collaboration (Earley, 2014; Maedche, 2016). Changes affecting organizational culture focus on establishing certain values within employees and the overall organizational culture, again with the purpose of making the organization more adaptable (Hartl & Hess, 2017; Karimi & Walter, 2015). Relevant works regarding leadership changes stress the importance of organizational leaders who establish and promote a digital mindset within the organization (Benlian & Haffke, 2016; A. M. Hansen et al., 2011). The final cluster of works focus on the changing roles and relevant skills of employees in DT implementation and use (Colbert et al., 2016; Watson, 2017).

The second literature review, conducted by Verhoef et al. (2019), began the analysis by stating that innovative business models resulting from DT “have fundamentally altered consumers’ expectations and behaviors, pressured traditional firms, and disrupted numerous markets.” This statement suggests a slightly broader and more holistic research approach to reviewing the current state of the field.

Verhoef et al. (2019) discuss the subject area using a “commonly used flow model” that structures the complex field into three categories (phases):

- External drivers of DT (e.g., Fitzgerald et al., 2014),
- Phases of DT (e.g., Legner et al., 2017), and
- Strategic imperatives of DT (e.g., Shah et al., 2006).

The first, external drivers of DT, includes such considerations as the available digital technology, competition, or the behavior of the digital consumer; the second, phases of DT, describes the interrelations of digitization, digitalization, and DT; and the third discusses the consequent strategic aims and tasks necessary to gain advantages and benefits, e.g. digital resources, new organizational structures, growth strategies, and useful metrics to measure goal achievement. This flow model was then used to structure and analyze a final sample of 84 papers. By incorporating a multidisciplinary perspective on DT, the process led to a research agenda that identified five key topics and recommended their associated scientific disciplines (e.g. IS research, strategic management, innovation research), thus affirming that DT is a multidimensional and multidisciplinary field of research.

Kahre et al (2017) point out that “research on the ‘how’ of change which can only be understood from a detailed analysis of the processes focusing on transformational changes is scarce,” while Matt et al. (2015) state that “integrating digital transformation strategies into firms” is one of the major fields for future work. Structured understanding of factors allowing companies to harness the advantages of DT is scarce, as shown by calls for future research (Verhoef et al., 2019; Vial, 2019). As a result, executives pursuing DT lack basic information on which areas of their organizations need to be altered and what goals should be pursued (Legner et al., 2017).

Therefore, from the foregoing, we derived the overall goal for this paper: To craft a framework and develop insight on the underlying factors that foster and enable companies to implement DT.

Within the described research fields, several empirical studies (El Sawy et al., 2016; R. Hansen & Sia, 2015; Rothmann & Koch, 2014), as well as several theoretical works (Bharadwaj et al., 2013; Martins & Terblanche, 2003), give fragmented insights on which factors allow a company to successfully apply and maintain DT, but none offer an organization or framework for assessing

these factors. To close the gap in the literature, this paper develops a framework structuring the current knowledge of the enabling factors for DT using a design science approach. This contributes to practitioners who intend to initiate DT programs within their companies as well as to the scientific community as a possible structure and guideline for further research in the topic.

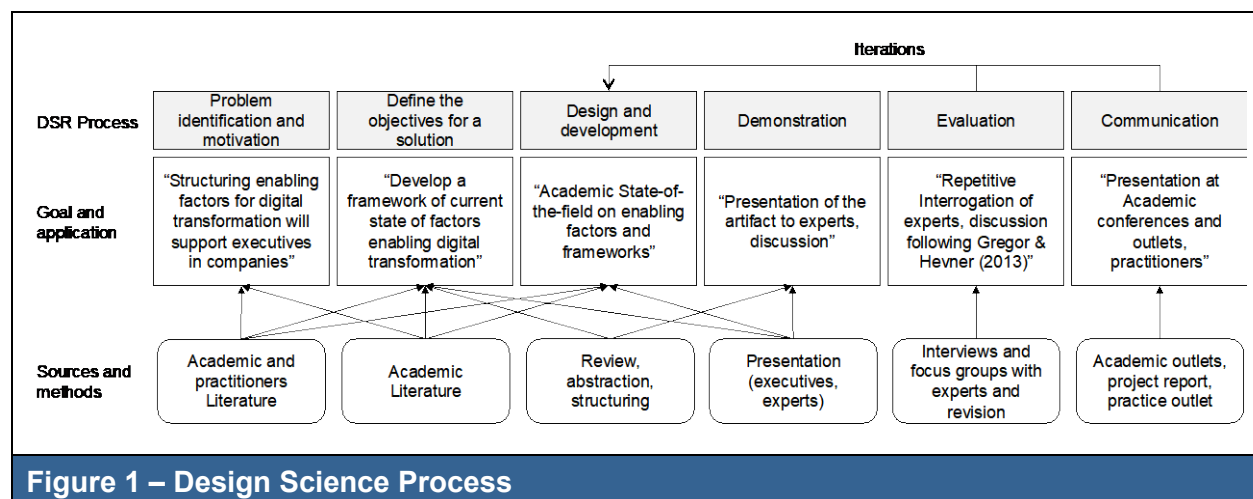
## Research Process

The next section describes the two-step design process of identifying and evaluating the contributing factors in successful DT as an artifact.

