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# Mastering the digital transformation through organizational capabilities: A conceptual framework

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ABSTRACT

As digital transformation is changing entire industries, organizations are struggling to keep up with these changes. Scholars are viewing organizational capabilities as a central mean for organizations to master digital transformation. Based on a comprehensive literature review, this study identifies a broad set of relevant organizational capabilities and introduces a conceptual framework in which organizational capabilities are clustered into seven relevant themes for managing digital transformation. These capabilities are then embedded in the logic of the dynamic capability theory, highlighting the development of organizational capabilities throughout the digital transformation process. The results reveal that a differentiated perspective on the digital transformation process is beneficial to account for changing needs of organizational capabilities during the transformation process. Just as organizations themselves change during the process, various capabilities at different time points are needed to support and enable organizations during digital transformation. The developed conceptual framework gives organizations guidance for the development of organizational capabilities throughout the digital transformation process.

## 1. Introduction

Digital technologies have transformed entire industries and created challenges for numerous traditional business models (Lansiti & Lakhani, 2014). Established organizations that neglected the transformative power of digital technologies were dared by innovative digital start-ups, lost their competitiveness or were driven out of business (Downes & Nunes, 2013; Hess, Matt, Benlian, & Wiesböck, 2016). For others, which have willingly embraced digital technologies, novel market opportunities have emerged and so far, unsolved problems have come within reach to be solved. The far-reaching disruptive power of digital technologies has created the mantra that spotting disruptive new technologies and finding beneficial ways to employ them is imperative for corporate survival. O'Reilly and Tushman turn to the underlying question of this mantra by asking: "How do organizations survive in the face of change?" (O'Reilly & Tushman, 2008, p. 185) and emphasize that organizations can create performance differences by learning and adjusting their existing business models to a changing (digital) world.

However, digital transformation goes beyond digital technologies (Henriette, Feki, & Boughzala, 2015) and – as socio-technical systems theory informs us – affects employees, structures, tasks and organizational procedures alike. Therefore digital transformation needs to be understood as a "holistic socio-technical challenge" (Schnasse, Menzefricke, & Dumitrescu, 2021, p. 160) that has drastic consequences for economies, societies, organizations, and individuals. This viewpoint suggests that the competitiveness of companies does not exclusively depend on integrating the latest technologies but also depends on how well companies address additional fields like the interactions with customers and partners (Loebbecke & Picot, 2015; Shaikh, Karjaluoto, & Chinje, 2015), the adjustment of organizational routines, and the creation of an appropriate organizational culture (Goran, LaBerge, & Srinivasan, 2017; Schuchmann & Seufert, 2015).

The dynamic capabilities theory provides a valuable answer to O'Reilly and Tushman's central question as it argues that the key to succeed in a disruptive (digital) world is rooted in organizations' abilities to sense changes in the environment, to seize upcoming opportunities, and to adapt, integrate, and reconfigure the current resource base (Helfat et al., 2009; Teece, 2007; Teece, Pisano, & Shuen, 1997). These abilities have been named dynamic capabilities by the strategic management literature and are considered as the central mean for organizations to cope with new digital realities (Eisenhardt & Martin, 2000; Peteraf, Di Stefano, & Verona, 2013; Teece et al., 1997).

Due to their importance, literature has created various definitions of dynamic capabilities (see e.g. Eisenhardt and Martin (2000), Helfat and Peteraf (2003), Teece et al. (1997), Zollo and Winter (2002)). Central to all definitions is that in its highest order, dynamic capabilities can be categorized as sensing, seizing, and transforming activities (Teece, 2018),

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which refer to the identification of technological opportunities in the external environment (sensing), the mobilization of a company's own resources to exploit these opportunities (seizing), and the continuous renewal of the organization by adapting, reconfiguring, and renewing the current resource base (transforming) (Albort-Morant, Leal-Rodríguez, Fernández-Rodríguez, & Ariza-Montes, 2018). Various empirical studies reveal positive effects of dynamic capabilities on competitive advantages of organizations, in particular when confronted with dynamic environments (Døving & Gooderham, 2008; Drnevich & Kriauciunas, 2011; Li & Liu, 2014). As a result, dynamic capabilities have been considered as a useful lens to understand and explain competitive advantages among firms engaged in the digital transformation (Nadkarni & Prügl, 2021; Soluk & Kammerlander, 2021; Vial, 2019). For instance, Soluk and Kammerlander state that dynamic capabilities can "faithfully reflect and guide firms' digital transformation processes" (Soluk and Kammerlander, 2021, p. 6). In this matter, the authors refer to a stream of research that breaks down the concept of dynamic capabilities into "hierarchies of capabilities" (Ambrosini, Bowman, & Collier, 2009, p. 10) with abstract dynamic capabilities at the top and a larger set of organizational capabilities at the bottom (Ambrosini et al., 2009; Collis, 1994; Danneels, 2002; Winter, 2003; Zahra, Sapienza, & Davidsson, 2006) which are crucial for managing digital transformation (Matt, Hess, & Benlian, 2015; Morakanyane, Grace, & O'Reilly, 2017).[1] A large body of the existing literature identifies necessary organizational capabilities for digital transformation, like big data analytics capabilities (Hausladen & Zipf, 2018; Nadkarni & Prügl, 2021), however, without differentiating what kind of organizational capabilities are needed at which point in time during the transformative process (e.g. Nadeem, Abedin, Cerpa, and Chew (2018), Henriette et al. (2015)).

However, recent discussions on digital transformation recognize that digital transformation is a process consisting of various stages (Nwankpa & Roumani, 2016; Soluk & Kammerlander, 2021; Zaoui & Souissi, 2020), and call for a process-oriented perspective (Soluk & Kammerlander, 2021) as existing literature still falls comparably short on examining the role and development of organizational capabilities in those stages of the digital transformation process (Forstner, Kamprath, & Röglinger, 2014; Warner & Wäger, 2019). Notable exceptions are the studies of Fischer, Gebauer, Gregory, Ren, and Fleisch (2010), Jenkins (2010), and Soluk and Kammerlander (2021) that investigate the development of capabilities and their contribution to growth in the capital goods sector, motorsport industry, and in the context of family-owned SMEs respectively. These studies implicitly connect the digital transformation process with dynamic capabilities by describing the digital transformation process as a sequence of sensing changes, seizing opportunities and transforming the resource base. In this matter, Warner and Wäger (2019) describe digital transformation as a process of building dynamic capabilities for the ongoing strategic renewal of organizations. However, these studies indicate a need for a more sophisticated conceptual framework of organizational capabilities by taking different stages of the transformative process into account (Konlechner, Müller, & Güttel, 2018; Vial, 2019). Referring to this, Schilke et al. outline that significant research opportunities "to more carefully unpack individual stages" (Schilke, Hu and Helfat, 2018, p. 407), along with their sequencing and potentially reciprocal nature of capabilities exist and that a process-oriented approach may prove particularly useful for practitioners attempting to implement such capabilities.

Based on the outlined current state of literature, this study aims to fill important research gaps by identifying necessary organizational capabilities for digital transformation and exploring the importance of particular organizational capabilities for different phases of the digital transformation process. To do so, a systematic literature review was conducted and a process-oriented conceptual framework was developed that segments the digital transformation process into three stages based on the dynamic capability theory, thus taking the successive nature of strategic change into account. This conceptual approach seems reasonable as process-related empirical evidence on how organizations are digitally transformed and what organizational capabilities were decisive in each phase of the digital transformation process is largely missing (Warner & Wäger, 2019) and empirical studies of such a general concept are problematic (Schilke, Hu, & Helfat, 2018). Building on this differentiated view, this study contributes to this understanding by revealing a recommended sequence of organizational capability development as a function of a phase's necessities during digital transformation.