### Design Science Processes

The framework development herein is based on design science research (DSR), primarily described in the works of Hevner et al. (2004), Gregor and Hevner (2013), and Peffers et al. (2007). Design science research aims not only on designing artifacts but also on iteratively improve artifacts against the background of research objectives in design and evaluation (Alismail et al., 2017). The research paradigm is well established in information systems research (Herwig & Rosenkranz, 2018) and shows particular strength in practice-oriented research (Goldkuhl & Sjöström, 2018), as sometimes explicitly referenced as practice design research. In such cases collaboration with practitioners and experts is crucial (Goldkuhl & Sjöström, 2018). Literature identifies both the clarification of the phenomenon DT and the need for derivation of enabling factors as highly relevant for practitioners (Verhoef et al., 2019; Vial, 2019). As DSR “strives for both scientific rigor and practical relevance” (Baskerville et al., 2019; Hevner, 2007) in an iterative engineering process, it seems appropriate in current research. By iteratively applying DSR, it does not only produce project design knowledge but also solution design knowledge (Drechsler & Hevner, 2019) necessary for further iterations in research.

Figure 1 shows the implementation of the DSR process with specific goals, applications, and sources and methods.



As mentioned above, the research process began by defining the problem of identifying the factors that contribute to or impede DT, assessing the motives behind those factors, and then proposing a solution. The first step was to analyze the literature of both academics and practitioners; research objectives were, however, solely based on peer-reviewed literature.

Following the DSR process proposed by Peffers et al. (2007), we initiated the design process in two steps. The first step – the design, demonstration, and evaluation of a new framework – was conducted and published in 2018–2019 (Muehlburger et al., 2019). The second step was triggered by our evaluation of results from the initial DSR process, the compelling discussion and feedback at the Americas Conference on Information Systems (AMCIS) 2019, and our examination of the holistic literature review on DT published by Vial (2019).

### ***Initial Framework Design and Evaluation (Step One)***

As the basis for the initial framework, the current literature was reviewed and a list of enabling factors for the implementation of DT initiatives was compiled. Additionally, we identified existing frameworks structuring these factors. Based on search terms and limiting criteria, a structured literature review was conducted using the ScienceDirect, Web of Science, and SpringerLink databases, as well as metasearch engines such as Google Scholar. We then scanned the search results for potentially relevant information on DT enabling factors and included explicitly mentioned factors within the developing framework. The preliminary result was 36 papers containing information relevant to this work. Due to the heterogeneous body of literature, the enabling factors that were found varied immensely in their level of abstraction and their method of scientific validation. In a deductive process based on factor names and descriptions, the broad list, often containing detailed factors, was consolidated and the enabling factors were grouped and combined into nine categories:

- Individual creativity and innovation capabilities,
- ICT literacy,
- Innovative organizational culture,
- Internal and external collaboration,
- Digital platform infrastructures,
- IT agility,
- Institutionalized innovation processes,
- Strategic embeddedness, and
- Digital leadership.

We then aimed to structure these factors in our initial framework (Muehlburger et al., 2019). Three holistic approaches for structuring enabling factors were identified within the literature. First, Karimi and Walter (2015) organized a hierarchical framework of dynamic capabilities into resources, processes, and values; second, Bärenfänger and Otto (2015) organized the dynamic capabilities necessary for digital business models; and third, Hess and Barthel (2017) described three fields of action as well as corresponding tasks necessary for successful DT. While the structure proposed by Karimi and Walter (2015) was applicable to six of our nine defined factors, we were unable to apply the structuring of Bärenfänger and Otto (2015). Hess and Barthel's (2017) structure accommodated eight of our nine defined enabling factors, and we, therefore, used it as a basis for the creation of the initial framework.

This analytical process resulted in four categories:

- Workforce capabilities,
- Organizational values,
- Organizational infrastructure, and
- Management capabilities.

Workforce capabilities and organizational values were directly derived from Hess & Barthel's (2017) task categories "prepare workforce" and "change company culture." Workforce capabilities herein contain factors that DT implementation programs require from individual employees. Organizational values describes the values and attitudes a company must adopt to foster an atmosphere that embraces possibilities and enables DT programs. To simplify the framework, organizational infrastructure combines Hess and Barthel's (2017) task categories "prepare IT-landscape" and "build innovation fostering structures." None of the framework categories contain a single, separate factor, and the newly designed category of organizational infrastructure contains three enabling factors. The final category, management capabilities, was not derived from Hess and Barthel (2017); it was introduced based on strategic embeddedness and digital leadership, as both enabling factors refer exclusively to strategic managerial tasks and responsibilities. While workforce capability focuses on the (human) individual's capabilities, management capabilities summarize more abstract managerial capabilities within an organization's administration. Thereby, management capabilities may semantically relate to the construct of dynamic capabilities (Helfat & Peteraf, 2009).

We then evaluated the developed framework through the use of seven semi-structured expert interviews, and our focus was primarily on deriving possible modifications. Interviewee selection criteria included several years of managerial experience or strategic consulting expertise in one or more DT programs.

Interviews were divided into four phases. The first phase provided information, introducing the interviewee to the key definitions and the general process of the interview. The second phase acquired general information about the current role of the interviewee and the status of their respective DT programs. This was followed by asking the interviewee to detail a complete list of enabling factors for DT programs based on his or her opinion and experience. The list was documented by the interviewer and checked with the interviewee to ensure its completeness. To avoid bias, the interviewees did not have access to the proposed framework before the completion of this phase. In the third phase, the proposed framework was presented and explained in detail to the interviewee. In the fourth phase, each factor previously proposed by the interviewee was analyzed for its suitability within the presented framework. To avoid false categorizations based on misunderstandings between the author and the interviewee, a factor was accommodated within the framework only if both parties agreed on the correctness of the proposed categorization. The interviewee was then asked to propose alterations of the framework (additional factors or additional categories) to accommodate any previously non-categorizable factors. This final interview phase finished with the interviewee describing perceived differences in the importance of the categories presented within the framework. Table 1 provides an overview of the interviewed experts. Table 2 provides data on how often the various factors in the proposed framework were referenced within the interviews without imparting knowledge of the proposed framework.

<b>Table 1 – Digital Transformation Expert Interviewees</b>		
<b>#</b>	<b>Position and Relevant Experience</b>	<b>Current Task Concerning DT</b>
A	Member of DT department within a multinational group from the technology manufacturing sector	Finding measurements to identify the overall success of past initiatives
B	Head of DT in a multinational group active in the telecommunications, transportation, and ICT sectors	Making strategic use of innovation capabilities
C	CEO of an IT consulting group active in strategic IT consulting	Digitalizing the value creation chain

#	Position and Relevant Experience	Current Task Concerning DT
D	Product manager for a highly digitized product line for a small- to medium-sized enterprise providing hygiene solutions	Establishing a stable digitalized product line and ensuring continuous transformational activities
E	CEO of a corporation active within the telecommunications sector	Managing transformational activities from conceptualization to pre-launch
F	CEO of a small- to medium-sized software business and former senior consultant managing DT initiatives	Connecting IT infrastructure with partners and fostering integration and homogeneity of internal IT infrastructure
G	Recently hired CEO of an IT consulting agency focusing on IT acquisitions and former IT strategy consultant	Rebuilding a digital agency after a recent restructuring

#	Enabling Factor	1	2	3	4	5	6	7
1	Individual Creativity and Innovation Capabilities	X	X	X	X		X	X
2	ICT Literacy	X	X	X	X	X	X	X
3	Innovative Organizational Culture		X	X	X	X	X	X
4	Internal and External Collaboration	X	X		X	X		X
5	Digital Platform Infrastructures	X	X	X		X	X	
6	IT Agility			X	X			X
7	Institutionalized Innovation Processes			X	X			X
8	Strategic Embeddedness		X	X		X		X
9	Digital Leadership	X	X	X	X	X	X	X

As discussed in more detail below, three findings in Table 2 suggest that the validity and integrity of the proposed framework can be derived from the results: First, all factors derived from the literature were also perceived as relevant by multiple practitioners working within the DT field; second, no practitioner presented a list of factors that did not contain at least one factor within each category of the proposed framework; in other words, each practitioner referenced each category at least once within his or her unbiased list of factors, and third, the experts referenced some factors more frequently than others. Table 3 gives an overview of relevant metadata obtained during the empirical evaluation phase of the framework. This metadata focuses on the integration of factors into the framework; it describes the number of factors for each interview that could not be integrated into the framework, and the number of multiple relations describes how often a single factor listed by an expert was represented by more than one factor of the proposed framework.

Expert Observations	A	B	C	D	E	F	G
Number of Non-Integrable Factors	1	1	1	2	1	0	0
Number of Multiple Relations	3	0	4	4	1	1	1
Perceived Difference in Importance P = Priority 1=Management Capabilities 2=Workforce Capabilities 3=Organizational Values 4=Organizational Infrastructure	1 > 3 4 > 2	-	1 > 2 2 > 3 & 4	-	1 > 2, 3, & 4 2 > 4 3 > 2 & 4	-	-

The results displayed in Table 3 allowed for the deduction of three additional findings concerning the evaluation: First, five out of the seven interviewees described at least one factor that was not integrable within the developed framework; second, six out of the seven interviewees described factors that, while represented in the framework, were not represented within a single factor but rather within more than one of the enabling factors, and third, only three interviewees understood the different categories presented as a means of ranking the differing importance of factors relative to enabling DT programs. Furthermore, as a non-structured feedback, experts were aware of interrelations among the factors spanning a complex system of relations. Due to its complexity, this system could not be properly derived within the interview setting.

Table 4 is an overview of changes to the framework proposed by the interviewed experts. The experts demanded no additional categories, so the proposed changes were limited to additional factors that were seen as underrepresented in the proposed framework. The first column shows the proposed new factors and the individual categories. The latter columns document interviewee references to specific factors during individual interviews.

Table 4 – Enabling Factor Categories by Experts							
Category	A	B	C	D	E	F	G
Management Capability/Forming Strategic Alliances	X						
Management Capabilities/Strategic Customer Focus				X			
Organizational Infrastructure/Bimodal Organization		X		X	X		
Organizational infrastructure/Organizational Agility			X				

Two findings may be deduced from the results presented in Table 4: No alteration to the proposed categories structuring the presented enabling factors was offered during the interviews, and five of the interviewed experts proposed four alterations to the initial framework in the form of additional factors.