Thereby, this study can make several contributions. First, it highlights the importance of organizational capabilities as a function of the digital transformation process that organizations undergo. Second, it provides a more sophisticated and detailed view on organizational capabilities needed to master the digital transformation process. Third, it provides clear guidance for managers and decision makers on how to prioritize the development of the necessary organizational capabilities and therefore enriches the knowledge of organizational development in dynamic environments.

As a result, from a practical viewpoint, this study can serve as a tool for a capability development roadmap and provide guidance through description of practical actions required to develop, acquire, or access key capabilities at the right point in time. This way, its focus on capabilities can help to steer strategic leadership efforts (Nadkarni & Prügl, 2021) and strategic human resource development (Garavan, Shanahan, Carbery, & Watson, 2016) to achieve competitive advantages.

From a theoretical viewpoint, the study adds value by creating a process-oriented conceptual model that outlines the importance of a broad set of organizational capabilities according to different phases of the digital transformation process. Thereby, the study enriches past research on organizational capabilities for digital transformation and the emergent field of digital capabilities by incorporating elements of the social subsystem of organizations (digital leadership, digital strategy, digital organizational culture) and thus overcomes the current technological focus.

The remainder of the study is structured as follows: First, the concept of organizational capabilities and their relationship to dynamic capabilities is introduced. Second, a literature review was carried out to identify existing categorizations of capabilities for digital transformation. Third, the identified capabilities were embedded into a model that allows to account for a capability development perspective. Fourth, the results are presented by describing the main characteristics of the developed structuring model for organizational capabilities for digital transformation and its importance during the digital transformation process by applying dynamic capability theory (Teece, 2007; Teece, Pisano, & Shuen, 1997). Finally, the findings are discussed and implications for a purposeful development of organizational capabilities in times of digital transformation are provided.

## 2. Theoretical background

### 2.1. Dynamic capabilities as a view for generating competitive advantages

The challenges firms face in the area of digital transformation raise the question of what causes performance differences among firms in competitive environments (Schilke et al., 2018). The dynamic capability theory puts dynamic capabilities in the center of attention. They allow organizations to systematically generate and modify their organizational capabilities (Zollo & Winter, 1999) to gain long-term competitive advantages (Cavusgil, Seggie, & Talay, 2007).

Dynamic capabilities allow organizations to "address rapidly changing environments" (Teece et al., 1997, p. 516), hereby guiding them through the digital transformation process (Battleson, West, Kim, Ramesh, & Robinson, 2016; Yoo, Boland, Lyytinen, & Majchrzak, 2012). As shown by empirical studies, organizations fostering dynamic capabilities "hold

[1] In this study, the term „organizational capabilities"is used to describe capabilities that are comparable to what Teece (2014, p. 330) calls "ordinary capabilities". Schilke (2014, p. 369) and Zahra et al. (2006, p. 918) refer to the term "substantive capabilities". Consistent with Karimi and Walter (2015), this study argues that organizational capabilities are necessary in everyday business routines to develop dynamic capabilities. Following Helfat and Peteraf (2003), this study defines organizational capabilities as the collective skills, abilities and expertise of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result.

the potential for a sustained competitive advantage, especially in a turbulent environment" (Breznik & Lahovnik, 2016, p. 182).

### 2.2. The relationship between dynamic capabilities and organizational capabilities

Helfat and Peteraf define organizational capabilities as "the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result" (Helfat and Peteraf, 2003, p. 999). These organizational capabilities are combinations of the resources that are available, owned, or controlled by the firm (Amit & Schoemaker, 1993) as well as routines learned through repeated patterns of behavior (Feldman, 2000; Nelson, 1982; Zollo & Winter, 2002). Organizational capabilities vary among firms, thus allowing some firms to perform static, dynamic, or creative activities in a more effective manner than their competitors (Collis, 1994).

In the academic literature, there is a consensus that dynamic capabilities are based on organizational capabilities (Eisenhardt & Martin, 2000; Helfat et al., 2009; Teece et al., 1997; Winter, 2003; Zollo & Winter, 1999) and cannot originate from a purely formal learning process (Nayak, Chia, & Canales, 2020). For instance, Wilden, Gudergan, Nielsen, and Lings (2013) indicate that dynamic capabilities influence performance through specific organizational capabilities. Moreover, the connection of dynamic and organizational capabilities is also reflected in hierarchical typologies developed by various scholars with abstract dynamic capabilities at the top and a larger set of organizational capabilities at the bottom (Ambrosini et al., 2009; Collis, 1994; Danneels, 2002; Winter, 2003; Zahra et al., 2006). In this matter, Schilke et al. outline that dynamic capabilities consist of a set of organizational capabilities "that can effect change in the firm's existing resource bases (and the associated support system such as the firm's organizational and governance structure), its ecosystem and external environment, as well as its strategy" (Schilke, Hu and Helfat, 2018, p. 393).

### 2.3. Three mechanism of dynamic capabilities

At its highest order, according to Teece (2007, 2014), dynamic capabilities can be structured into three distinct mechanisms: sensing, seizing, and transforming capabilities. He describes the first mechanism, sensing capabilities, as the ability of internalized analytical systems to detect changes, in internal or external structures, that could pose threats or offer opportunities for existing or new business models (Teece, 2007).

Based on these insights, sensing capabilities allow the organization to develop, co-develop, and assess technological opportunities in relationship to customer needs (Teece, 2014). According to Teece (2018), the sensing mechanism identifies customers with unmet needs and develops technological opportunities. The required capabilities are therefore threefold. Before directing innovation efforts, organizations have to identify target market segments, customer needs, and they must be able to assess developments in the business ecosystem. Furthermore, organizations have to exploit internal innovations and to direct internal innovation processes. Accordingly, external sources for innovation must be tapped too, which are suppliers and complementors, exogenous science, and the engagement of customers in open innovation. (Teece, 2007, 2018).

Seizing capabilities refer to the ability to mobilize resources, to address needs and to exploit business opportunities in order to capture value and to mitigate risks for the own organization. Seizing capabilities give special attention to the value of partnerships, realign the boundaries of the enterprise, and integrate these concepts into the business model (Teece, 2007, 2014). Within this mechanism, the organization realigns the business model by designing value-capturing mechanisms, managing partnerships, designing cost structures, and selecting the composition of technologies and features to be "embedded in the product and service" (Teece, 2007, p. 1329). With the integration of external partners and sources of information the need for decision making protocols emerges. Organizations have to avoid decision errors and anti-cannibalization proclivities while removing non-value yielding assets and activities. All while recognizing inflexion points and complementaries as well as learning from mistakes. Also, the organization has to determine the boundaries in which it is operating. This includes decisions about the arrangement of alliances to develop capabilities as well as the management of integration, in- and outsourcing, and the value of co-specialization within the value network. All while protecting intellectual properties and designing an organizational culture for innovation (Teece, 2007, 2014).

The last building block, transforming capabilities, refers to the continuous recombination and reconfiguration of resources and structures under changing environments to support the business models (Teece, 2007). This mechanism highlights that organizations need to continuously renew their resource base. Via decentralization, decomposition, and co-specialization, organizations can strategically fit assets within the value network, e.g. by embracing open innovation. An effective governing of internal and external resources as well as the management of knowledge allows for an effective and continuous realignment of resources (Teece, 2007, 2014).

It is widely recognized that the sensing mechanism is followed by the seizing mechanism, which are both prerequisites for the transforming mechanism. This sequential order can be understood as a gradual process-oriented perspective (Teece, 2007). Rooted in the evidence that dynamic capabilities are a crucial mean for organizations in environments impacted by digital transformation, this study uses the three mechanisms sensing, seizing, and transforming (Teece, 2007, 2014) to theorize on the digital transformation process. Empirical studies (e.g. Breznik, Lahovnik, and Dimovski (2018), Tallon and Pinsonneault (2011), Ellonen, Janutunen, and Kuivalainen (2011), Wilhelm, Schlömer, and Maurer (2015)) or the theoretical works of Yeow, Soh, and Hansen (2018) and Matysiak, Rugman, and Bausch (2018) indicate that these mechanisms are essential to explain the development of competitive advantages. Following Warner and Wäger (2019) who describe digital transformation as a process of building dynamic capabilities for the ongoing strategic renewal of organizations, this study takes in a gradual process-oriented perspective on the sensing, seizing, and transforming mechanisms and argues that organizations rely on these mechanisms when coping with digital transformation.