### Framework Redesign and Evaluation (Step Two)

The second iteration in our DSR process was deemed necessary after evaluating the results of our first framework, participating in discussions among IS scientists, and the recent publication of Vial’s (2019) broad and holistic DT literature review. To revise our framework, we decided to take three actions:

- Rework the identified set of enabling factors based on new insights from the literature and the evaluated results of the initial framework application,
- Define, refine, and analyze the categories and their respective relationships within the revised framework, and
- Evaluate the enabling factors, categories, and efficacy of the revised framework.

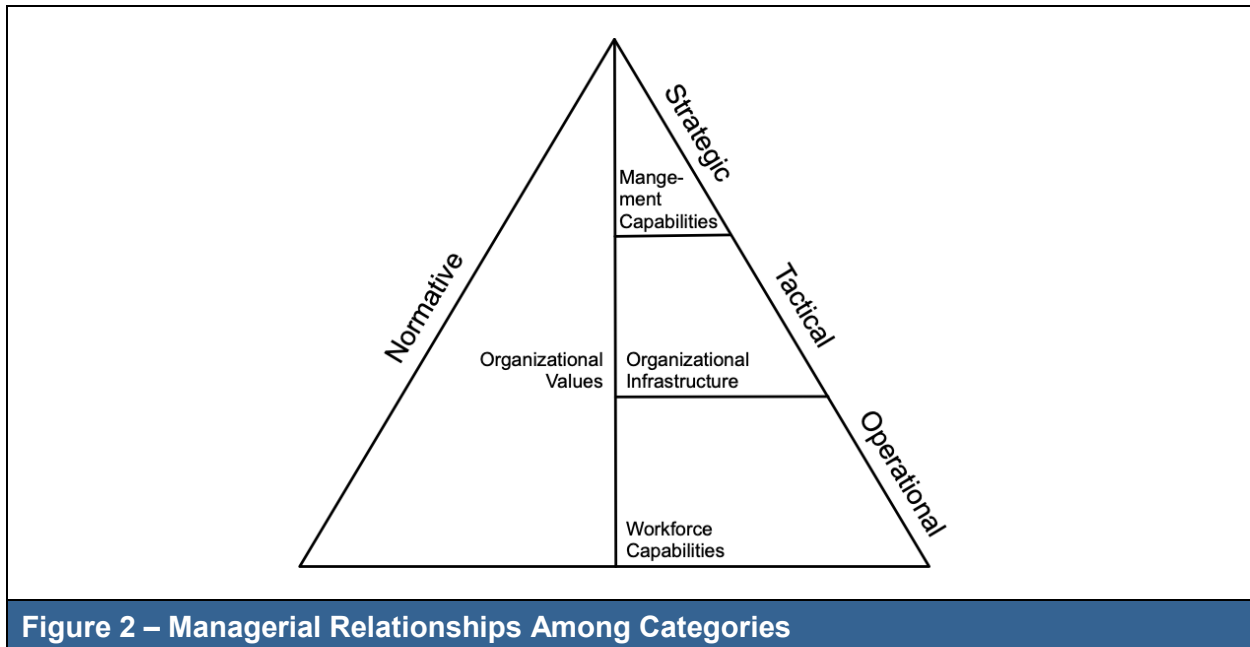
To this end, we first conducted an in-depth analysis of the 59 works identified by Vial (2019) that contained relevant information on structural changes required for DT. New insights on enabling factors were applied, and the set of existing enabling factors was refined. This process led to a new set of nine enabling factors. Six factors received only minor semantic updates from the originally proposed factors for better definition and delineation as neither our analyses of the additional literature nor the results of our initial evaluation phase indicated any shortcoming in our understanding and application of these factors.

Three of the initial enabling factors changed more significantly based on the results of our first evaluation phase and the application of our new insights from our analyses based on recent literature. First, “IT agility” was updated to “bimodal IT structures.” In our initial evaluation, experts indicated that achieving agility is not enough to successfully implement DT programs, and they pointed out the necessity of achieving bimodality. The expert input was supported by recent literature which also indicates the increased relevance of bimodal IT structures in DT development (Badr, 2018; Haffke et al., 2017; Horlach et al., 2017). Second, our conceptualization of digital platform infrastructures changed to accommodate the concept of an operational backbone, as presented by Sebastian et al. (2017). Third, strategic embeddedness was further developed as an enabling factor; during our initial evaluation, the experts indicated that increased focus by an organization’s leadership on external parties, such as partner organizations or customers, was a relevant enabling factor. DT strategy building research further supports this argument.

The resulting set of nine factors was again organized into a framework using the established categories. This revised framework was presented (demonstrated) to a team of four additional experts for a second round of application and evaluation.

This second evaluation was a two-part process consisting of both expert interviewees and a focus group. The expert team consisted of a CIO responsible for DT in a metalworking company, a project portfolio manager of an IS department responsible for holistic prioritizing, planning, and digitalization of IS projects, and two IS scientists. As proposed by Gregor and Hevner (2013), for the first part of the evaluation, the framework was sent to the experts for an assessment of its validity, utility, quality, and efficacy using the selected factors. These factors were then discussed in an interview setting, and additional changes to the framework were derived therefrom. All of enabling factors were confirmed in the second evaluation, and no additional factors were mentioned; feedback from the experts focused on the categories and their relationships.

While the evaluation of categories in the first design focused on the (relative) importance of individual categories, the newly formed focus group mentioned target relationships and implicitly occurring structures. The focus group mainly consisted of persons with a strong managerial background, so the participants identified similarities and counterparts to common management-layer frameworks. According to their expertise, the four categories and underlying factors are strongly associated with normative, strategic, tactical, and operational management layer logic, and this is confirmed by common management and IS management literature (Davis, 1979; Heinrich et al., 2014; Rüegg-Stürm & Grand, 2017). Managerial decisions on strategic goals and measures on the strategic layer are to be structured (e.g. in projects and programs) and managed on the tactical layer and implemented on the operational layer. The normative layer, usually derived from companies’ vision and mission, defines (managerial) values and culture for all actions on all of the layers. The association of factors to managerial layers indicates interrelations and connections among the factors and categories. This resulted in a redesign of categories as visualized in Figure 2.



**Figure 2 – Managerial Relationships Among Categories**

This structure was then incorporated into the initial framework to generate a revised framework, and the results are presented in the following section.

## Results

The reported results are structured as follows: First, the evaluated enabling factors are described in detail, and second, the revised DT enabling factor framework is presented.

### *Factors Enabling Digital Transformation*

As part of the second step in our two-step DSR process, the following nine enabling factors were presented:

- Innovative organizational culture,
- Internal and external collaboration,
- Strategic embeddedness,
- Digital leadership,
- Digital platform infrastructures,
- Bimodal IT structures,
- Institutionalized innovation processes,
- Individual creativity and innovation capabilities, and
- ICT literacy.

## **Innovative Organizational Culture**

A variety of literature on DT describes organizational culture as a key precondition for successful transformation (Holotiuk & Beimborn, 2017; Kane et al., 2015; Mueller & Renken, 2017). In addition to research on characteristics and values constituting a general innovative organizational culture (Khazanchi et al., 2007; Martins & Terblanche, 2003), we identified values particularly relevant for organizations facing the challenges of DT (Dürr et al., 2018; Hartl & Hess, 2017). Naturally, these relevant values described in the respective concepts showed minor deviations due to different levels of abstraction. The set of organizational values described by Hartl and Hess (2017) includes the values identified as relevant by the other authors shown. Based on the Hartl and Hess (2017) results, an innovative organizational culture can be described as a company culture that fosters innovation, creativity, and an entrepreneurial mindset. An innovative company cultivates organizational values in its employees such as openness to change, agility, and tolerance of failure, willingness to learn, participation, trust, risk affinity, entrepreneurship, innovation, cooperation, communication, and a customer-centric focus.

## **Internal and External Collaboration**

Works describing the values in organizational cultures beyond innovation already identify collaboration as another important value (Martins & Terblanche, 2003). We identified two distinct perspectives in the literature stressing the importance of collaboration for DT: The first perspective is focused on collaborating within an organization, i.e. internal collaboration; the second focuses on collaboration between an organization and elements outside of that organization, i.e. perspective, external collaboration.

Fostering internal collaboration has been shown to enable organizations to better combine different viewpoints, experiences, and areas of expertise to identify and unlock the opportunities arising from new digital technology (Mueller & Renken, 2017). Literature on the value of organizational collaboration systems further specifically highlights the importance of internal collaboration as an enabler for DT (Dery et al., 2017).

The literature on DT gives examples of external cooperation and collaboration with various actors outside the company that positively influence DT initiatives; for example, Islam et al. (2017) described the positive effects of collaboration between incumbent firms and start-ups. Other studies indicate the importance of user/customer collaboration for the success of DT programs (Leipzig et al., 2017; Tiefenbacher & Olbrich, 2016). While specific external actors differ based on the organizational contexts, the literature documents the need to include external partners within organizational innovation processes (Dürr et al., 2018). This idea is closely connected with the paradigm of open innovation described by Chesbrough et al. (2006).

The enabling factor of internal and external collaboration is understood as a value structure within a company that fosters collaboration between its employees, independent of their specific roles and departments, and the inclusion of third parties within all steps of an innovation process.

## **Strategic Embeddedness**

Several authors describe different approaches toward handling the strategic dimension of DT. Researchers from the literature understand that a strategic approach is a necessary precondition for sustainable DT efforts (Bharadwaj et al., 2013; Matt et al., 2015). Bharadwaj et al. (2013) argue that general business strategies need to include specific digital business strategies that

represent a fusion between the traditional role of information technology and new, overarching business strategies.

Matt et al. (2015) identified this strategic viewpoint of the tasks that enable successful transformation as highly relevant in times of DT. We adopted (Matt et al., 2015) definition of DT strategy: a “blueprint that supports companies in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation.” While empirical research strongly indicates the importance of these types of strategies (Chanas, 2017; Chanas et al., 2019; Ross et al., 2016), research also provides insights on the specific characteristics of successful digital strategies. Mirroring the importance of internal and external collaboration as an organizational value, successful digital strategies are open to co-design by various internal actors employing bottom-up strategic approaches (Chanas, 2017). By embedding the value of external collaboration into strategizing approaches, DT can satisfy the requirements of external actors, such as customers and strategic partners (Sia et al., 2016).