In the following, the methodology of study is described, which comprises a comprehensive literature analysis.

## 3. Methodology

To develop a conceptual framework of organizational capabilities for digital transformation, a four-step approach was followed. First, a systematic literature review was conducted to collect a broad set of organizational capabilities that are relevant for organizations when dealing with digital transformation. Second, based on aggregated categories, seven selective themes of organizational capabilities for digital transformation were identified. Third, to develop a process-oriented framework, identified organizational capabilities were matched with Teece's (2007, 2014) three mechanisms of sensing, seizing, and transforming. Finally, the relative importance of the mechanisms for each theme was calculated.

### 3.1. A structured literature review to identify organizational capabilities for digital transformation

To identify organizational capabilities for digital transformation, a systematic literature review was performed by following the recommendations of Cooper (2015) and Fink (2019). The recommended steps are described in the following.

*Time horizon of selection of articles:* The year 2010 was set as the starting point because here, the emergence of digital technologies started the platform disruption of industries and, according to Reis, Amorim, Melão, and Matos (2018), the vast majority of high quality publications on digital transformation emerged only after 2010. The year 2020 set the endpoint to include the latest academic journal publications.

*Selection of databases:* In order to provide a comprehensive view on organizational capabilities in the interdisciplinary literature on digital

transformation, two well-established online databases were used as search tools: Web of Science (WoS) and EBSCOhost. WoS is one of the most popular multidisciplinary databases (Waltman, 2016) and with the large size of EBSCOhost (Gusenbauer, 2019) the combination of both databases ensures a sufficient coverage of the topic.

*Article identification:* To create a reproducible and transparent analysis, a systematic article selection process was applied. First, keywords were defined as search criteria in online databases. As this study aims to generate a broad and comprehensive picture of organizational capabilities for digital transformation more general search terms were chosen. To be more precise, the combined search terms "competenc*" or "skill*" or "capabilit*" and "organization*" in the full-text in both databases were used in order to ensure the identification of all relevant articles.[2]

While technologies are an essential part of the most accepted definitions for digital transformation, extensive reviews of definitions for digital transformation reveal the importance of other aspects such as the human factor and leadership (Gong & Ribiere, 2021; Vial, 2019).

Although this area of digital transformation isn't much focused on in current discussions (Verina & Titko, 2019), some researchers highlight the necessity of the human and cultural factors for a successful transformation (Del Rowe, 2017; Schwertner, 2017). This study's view on digital transformation is centered on a fundamental change in thinking and strategy (Rogers, 2016) which goes beyond functional or technological thinking (Singh & Hess, 2017). Because of the ambiguity of definitions for digital transformation in the specified time horizon, the inclusion of the term "digital transformation", or relating terms, was avoided in order to obtain results that fall into the area of interest but do not depend on being classified as for digital transformation by the authors.

*Article screening:* The following criteria were used to evaluate the results. An initial search on the subject revealed that there is a broad set of articles which only mentions a particular skill or competence or assesses capabilities from an individual's perspective. The study's objective is to provide a holistic view on capabilities for digital transformation, therefore, as a first inclusion criteria, the identified articles must have a clear and comprehensive view on organizational capabilities, aiming at providing a holistic overview of organizational capabilities. Second, to reach a wide variety of the academic literature, the results are not limited to a specific journal ranking to open up the possibility to take in more practical contributions to the subject, like conference papers. Third, the identified organizational capabilities must address the spectrum of digital transformation. Fourth, the articles must be written in English language. As a result, the articles must aim to provide a comprehensive overview of organizational capabilities for digital transformation. After eliminating duplicates, the titles and abstracts of 2992 articles were screened to judge the relevance of the articles regarding organizational capabilities for digital transformation. In this step, 2814 results were excluded. The main reason was the lack of indication of thematic coherence, e.g. no mentioning of capabilities on an organizational level but rather relating to individual-level competences, and no indication of the application of the concept of organizational capabilities in a digital transformation setting. Noteworthy, the literature search resulted in a large amount of results related to the medical-field, with no connection to digital transformation. Consequently these articles were excluded.

As recommended by Wolfswinkel, Furtmueller, and Wilderom (2013), the results were further augmented through backward and forward search. This step resulted in the inclusion of 11 further articles that were additionally screened. In a further step, the possibility to link the articles to Teece's framework was evaluated. In two instances, however, even after extensive discussions, it was not possible to connect the context to the sensing, seizing, or transforming mechanism. As a consequence, these results were also excluded from further analysis. Finally, as recommended by Paré, Tate, Johnstone, and Kitsiou (2016), the authors assessed the quality of the four identified articles that did not run through a double-blind review process. The quality of these four articles has been considered as satisfactory by all authors, resulting in the inclusion of these articles. In total, 22 articles were included for an in-depth analysis.

Fig. 1 provides a summary of the conducted literature review process and Table 1 shows the articles included in the literature review.

### 3.2. Coding of journal articles on organizational capabilities

In accordance with the study's research objectives, the assessment of the identified articles was twofold. First, organizational capabilities relevant for digital transformation had to be identified. Therefore, the articles were analyzed line by line to detect statements that refer to specific valuable organizational capabilities (open coding). Whenever possible in-vivo codes (i.e., terms and language used by the authors) or a simple descriptive term were used when an in-vivo code was not available (Strauss & Corbin, 1998). The identified capabilities during the open coding phase ranged from very specific technology-related (e.g., robot process automation) to broad and general aspects (e.g., managerial foresight). In a second step, axial coding was used to examine similarities and differences between the generated codes. In this axial coding phase similar codes were aggregated in higher-order codes (categories). For instance, the codes "ensuring IT and information security" (Lin & Hsia, 2011), "digital security" (Hoberg, Krcmar, Oswald, & Welz, 2017), and "digital security and security management" (Andriole, 2018) were grouped into the higher–order code (category) "data security". Finally, selective coding was used, which has the goal to integrate different categories that have been developed, elaborated, and mutually related during axial coding into one cohesive conceptual framework or theory. As no cohesive conceptual framework exists for digital transformation, 26 definitions (see Appendix A - Definitions) of digital transformation were analyzed and seven distinct themes were deduced.[3] Building on these identified themes, the categories of organizational capabilities derived from the axial coding were assigned to themes with thematic coherence in this phase. For instance, the categories "data understanding", "data analytics", "data security" and "data visualization" among others were assigned to the theme "data".

Second, the context of each identified organizational capability had been investigated and embedded in the logic of Teece's (2007) dynamic capability theory. In this step, it was assessed whether a certain organizational capability is beneficial for spotting changes in the environment such as transformed consumer habits (sensing mechanism), exploiting business opportunities (seizing mechanism), or recombining and reconfiguring resources and structures of an organization (transforming mechanism). In 34 instances, however, the context of the described capabilities was too vague to match it exclusively to one mechanism of Teece's (2007) dynamic capability theory, and it was agreed on multiple mechanisms.

### 3.3. Calculation approach for the relative importance of the themes during the digital transformation process

To realize the research objective regarding the changing characteristics of the organizational capabilities, a relative relevance of each theme of organizational capabilities for digital transformation was calculated. For the relative relevance (rr), of each theme (c) the number of matchings of each theme in the respective mechanism of the Teece (2007, 2014) framework (t) was divided by the absolute number of entries across all of Teece' mechanisms for the respective theme. See the following formula for a mathematical representation of this process.

$$rr(c_t) = \frac{c_t}{\sum_{t=1}^{3} c_t}$$

[2] The operator NEAR/5 in EBSCOhost and N5 in WoS was used. This operator forces that the combined terms need to be in a distance of 5 words from each other. Moreover, the terms (medic* OR nurs* OR physician*) were excluded when using the EBSCOhost database, as a broad set of irrelevant articles for this study's purposes has been found in a test run.