The enabling factor of strategic embeddedness is understood as a set of collaborative strategizing processes resulting in an interwoven DBS while also governing the necessary transformational processes within the organization.

### **Digital Leadership**

Aside from discussing what values, techniques, and strategies organizations need to acquire to effectively exploit the possibilities of the DT trend, the scientific community frequently discusses how management structures and paradigms need to change to accommodate successful transformations. The literature describes various positions within a company that can be responsible for managing DT. While some sources suggest reframing the tasks and activities of the CIO (Gerth & Peppard, 2016), others suggest the creation of a new role, the CDO (Horlacher et al., 2016). While the need to integrate DT responsibilities within the C-Level is vital and well documented (Agarwal et al., 2011; Benlian & Haffke, 2016; A. M. Hansen et al., 2011; Horlacher et al., 2016), determining who should be in charge of DT is still disputed. Research clearly indicates a shared understanding of the importance of digital technology within the top management team is essential for successful DT initiatives, and several papers identify a lack of mutual understanding about its role within the leadership team as a main factor that hinders successful DT initiatives (Benlian & Haffke, 2016; Gerth & Peppard, 2016). A. M. Hansen et al. (2011) developed a framework that identifies the relevant dimensions for which mutual understanding within a leadership team is necessary. We utilized this framework within our own revised framework to describe the digital leadership enabling factor as having a management board that views digital technology as an asset, recognizes its strategic or turnaround orientation, and contains a member fulfilling the role of an IT orchestrator.

### **Bimodal IT Structures**

DT requires organizations to simultaneously identify and seize opportunities presented by digital technologies while continuing to operate with the existing organizational model. In this context, ensuring organizational flexibility has been identified as a key goal in times of DT (Dixon et al., 2017). Exploration and exploitation capabilities within an organization’s IT functions are pivotal preconditions for an agile organizational capable of effectively using current systems while embracing new ones (Lee et al., 2015; Tai et al., 2017). IT structures that enable this balance are often referred to as bimodal IT, and they have been identified as playing a vital role in an organization’s DT endeavors. Bimodal IT structures are considered enabling factors and are thus another precondition for successful DT (Badr, 2018; Haffke et al., 2017; Sebastian et al., 2017).

Various approaches to setting up bimodal IT structures have been identified (Haffke et al., 2017; Horlach et al., 2017), but the specific setup for an individual organization remains highly dependent on contextual factors.

We describe the bimodal IT enabling factor as structures that facilitate the IT function of providing and developing stable core infrastructure for the existing organizational model while simultaneously enabling the rapid exploration and implementation of innovative IT applications.

### ***Digital Platform Infrastructures***

Various authors present insights on the technological infrastructures required for enabling the DT of their respective organizations. Westerman et al. (2011) assert that the need for integrated and unified data and processes is the most fundamental technological precondition for DT, while Quaadgras et al. (2014) describe digital platforms representing IS that globally integrate a company's technological infrastructure, business processes, and data. These platforms provide links to external parties that are a key to maximizing the business value provided by digital technology. Such unique and highly integrated infrastructures are understood as enabling factors for DT; they are a prerequisite for companies to follow certain digital strategies and paths (Kohli & Johnson, 2011; Ross et al., 2016; Westerman et al., 2011). Furthermore, these infrastructures provide the technological base of an organization's operational backbone, i.e. its capability to ensure core operations are efficient, scalable, reliable, high quality, and predictable (Sebastian et al., 2017).

The enabling factor of digital platform infrastructures is understood as an integrated IT and/or IS infrastructure following an investment into digital technology and data infrastructures, digitized business processes, and electronic links to external parties; when satisfied, this factor enables the efficient, scalable, reliable, high quality, and predictable execution of core organizational operations through DT.

### ***Institutionalized Innovation Processes***

Various DT approaches require organizations to focus on creativity and innovation to generate new ideas at various organizational levels, yet such ideas must also be evaluated, prioritized, and orchestrated to enable a sustainable and holistic DT (Berghaus & Back, 2016). These two tasks require different value profiles to be enacted within the structure of an organization; flexibility value profiles represent values such as creativity, individual empowerment, and change, while control values are described as encouraging efficiency, productivity, stability, and structure (Khazanchi et al., 2007). Organizations embracing DT must provide a set of processes that enable creativity and innovation within certain aspects of an organization while ensuring efficiency and structure in the process of implementing those ideas (Kohli & Melville, 2009; Ross et al., 2016; Sebastian et al., 2017). The set of processes naturally depends on the organizational setting as well as the organization's specific approach to DT (Berghaus & Back, 2016).

The enabling factor of institutionalized innovation processes is, therefore, described as a set of systematic processes aligned within the individual organizational setting to impose structural value profiles encouraging efficiency, productivity, stability, and structure over an organization's innovation environment, which is generally based on flexibility value profiles such as creativity, individual empowerment, and change.