[3] To deduce the distinct themes, the content of each definition was analyzed and clustered into higher-order categories, using open and axial coding (Williams & Moser, 2019).

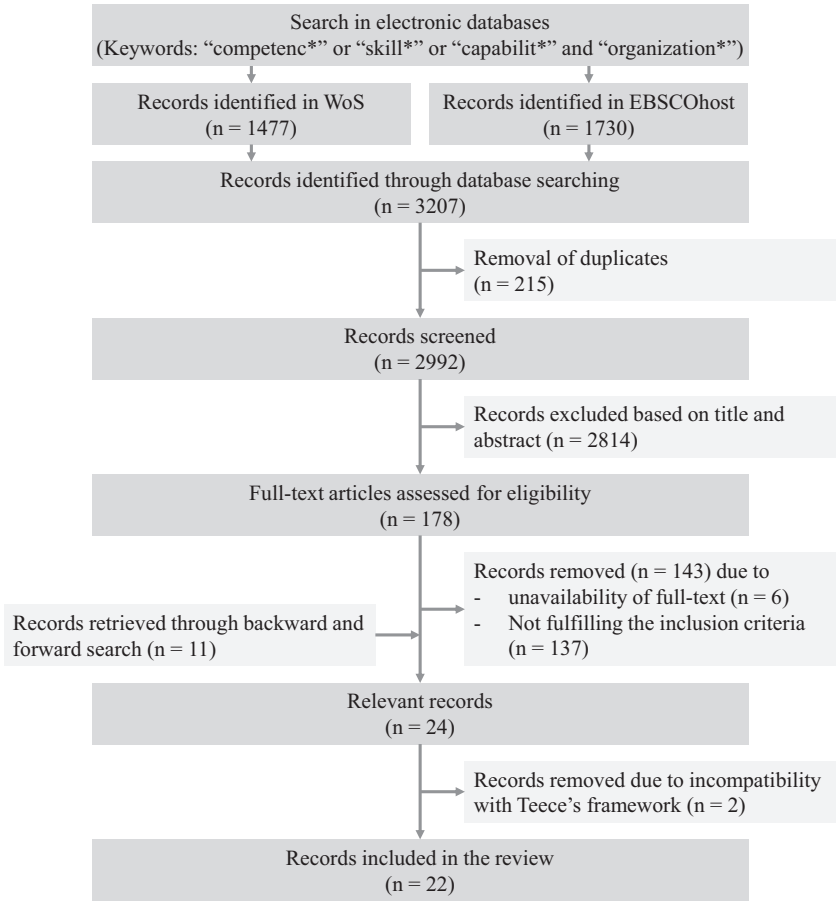


**Fig. 1.** Summary of the article selection process.

**Table 1**
Included articles in the literature review.

| Author (year) (alphabetical) | Title | Journal |
|---|---|---|
| Akroush (2012) | Organizational capabilities and new product performance | Competitiveness Review |
| Ali et al. (2012) | An organizational learning perspective on conceptualizing dynamic and substantive capabilities | Journal of Strategic Marketing |
| Andriole (2018) | Skills and Competencies for Digital Transformation | IT Professional |
| Berkowitz (2018) | Meta-organizing firms' capabilities for sustainable innovation: A conceptual framework | Journal of Cleaner Production |
| Breznik and Lahovnik (2016) | Dynamic Capabilities and Competitive Advantage: Findings from Case Studies | Management: Journal of Contemporary Management Issues |
| Chang et al. (2012) | How do established firms improve radical innovation performance? The organizational capabilities view | Technovation |
| Day (1994) | The Capabilities of Market-Driven Organizations | Journal of Marketing |
| Evans et al. (2016) | Organizational Context and Capabilities for Integrating Care: A Framework for Improvement | International Journal of Integrated Care |
| Fernandes et al. (2017) | The dynamic capabilities perspective of strategic management: a co-citation analysis | Scientometrics |
| Guo et al. (2014) | The Development of Organizational Capabilities and Corporate Entrepreneurial Processes: The Case of Chinese Automobile Firms | Thunderbird International Business Review |
| Hoberg et al. (2017) | Skills for digital transformation | – |
| Lampel (2001) | The core competencies of effective project execution | International Journal of Project Management |
| Lin and Hsia (2011) | Core capabilities for practitioners in achieving e-business innovation | Computers in Human Behavior |
| Martelo et al. (2013) | The use of organizational capabilities to increase customer value | Journal of Business Research |
| O'Connor (2008) | Major Innovation as a Dynamic Capability: A Systems Approach | Journal of Product Innovation Management |
| Orji (2019) | Digital business transformation: towards an integrated capability framework for digitization and business value generation | Journal of Global Business & Technology |
| Osmundsen (2020) | Competences for Digital Transformation: Insights from the Norwegian Energy Sector | Proceedings of the 53rd Hawaii International Conference on System Sciences |
| Pavlou and El Sawy (2006) | From IT Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development | Information Systems Research |
| Sousa and Rocha (2019) | Digital learning: Developing skills for digital transformation of organizations | Future Generation Computer Systems |
| Verona (1999) | A Resource-Based View of Product Development | The Academy of Management Review |
| Warner and Wäger (2019) | Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal | Long Range Planning |
| Whitley (2003) | The Institutional Structuring of Organizational Capabilities: The Role of Authority Sharing and Organizational Careers | Organization Studies |

The relative relevance of the mechanisms for each theme can now directly be translated into a prioritization for the development of organizational capabilities depending on the current state of an organization regarding digital transformation, which helps to achieve the abovementioned research objective.

## 4. Results and discussion

The conducted coding process of the definitions of digital transformation resulted in seven themes of organizational capabilities for digital transformation: (1) Strategy and Ecosystem, (2) Innovation Thinking, (3) Digital Transformation Technologies (DT Technologies in the following), (4) Data, (5) Operations, (6) Organizational Design, (7) Digital Transformation Leadership (DT Leadership in the following).

*Strategy and Ecosystem*: The first theme relates to the strategy and ecosystem of the organization. Organizational capabilities in this theme refer to abilities to adapt the business models during the digital transformation (Henriette et al., 2015; Verhoef et al., 2019; Warner & Wäger, 2019). They also enable the formation and management of ecosystems spanning across multiple organizations, functions, and industries, initiated by the digital transformation (Berman & Marshall, 2014).

*Innovation Thinking:* Innovation thinking refers to organizational capabilities that enable the emergence of innovation from inside or outside the organization (open innovation). The inclusion of the customer in the innovation processes (co-creation) is a key element of innovation thinking, especially by focusing efforts on the enhancing of customer experience (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2014; Morakanyane et al., 2017; Paavola, Hallikainen, & Elbanna, 2017; Piccinini, Hanelt, Gregory, & Kolbe, 2015). This also includes the ability to enhance products with digital technologies (Berghaus & Back, 2016; Nwankpa & Roumani, 2016). All of this requires a solid understanding of formal innovation processes and methodologies (Mazzone, 2014) as well as abilities to scan, analyze, and evaluate the competitive environment (Nwankpa & Roumani, 2016; Stalk, Evans, & Shulman, 1992).

*DT Technologies:* Technologies were identified as a main driver of digital transformation by Morakanyane et al. who stated that technologies "play a vital role in the digital transformation process" (Morakanyane, Grace and O'Reilly, 2017, p. 432). Indicated by the prefix "DT" for digital transformation, for this theme, only capabilities relating to new and/or disruptive technologies by relying on Danneels' definition: "A disruptive technology is a technology that changes the bases of competition by changing the performance metrics along which firms compete" (Danneels, 2004, p. 249) were considered.

*Data:* This theme is referring to organizational capabilities regarding the handling, security, and capitalization of data. Data has a decisive role in the digital transformation process (Schallmo, Williams, & Boardman, 2017). In fact, the broad literature outlines that even strategic decision-making will be based on data driven insights (Haffke, Kalgovas, & Benlian, 2017; Nwankpa & Roumani, 2016), resulting that organizations need to develop capabilities regarding the exploitation of data.

*Operations:* In contrast to the theme of DT Technologies, this theme comprises organizational capabilities that are related to ordinary business activities and value creation along with basic technologies. As literature teaches, existing business operations need to remain competitive and profitable to fund exploratory processes (Du, Pan, & Zuo, 2013; O'Reilly & Tushman, 2004).

*Organizational Design:* The structural and procedural organization must adapt to support digital transformation strategies (Verhoef et al., 2019). Changes can be triggered by new or adjusted business models (Hess et al., 2016) or new technologies (Li, Su, Zhang, & Mao, 2018). As a result, the theme Organizational Design is proposed, that refers to capabilities relating to the design of the organizational structure, infrastructure, and the flow of information and knowledge.

*DT Leadership:* The last theme comprises aspects on leadership and organizational culture. The importance of leadership and culture for digital transformation, indicated by the prefix "DT" for digital transformation, is widely accepted in the relevant literature (Brown, Fishenden, & Thompson, 2014; Eisenhardt, Furr, & Bingham, 2010; Gong & Ribiere, 2021; Goran et al., 2017; Ismail, Khater, & Zaki, 2017; Matt et al., 2015; Schwertner, 2017; Sow & Aborbie, 2018) but largely neglected in the dynamic capabilities literature (Schilke et al., 2018; Vogel & Güttel, 2012). Yet, a suitable organizational culture is a key requirement for the successful transformation of businesses (Nadkarni & Prügl, 2021) and to overcome internal resistance from various stakeholders during the transformational processes (Matt et al., 2015). A brief overview of the identified themes is displayed in Table 2.

**Table 2**
Themes of organizational capabilities for digital transformation.

| Themes of organizational capabilities | Description |
|---|---|
| Strategy and Ecosystem | Capabilities relating to the strategy and ecosystem of the organization. |
| Innovation Thinking | Capabilities relating to the emergence of innovation in the organization, focusing open innovation and co-creation. |
| DT Technologies | Capabilities relating to new and/or disruptive technologies. |
| Data | Capabilities relating to the handling, security, and capitalization of Data. |
| Operations | Capabilities relating to ordinary business activities and value creation. |
| Organizational Design | Capabilities relating to the design of the structural and procedural organization. |
| DT Leadership | Capabilities relating to the management and culture of the organization. |

The results, see Fig. 2, also point to major differences in the relative relevance of the themes during the digital transformation process (e.g., for the three mechanisms of dynamic capabilities). While the findings do not result in a ranking of the themes themselves, they give valuable advice for the development process of organizational capabilities.

The results outline how organizational capabilities vary throughout the transformation process and provide first insights on how organizations should manage the capability development over time. To do so, the key findings of the study are outlined in the following by presenting the seven themes differentiated for each of the three mechanism of dynamic capabilities.

### 4.1. Strategy and ecosystem

*Sensing:* Strategy and Ecosystem capabilities set the direction of the transformation process by defining a long-term vision and related strategies for the organization (Martelo, Barroso, & Cepeda, 2013; Warner & Wäger, 2019). More tangible capabilities are involved in the building of strong exploitable relationships with external entities such as potential customers (Chang, Chang, Chi, Chen, & Deng, 2012; Whitley, 2003) and business partners (Chang et al., 2012; Guo, Jiang, & Yang, 2014; Lampel, 2001), with the intention to harvest information for innovation projects from multiple external sources, which can be used to leverage relationships to build a superior value network (Lin & Hsia, 2011) later in the transformation process.

*Seizing:* Inside the Strategy and Ecosystem theme, the seizing mechanism accounts for the greatest relative relevance of organizational capabilities. Here, Strategy and Ecosystem capabilities enable organizations to establish strong relationships with relevant external entities and to manage the value network. Capabilities relating to the management of the collaborative ecosystem include the selection of foreign and domestic business partners (Andriole, 2018; Guo et al., 2014), research institutes and universities (Guo et al., 2014) as well as the government (Guo et al., 2014). This also includes the development of appropriate evaluation frameworks to estimate risks in the partner-ecosystem (Lampel, 2001). Having integrated new partners into the ecosystem (Whitley, 2003), organizations must be able to continuously govern the value network (Lampel, 2001; Lin & Hsia, 2011) and constantly review the driving forces (e.g., interests and needs) of their business partners (Whitley, 2003). This allows organizations

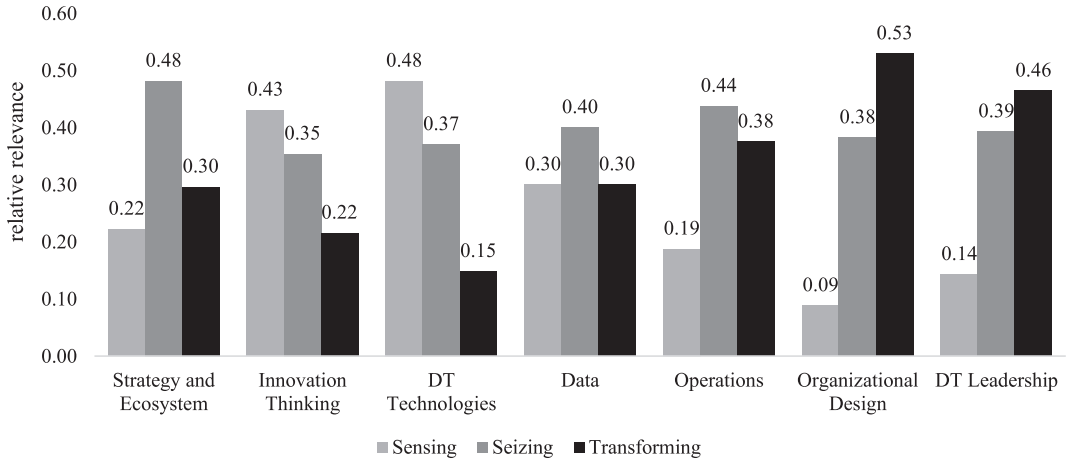


**Fig. 2.** Relative relevance of themes throughout the digital transformation process.

to build on novel ideas from the whole ecosystem and to develop innovative solutions (Lin & Hsia, 2011). Another important element is the capability to create a strong link between the envisioned strategy and the business model. This means in addition to the capability of formulating a suitable and sustainable corporate strategy (Day, 1994; Martelo et al., 2013; Warner & Wäger, 2019) organizations need adequate capabilities to reinvent or realign their business models (Lin & Hsia, 2011; Warner & Wäger, 2019). Portfolio management (Osmundsen, 2020) and product/service integration capabilities (Hoberg et al., 2017) complement this process.

*Transforming:* In this mechanism, the focus shifts from pure management of the ecosystem to a stronger strategic and long-term perspective that allows organizations to define their role in the value network. As business areas are subject to sudden and constant changes in the digital transformation, organizations can improve their resilience engaging in strong ecosystems. Organizations must have the capability to be open to redefine their position in the value network and to recognize the value of co-creation and complementary assets that partners in the ecosystem can provide (Lin & Hsia, 2011; Teece, 2007). In this context, Warner and Wäger (2019) mention the so called "unlearning" of existing practices as an important capability to effectively interact and collaborate with partners in the ecosystems. As emphasized by Berkowitz (2018), Guo et al. (2014), Lampel (2001), and Lin and Hsia (2011), organizations need to develop a deep understanding of one's own role and those of business partners (Whitley, 2003) and explicit linkages between the organization itself and the environment in order to absorb spillover learning from external sources (Guo et al., 2014; Lampel, 2001).