## ***Individual Creativity and Innovation Capabilities***

Various case studies indicate the importance of individual creativity and innovation capabilities. In a case study of the German newspaper industry, Rothmann and Koch (2014), identify creativity within the workforce as a central precondition for the successful identification of novel, digital technology-driven business opportunities, and this is consistent with another case study on the digitalization journey of the LEGO group in Denmark (El Sawy et al., 2016). Fostering creative and innovative capabilities throughout the corporate workforce enabled the LEGO group to decentralize their creative and innovative efforts and manage the possibilities that resulted from technological change. While these authors identify these capabilities as necessities within the workforce, other works focus on identifying measures organizations can take to foster capabilities within their workforce to enable DT. Both approaches illustrate the importance of the creativity and innovation within an organization embracing DT (Dery et al., 2017; Mueller & Renken, 2017).

For purposes of this paper, the description of individual creativity and innovation capabilities as an enabling factor is based on the skillset defined by Binkley et al. (2012) and defined as an individual's capability to think creatively, work creatively with others, and implement innovations.

## ***ICT Literacy***

The requests for “digitally savvy staff” (Kane et al., 2015), “technical talent” (Brown et al., 2013), and “digital generalists” (El Sawy et al., 2016) contained within the literature support the intuitive assumption that the digital technology skills of individuals within the organization are crucial to successful DT initiatives. Recent reviews show there is a lack of research identifying specifically relevant individual capabilities for DT (Murawski & Bick, 2017); however, the field of educational studies attempted to conceptualize individual capabilities in relation to digital technologies, and the result was the concept of information and communication technology literacy. ICT literacy was used to link the weakly formulated demands found in DT literature to pre-defined knowledge and a particular skillset. While cognitive proficiency refers to foundational skills such as general literacy, numeracy, problem-solving, and spatial and visual literacy, the concept of technical proficiency describes knowledge of the elements of digital technology, hardware, software applications, and networks. The resulting combined skillset is defined as ICT literacy.

ICT literacy allows individuals to maximize the capabilities of digital technology (Educational Testing Service, 2002). For purposes of this paper, the definition of the term is based on the definition generated by the ICT literacy panel: The ability to use “digital technology, communications tools, and/or networks to access, manage, integrate, evaluate and create information in order to function in a knowledge society and to at its highest level enable innovation, individual transformation, and societal change.”

### Digital Transformation Enabling Factor Framework

Table 5 shows the re-designed and re-evaluated DT enabling framework. The nine enabling factors are divided among four categories (organizational values, management capabilities, organizational infrastructure, and workforce capabilities) and on four managerial layers (normative, strategic, tactical, operational).

Table 5 – Digital Transformation Enabling Framework			
Layer	Category	Enabling Factor	Short Description
Normative	Organizational Values	Innovative organizational culture	A company culture that fosters innovation, creativity, and an entrepreneurial mindset in its employees by cultivating openness toward change, agility, tolerance of failure, willingness to learn, participation, trust, risk affinity, entrepreneurship, innovation, cooperation, communication, innovation, and customer-centricity as central organizational values.
		Internal and external collaboration	A value structure within a company that fosters cooperation and problem-solving between its employees, independent of their specific roles and departments. It also fosters the inclusion of third parties within all steps of an innovation process following the paradigm of open innovation.
Strategic	Management Capabilities	Strategic embeddedness	A set of collaborative strategizing processes resulting in an interwoven DBS which also governs the necessary transformational processes within the organization.
		Digital leadership	A management board which includes a member, fulfilling the role of IT orchestrator that has reached a mutual accord to view digital technology as an asset and recognize its strategic or turnaround orientation.
Tactical	Organizational Infrastructure	Digital platform infrastructures	An integrated infrastructure created by investment in digital technology and data infrastructures, digitized business processes, and electronic linkages to external parties that enables efficiency, scalability, reliability, high quality, and the predictable execution of core organizational operations.
		Bimodal IT structures	Infrastructures that enable the IT function to develop and maintain stable core infrastructures by exploiting the existing organizational model while simultaneously enabling the rapid exploration and implementation of innovative uses of digital technology.
		Institutionalized innovation processes	A set of systematic processes aligned with the individual organizational setting that imposes structural value profiles encouraging efficiency, productivity, stability, and structure on an

			organization's innovation environment that is generally based on flexibility value profiles such as creativity, individual empowerment, and change.
Operational	Workforce Capabilities	Individual creativity and innovation capabilities	An individual's capability to think creatively, work creatively with others, and implement innovations.
		ICT literacy	An individual's capability for using digital technology, communications tools, and networks to access, manage, integrate, evaluate, and create information to function in a knowledge society, and at its highest level, enable innovation, individual transformation, and societal change.