Therefore, organizations need the ability to create appropriate interfaces (e.g., collaboration possibilities) between the organization and knowledge sources in the ecosystem through informal relationships and formal alliances (O'Connor, 2008). In this matter, Berkowitz (2018) argues that organizations which coordinate and align own innovations with ecosystem activities can increase the resilience of their own business models. On a general level, organizations must also keep the triple bottom line framework in mind and, in addition to the economic perspective, reflect about impacts on environment health and safety, and society (Berkowitz, 2018; Day, 1994).

### 4.2. Innovation thinking

*Sensing:* During the sensing mechanism, the ability to create processes to support and enable the emergence of innovation in the organization is a basic prerequisite. It is outlined that organizations need to develop capabilities that allow them to detect changes in the society and environment (Akroush, 2012; Berkowitz, 2018; Breznik & Lahovnik, 2016; Chang et al., 2012; Day, 1994; Guo et al., 2014; Verona, 1999; Warner & Wäger, 2019) as well as capabilities that create a deep understanding of current and future needs of customers (Akroush, 2012; Ali, Peters, & Lettice, 2012; Pavlou & El Sawy, 2006; Warner & Wäger, 2019; Whitley, 2003). Moreover, it is emphasized that organizations need capabilities to anticipate future states of the environment (Berkowitz, 2018; Breznik & Lahovnik, 2016). This harvesting of information from a wide array of sources (more known as the fuzzy front-end) is critical for successful innovation (Chang et al., 2012). These capabilities enable organizations to make proper design choices for products and services (Whitley, 2003), to formulate effective marketing strategies (Pavlou & El Sawy, 2006), and to guide innovation projects into promising directions. Gathering external information can also reveal areas in which the organization lacks necessary organizational capabilities (Breznik & Lahovnik, 2016; Guo et al., 2014) and guide the development of these capabilities throughout the transformation process. The results show that the sensing mechanism has the highest relevance for the Innovation Thinking theme. This finding emphasizes that organizations must develop Innovation Thinking capabilities from the beginning of the digital transformation journey.

*Seizing:* While Innovation Thinking capabilities in the sensing mechanism largely refer to the detection of innovation, the formalization of the innovation processes is emphasized in the seizing mechanism. Here, organizations require capabilities that enable them to repeatedly develop new technologies, products, and services (Day, 1994) and to integrate and align corporate R&D units and existing lines of business (Chang et al., 2012; Lampel, 2001). The ability to learn, to probe, and to experiment with new ideas (Chang et al., 2012) requires capabilities in ideation processes and methodologies like testing of prototypes (Pavlou & El Sawy, 2006), minimum viable products, lean start-up, innovation labs (Warner & Wäger, 2019), as well as a certain scientific expertise in R&D (Verona, 1999). The literature especially highlights the importance of customer inclusion in the innovation processes and points to capabilities that enable long term relationships with customers (Martelo et al., 2013) for obtaining information that allow to align with customer experiences (Whitley, 2003) and to make appropriate design choices to meet current and future needs (Martelo et al., 2013; Whitley, 2003).

*Transforming:* Innovation Thinking capabilities in the transforming mechanism allow the organization to embrace open innovation in ideation processes and methodologies. To achieve this, it is outlined that organizations need to have capabilities to actively integrate external innovations into the value network and to converge internal innovation with impulses from the ecosystem (Day, 1994; Lin & Hsia, 2011). The engagement of customers, research institutes, strategic partners, and universities (Guo et al., 2014) enables organizations to better adapt own technologies, products, and services to environmental changes (O'Connor, 2008) and to better design, deliver, and advertise new products and services (Lin & Hsia, 2011). Internal innovation processes must keep up with these changes and need capabilities that allow quick responses to external influences (Guo et al., 2014) through adaptive processes and methodologies.

### 4.3. DT technologies

*Sensing:* The analysis shows that the organizational capabilities related to the sensing mechanism are of the highest relevance for this theme. This means that organizations should predominantly develop these capabilities at the beginning of the digital transformation process in order to best exploit new technical possibilities throughout the entire transformational process. The experiences in different industries have shown that the emergence of new technologies led to fundamental changes and made existing business models obsolete (see Hoberg et al. (2017) and Sousa and Rocha (2019) for examples of specific technologies for digital transformation). Many researchers emphasize that organizations need to acquire comprehensive knowledge of disruptive technologies (Hoberg et al., 2017; Sousa & Rocha, 2019) and competitive technology intelligence to secure long-term survival (Andriole, 2018; Osmundsen, 2020) resulting in organizational capabilities to understand and assess new technologies that can trigger innovation processes within the organization (Osmundsen, 2020).

*Seizing:* Regarding the seizing mechanism, this theme is mainly concerned with technology adoption capabilities, leveraging the previously acquired capabilities in technology knowledge and intelligence and effectively using technological assets and engineering know-how (Lampel, 2001). Technology adoption supposes the commitment of employees to utilize new technology in their work tasks and the belief that those technologies will add value to it (Osmundsen, 2020). New product and service designs, tests of prototypes, and the evaluation of technical feasibilities or technical specifications are manifestations of an adoption of disruptive technologies in an organization (Ali et al., 2012; Pavlou & El Sawy, 2006). As disruptive technologies promise huge benefits for business processes (Lin & Hsia, 2011) organizations often seek a pioneer role (Orji, 2019), even though the alignment of operations with disruptive technologies continues to be a major challenge for organizations (Lin & Hsia, 2011).

*Transforming:* As organizations are confronted with a high uncertainty whether disruptive technologies will be accepted by the market, capabilities of DT Technologies from previous mechanisms remain relevant. For this reason, it is imperative that organizations are prepared for current and future realities of constant technological change. They are far less tangible than other capabilities from this theme, as they predominantly refer to the human factor, often overlooked at technology decisions during business transformations (Orji, 2019). Organizations must keep their workforce open-minded and preferably enthusiastic (Osmundsen, 2020) about continuous changes. Capabilities in knowledge management that facilitate, collaboration, peer learning, and know-how transfer are important elements for the transforming mechanism (Osmundsen, 2020). This is not only relevant for technical tasks, but also for nontechnical ones such as managing projects (Lampel, 2001).

### 4.4. Data

*Sensing:* Capabilities related to the Data theme mainly leverage analytical capabilities (Andriole, 2018) to support insight-generating processes. Data-science capabilities can utilize internal and external data to acquire knowledge, e.g. about markets and customers (Osmundsen, 2020).

*Seizing:* The seizing mechanism has the highest relevance for the Data capabilities, which highly focus on the protection of innovation. Since industrial value chains are highly integrated with information and communications technology, organizations are frequently confronted with cyber-attacks (Hoberg et al., 2017). Therefore, data-security capabilities are mentioned by various researchers (Andriole, 2018; Hoberg et al., 2017) which can trigger the installation of state-of-the-art IT architectures including cloud computing, decentralized data, and data lakes as well as access and identity management (Lin & Hsia, 2011).

*Transforming:* Data capabilities in the transforming mechanism are necessary to deal with the increasing amounts of data (Osmundsen, 2020) and to adapt the storage mechanisms across organizational units (Evans, Grudniewicz, Baker, & Wodchis, 2016). Data capabilities are especially important to support all other lines of business with data driven insights. Capabilities for data management, data understanding, data analysis, and data security are existential to transform organizations.

### 4.5. Operations

*Sensing:* Operations capabilities, relating to ordinary business activities and value creation, are often overlooked in the transformation process, as innovation efforts are pursued at the expense of existing business activities (Birkinshaw & Gibson, 2004). In line with literature on ambidexterity in business innovation (Markides, 2013), Operations capabilities focus on the performance of existing value chains. They enable the analysis of potential inefficiencies in the value chain (Ali et al., 2012) and increase the efficiency of existing business processes (Andriole, 2018; Verona, 1999; Whitley, 2003).

*Seizing:* The seizing mechanism accounts for the highest number of Operations capabilities. While they continue to focus on the analysis and improvement of internal business processes, external insights are increasingly considered. This requires capabilities to gather information about internal and external processes (Whitley, 2003) and to analyze (Osmundsen, 2020) and evaluate (O'Connor, 2008) the results. These insights lead the efforts to improve business processes (Lampel, 2001; Whitley, 2003) and to reallocate resources (Warner & Wäger, 2019). These capabilities are not limited to a specific functional area but can range from financial (Day, 1994; Lampel, 2001), human resource (Day, 1994), purchasing (Day, 1994) over manufacturing (Ali et al., 2012; Day, 1994; Verona, 1999), to logistics-related processes (Ali et al., 2012; Day, 1994).

*Transforming:* Regarding the transforming mechanism, the focus of the Operations capabilities shifts from process analysis and improvement to the integration and connection of operations with other lines of business. Especially in the context of ambidexterity, operational processes must not be neglected, as they provide management with the ability to monitor, analyze, control, and improve the organization's workflow and activities (Orji, 2019). Because knowledge is subject to sudden changes, it is crucial to develop the necessary capabilities for restructuring operations (Whitley, 2003). Impulses for restructuring may come from other business lines including research labs or marketing - highlighting the benefits of inter-connected operations and cross-organizational collaboration (Chang et al., 2012). In particular, capabilities related to innovation greatly benefit from knowledge about current processes (Breznik & Lahovnik, 2016) as collective knowledge of the organization can be applied to incremental and radical improvements of existing operational activities (Akroush, 2012). As a result, no matter the exploring or exploiting activities of organizations, the capabilities to interconnect operations with other business lines and to adequately align processes are existential to the transforming mechanism.

### 4.6. Organizational design

*Sensing:* In the sensing mechanism, the main objectives of Organizational Design capabilities are to support the information and knowledge flow across organizational units through infrastructural and knowledge management related initiatives (Breznik & Lahovnik, 2016; Lampel, 2001; Martelo et al., 2013).

*Seizing:* Organizational Design capabilities in the seizing mechanism leverage the intra-organizational infrastructure to facilitate the flow of information inside the organization and with external entities. Prerequisites for this are a clearly recognizable organizational structure (O'Connor, 2008) and the ability to plan and implement the necessary infrastructure, especially IT infrastructure (Ali et al., 2012; Lin & Hsia, 2011). Formal capabilities that allow to structure information (Andriole, 2018) and to distribute it across business lines (Martelo et al., 2013) are necessary to develop, just as an organizational understanding and open, transparent, and valuing communication (Breznik & Lahovnik, 2016).

*Transforming:* The transforming mechanism has the highest relative relevance for Organizational Design capabilities, which mainly relate to the adoption of internal structures and knowledge management. The adoption

of internal structures refers to structural and functional characteristics. The creation of team-based structures and the decentralization of business units enables organizations to better respond to unforeseen situations (Warner & Wäger, 2019). These entities must be equipped with proper capabilities to operate without being held back by outdated structures (O'Connor, 2008). The need of capabilities to integrate these new structures into existing lines of business is apparent. Innovation must be transferred into the existing strategy as well as the relevant areas of the organization (Chang et al., 2012). This ultimately leads to the necessity of capabilities enabling organizations to be capable to adapt to changing circumstances (Berkowitz, 2018) and to form ambidextrous structures that allow exploration and exploitation to coexist (Chang et al., 2012). Knowledge management is well recognized as an organizational capability (Gold, Malhotra, & Segars, 2001) and is seen as a lever to raise the potential for competitive advantages (Fernandes et al., 2017). Capabilities in the Organizational Design theme facilitate the distribution of knowledge in the organization and the value network to ensure its appropriate use (Chen & Huang, 2009). Structures enable the quick codification and diffusing of knowledge throughout the organization (Lampel, 2001; Whitley, 2003).

### 4.7. DT leadership

*Sensing:* Only a fraction of the DT Leadership capabilities is relevant in the sensing mechanism. Here, the main purpose of the capabilities is to introduce the right mindset for the transformational process into the organization. This includes the capability to promote experimentation with and learning from new technology and ideas (Chang et al., 2012; Osmundsen, 2020), as well as to facilitate entrepreneurial aspirations among the members of the organization (Hoberg et al., 2017; Warner & Wäger, 2019).

*Seizing:* DT Leadership capabilities for the seizing mechanism primarily refer to an innovation-promoting culture. Creating a culture that fosters risk-taking, freedom, and self-management is crucial to the emergence of innovation inside the organization (Chang et al., 2012). This requires leadership capabilities that introduce soft skills-based practices such as open, transparent, and valuing communication at all levels of an organization, open-door policies, and trust-based relationships between employees and management (Breznik & Lahovnik, 2016). Of course, culture is not an end in itself, but rather instrumental to achieve long-term success (Orji, 2019). In fast-changing environments, unforeseen contingencies are inevitable and require continuous redirection. These constant redirections and adjustments may result in conflicts that threaten the foundations of the collaborative process (Lampel, 2001; Warner & Wäger, 2019), such conflicts must be mitigated through adequate capabilities.

*Transforming:* The transforming mechanism has the highest relevance for this theme. Continuous adoption to volatile environments relies on the abilities of the workforce as well as on the right culture. DT Leadership capabilities allow organizations to engage in a balanced capability development from both externally appointed and internally promoted employees (Warner & Wäger, 2019). Here, DT Leadership capabilities enable the organization to recognize the best candidate to succeed in their internal environment and to contribute to the work culture (Breznik & Lahovnik, 2016). While managers in established organizations rely much more on known routines and smooth, predictable operations to deal with highly uncertain environments (O'Connor, 2008), others must be able to restructure their operations and routines radically (Whitley, 2003). Proper incentives for the workforce may also increase the adaption of individual skills (Pavlou & El Sawy, 2006; Verona, 1999). As a result, the adoption of a new mindset within the organization is required - based on a customer-oriented and change-embracing culture (Chang et al., 2012; Day, 1994).

A summary of selected major findings of the themes for digital transformation for the respective mechanisms is displayed in Table 3.

## 5. Theoretical implications, limitations, and further research

This study proposes a sound conceptual framework of organizational capabilities for digital transformation consisting of seven themes of organizational capabilities related to (1) Strategy and Ecosystem, (2) Innovation Thinking, (3) Digital Transformation Technologies, (4) Data, (5) Operations, (6) Organizational Design, (7) Digital Transformation Leadership. By integrating Teece's (2007, 2014, 2018) dynamic capability theory to differentiate phases of the digital transformation process, this study helps to overcome the so far oversimplistic representation in the face of digital transformation. As a result, this study contributes to the literature by providing a more nuanced picture of organizational capabilities needed to master the digital transformation process by creating a process-oriented framework. The findings point to the fact that the scope and relevance of organizational capabilities varies along the digital transformation process. The developed process-oriented framework can therefore serve scholars and practitioners as a structured path for the development of organizational capabilities during digital transformation and helps exploring the effects of certain organizational capabilities to master the digital transformation.

Organizations benefit from this structured approach as it helps them to create a capability development roadmap for different actors in the organization and to align processes, structures, and systems to the new digital reality. As the necessary organizational capabilities vary throughout the transformational process, it is recommended for organizations to engage in a digital maturity assessment (Klötzer & Pflaum, 2017; Remane, Hanelt, Wiesboeck, & Kolbe, 2017). With the results from the digital maturity assessment, organizations can identify current gaps and get indications of which phase they are in and what kind of organizational capabilities are underrepresented or missing.