## Discussion

Both iterations of the framework design and evaluation indicate that the enabling factors derived from the literature and integrated within the proposed framework are perceived by experts as being highly relevant to the success of DT programs. Furthermore, experts underscore the validity of the categories structuring the enabling factors within the framework. Experts differ on the level of significance attached to the different factors; this may be rooted in the varying effects or influences the factors have on different transformation programs, or it could be attributed to a difference in scope within the defined enabling factors. While factors like bimodal IT or institutionalized transformation processes have a rather limited scope, ICT literacy and digital leadership have a broader scope, and therefore, accumulate a more diverse set of underlying phenomena. Although the reason for the different levels of significance for the different factors cannot be definitively answered within this paper, the empirical data shown in Tables 2 through 4 clearly indicate the validity of the categories and enabling factors defined in the final proposed framework. After the first iteration, the newly proposed factors clearly showed that experts not sufficiently inclusive of all the enabling factors observed the first version of the proposed framework. For the revised framework, four additional factors were proposed through empirical input. After refining them, integrating them into the second iteration of the framework, and evaluating them with expert and focus group input, no additional factors were identified. This underscores the validity of framework's final nine factors and four categories.

Although evaluation of the framework shows a high number of multiple relations between factors, this finding does not challenge the general validity of the defined factors; rather, it indicates there are different conceptualizations of the enabling factors between the proposed framework and the interviewed experts, and the second evaluation indicated no need to change the relations. The empirical findings of a difference in the importance of the described categories as shown can be considered inconclusive, as there is no recognizable pattern within the answers given by the experts in the first evaluation. The second evaluation showed the way forward by associating categories to managerial levels, as this does not indicate "importance" but rather reflects structure and hierarchy. The question remains whether any single factor is more important than some other or others. For example, digital leadership could have a greater effect than ICT literacy or individual creativity. Or, on the one hand, strategic capabilities can doubtlessly have a greater effect on a company's long-term evaluation of the enabling factors; on the other hand, companies' hierarchies are based on bottom-up service provisions and top-down directives within a fundamental understanding of a structured, yet symbiotic relationship. The impact and importance

of certain factors may vary by industry, branch, or market, as, for example, innovative organizational culture could be more significant for companies participating in innovative or highly competitive markets. The findings of this study do not, however, indicate any significant differences, even though the expert interviewees' companies varied considerably in size, industry, branch, and market (behavior). Neither does the literature suggest differences: Even though we focused on different branches (Chaniias, 2017; Karagiannaki et al., 2017), the identified enabling factors appear to be consistent, and this has also been seen in cross-industry studies (Holotiuk & Beimborn, 2017).

Interestingly, the enabling factors seem to be not only related but also connected. The indirect connection of factors due to their connected categories (and management layers) is obvious. Furthermore, analogous factors may be connected or arranged from the top down as digital leadership may lead to institutionalized innovation processes, which again may support or foster individual creativity and innovation capabilities.

Above all, an innovative organizational culture may be the root node, as it accommodates even bottom-up connections; general ICT literacy may lead to institutionalized bimodal IT structures and digital platform infrastructures, which may then lead to strategic embeddedness, as suggested by theories on bottom-up strategy building (Chaniias et al., 2019). Hartl and Hess (2017) stated – based on the Delphi method – that normative factors such as cultural values seem to be crucial for DT initiatives. This assumption is strongly supported by our empirical studies, as in both the top-down category and the factor structure, organizational values are of normative impact. Similarly, the overall importance of and dependency on leadership (Agarwal et al., 2011) may also be of strategic importance within the framework.

## Conclusion

The initial motivation for this DSR project, as shown in Step One, was to foster insights on which underlying DT program enabling factors exist within organizations to foster or impede successful transformations. An initial framework structuring nine enabling factors into four categories was constructed. This framework was then evaluated through seven, semi-structured interviews with organizational experts, and the experts assessed the applicability of the framework to the enabling factors. The empirical data showed the validity of the enabling factors and categories described within the initial framework. In addition to indicating the general validity of the framework, empirical data also showed the limitations of the developed framework, as not all enabling factors described by experts were represented (Muehlburger et al., 2019).

The evaluation results from the first iteration of the framework, a recent literature review, and a scientific discussion about the limitations of the framework led to a second iteration of design followed by an evaluation. The revision of the framework was organized around three tasks: rework the identified set of enabling factors based on new insights from the literature and the evaluation results from the first iteration, define and analyze categories and their relationships, and evaluate the revised factors, categories, and structures. The resulting revised framework still consists of nine enabling factors, newly defined, and organized around four categories. The categories were then structured to make the framework more applicable in practice and more scientifically rigorous. The revised framework may yet be combined with managerial frameworks such as information management models (Riedl et al., 2017) to strengthen its organizational and scientific anchoring.

In detail, the proposed framework's contribution to organizational practice and science is represented by its holistic approach to categories that structure the set of DT enabling factors. The framework provides new insights into the necessary preconditions that organizations need to foster to successfully implement DT. Through the defined categories, practitioners can plan and act based on a holistic representation, thereby reducing the complexity of implementing DT. Besides the practical benefits provided by this framework to practitioners, it also provides two benefits to the scientific community: The enabling factors described within the framework represent a cohesive summary of the literature's current state of knowledge on DT enabling factors, and the categories described within the framework allow for a more structured research approach to organizational characteristics that foster successful DT with a strong connection to information management models.

To the best of our knowledge, the current framework gives a comprehensive overview of the enabling factors; future work could repetitively identify and integrate new enabling factors within the evaluated framework. Furthermore, research on the interrelations among the factors and categories on a semantic level is of interest. This may further clarify the frameworks underlying system and can be focus of an upcoming iteration in DSR.

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