Drawing on the findings, organizations can start a meaningful capability development that helps them to efficiently allocate their resources. The efficient allocation of resources and the prioritization on certain organizational capabilities are important as many organizations are confronted with resource constraints and idiosyncrasies, which impede a successful

**Table 3**
Selected major findings of the themes for digital transformation.

| Theme | Mechanism | | |
|---|---|---|---|
| | Sensing | Seizing | Transforming |
| Strategy and Ecosystem | Setting a long-term vision and strategies, establishment of long-term relationships | Managing and leveraging long-term relationships by creating a network for value creation | (Re)defining the organization's role in the collaborative ecosystem and alignment of business activities |
| Innovation Thinking | Monitoring changes in society, technology, and business environments | Developing open, flexible, and innovation-friendly processes | Embracing open and collaborative innovation |
| DT Technologies | Acquiring comprehensive knowledge of (disruptive) technologies | Adopting appropriate technologies | Managing technical knowledge and staying open-minded for new technologies |
| Data | Generating data-driven insights | Ensuring the protection of innovation and leveraging data-driven insights | Preparing for effective handling of data volume |
| Operations | Managing existing operations efficiently | Leveraging external insights to improve operational performance | Interconnecting operations with other business lines |
| Organizational Design | Supporting information and knowledge flows | Establishing a supporting organizational structure | Continuously adapting internal structures to changing requirements / market needs |
| DT Leadership | Promoting experimentation and the readiness for change | Embracing an innovation-promoting culture | Incentivizing entrepreneurial behavior |

digital transformation process (Soluk & Kammerlander, 2021). Moreover, the findings can serve to build a top-down orientated roadmap for developing organizational capabilities by operationalizing the organization's vision. By knowing the bigger picture, an organization's future including the main purpose for creating value, it is possible to determine and concretize the organization's future core capabilities. Derived from these core capabilities, a roadmap for targeted development of organizational capabilities can be built.

As with every study, this one is not without limitations. The rigorous criteria for the literature review process resulted in a final set of 22 studies. While this could be considered as a narrow coverage of articles, the analyzed articles enabled us to identify more than 200 statements of organizational capabilities and to connect them to the sensing, sizing, and transforming mechanism. To the best of the authors' knowledge, there is no similar literature review that takes in an interdisciplinary view of dynamic capabilities and organizational capabilities with digital transformation.

Given the novelty of this study, the sufficiency of the number of results was judged by two measures. First, abstracting reviews on dynamic and organizational capabilities with different foci. Empirical studies (see Evans et al. (2016), Jenkins (2010), and Soluk and Kammerlander (2021)) relied on 23, 15, and 10 interviews to develop or validate their capability-based models. Theoretical works from Nadeem et al. (2018) and Knobbout and van der Stappen (2020) used samples of 28 and 15 studies to develop models on business strategy and analytics adoption. Literature reviews frequently connect digital transformation with various kinds of capabilities (e.g. Morakanyane et al. (2017), Vial (2019)), but present only a limited number of sources (7 and 3 respectively).

Second, the total number of identified capabilities was well over 200. During the codification process, a point in the category development was reached, at which no further capability, theme, or relationship emerged (e.g. “theoretical saturation” (Strauss & Corbin, 1998, p. 143)). In fact, the last quarter of results did not enhance the results in a significant way, but rather strengthened the existing findings.

To further enrich the identified themes, a fruitful avenue of future research is to focus on single organizational capabilities for digital transformation, hence providing an in-depth view on specific organizational capabilities for each theme, and to explicate how organizations can advance the particular capability in a systematic and appropriate matter. By doing so, future research could connect the organizational capability literature with research on digital maturity models. Researchers such as Klötzer and Pflaum (2017) or Soluk and Kammerlander (2021) focus on the company itself as the target entity (for an overview of various other maturity models in technology-driven environments see Angreani, Vijaya, and Wicaksono (2020) or Hizam-Hanafiah, Soomro, and Abdullah (2020)). Research on digital maturity models of organizations regards its processes, products/services, and business models, and defines the necessary development of corresponding capabilities to achieve a desirable future state (Lee & Kim, 2001; Schumacher, Erol, & Sihn, 2016). This approach is rooted in convergence theory, which assumes an “ideal” state (Poeppelbuss, Niehaves, Simons, & Becker, 2011). The themes proposed in this study follow the logic of divergence theory in which it is argued that there is no known ideal state for the target entity per se, except for its capabilities to deal with the dynamics of change that are the central point of digital transformation (Hanelt, Bohnsack, Marz, & Antunes Marante, 2020).

In both fields a dominance of technological aspects can be observed, whereas other elements that are affected by the digital transformation such as strategy, people, culture among others are only peripherally considered (Goran et al., 2017; Henriette et al., 2015). The wide-ranging perspective of recent reviews (e.g. Gong and Ribiere (2021), Morakanyane et al. (2017), Vial (2019)) as well as the findings in this study encourage further studies to take in a socio-technical systems perspective (Trist, 1963) on digital transformation and to include organizational capabilities that go beyond technological aspects. Based on the findings, the merit to consider the socio-technical systems-theory as a useful framework can be seen as it stresses the importance of joint optimization of both, the technical and the social subsystem of an organization (Appelbaum, 1997). By recognizing interdependencies between the social and technical subsystem within the development process of organizational capabilities (Spanos & Prastacos, 2004), future research would further advance the understanding of the cause-effect relationships of various organizational capabilities.

As a result, this study also contributes to an emerging stream of research on digital capabilities, which started to incorporate digital data and information technologies into organizational capabilities (Hanelt et al., 2020; La Calle, Freije, Ugarte, & Larrinaga, 2020). According to Hanelt et al. (2020), firms might favor the development of digital capabilities as their dynamic nature (Kallinikos, Aaltonen, & Marton, 2013) allows for a fast adaption to turbulent environments (Hirvonen & Majuri, 2020). Despite the ambiguity regarding definitions of digital capabilities (da Silva Freitas, Maçada, Brinkhues, & Montesdioca, 2016) and the blurry line of distinction from other types of capabilities (de Vasconcellos, da Silva Freitas, & Junges, 2021),[4] this study encourages further discussions on digital capabilities by expanding the discussion to the social subsystem (digital leadership, digital strategy or digital organizational culture).

As outlined before, organizations must recognize their current state in the transformational process, with special attention on their capabilities in order to develop capabilities in a targeted manner. While numerous models to assess the digital transformation maturity have been developed over the past decade (see Teichert (2019) for an overview on assessment models), there is still a lack of a consistent concept of describing the maturity levels (Teichert, 2019), which makes it challenging for organizations to assess their current state in the transformational process and to combine them with a capability development roadmap. As a result, future research may build on the conceptual framework of this study to adapt existing digital maturity models and to better integrate a capability building perspective. Another limitation of the study is that only capabilities on the organizational level had been considered, resulting in the fact that only limited insight on how to develop employee-level individual competences is given. Some researchers already identified individual-level competences as an explanation for organization level heterogeneities (Fallon-Byrne & Harney, 2017; Rothaermel & Hess, 2007), indicating that research should focus on the connection of organizational capabilities for digital transformation with employee-level competences. While the conceptual framework of organizational capabilities can serve as a blueprint for personal development paths of members of the organization, future research is needed to translate them into employee-level knowledge, skills, and abilities. This leads to the ability to create an actionable HR development roadmap that helps HR managers to impart the necessary knowledge, to initiate attitude changes, and to alter staff behavior.

This study is a further step to provide organizations with the necessary understanding and instruments to master the digital transformation process.

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[4] Korhonen and Gill define digital capability as an “enterprise's capacity to integrate and utilize digital data and information technologies in its products, services, business processes, and organizational systems and practices to create added value to its constituents and beneficiaries” (Korhonen & Gill, 2018, p. 2).

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.digbus.2021.100019.

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