Journal of Business Research 185 (2024) 114895

Contents lists available at ScienceDirect

Journal of Business Research

journal homepage: www.elsevier.com/locate/jbusres

Expanding the boundaries of digital orientation research: Scale development and validation

Bastian Kindermann [a,*], Corinna Vera Hedwig Schmidt [a], Florian Fengel [b], Steffen Strese [b]

[a] Chair of Technology & Management, TU Dortmund University, D-44221 Dortmund, Germany
[b] Chair of Innovation Management, TU Dortmund University, D-44221 Dortmund, Germany

ARTICLE INFO

Keywords:
Digital orientation
Digital transformation
Digital business strategy
Firm performance
Empirical research
Scale development

ABSTRACT

Firms keep struggling to realize the benefits of digital transformation processes. Research, therefore, proposes implementing a firm-wide organizational configuration with a digital orientation (DO) fostering digital innovation and transformation initiatives. However, exploration of DO remains somewhat constrained as existing measurement approaches are limited to secondary data. In this study, we develop a new scale to measure DO, specifically in survey-based research. Leveraging survey data from 1,488 top executives of German companies and drawing on the resource-based view, we empirically validate that our scale captures the performance-enhancing effects of DO.

1. Introduction

Digital transformation and the corresponding digitally enabled value propositions are widely considered a prerequisite for remaining competitive—yet many firms struggle to realize their benefits. A recent McKinsey report (Lamarre et al., 2023) indicates that although firms engage with digital transformation, they attain only around one-third of the expected performance gains. The authors underline that successful digital transformation requires more than merely purchasing digital technologies: firms must also adjust their organizations to leverage the full potential of such technologies. Considering firms' continuing struggle with digital transformation, recent research suggests that organizational factors are decisive in enabling digital innovation and transformation (Deist et al., 2023; Hanelt et al., 2021; Hund et al., 2021; Kohli & Melville, 2019; Opland et al., 2022; Vial, 2019). For instance, scholars emphasize the significance of capabilities (Hund et al., 2021), leadership (Kohli & Melville, 2019), and appropriate infrastructures (Vial, 2019). However, as insights into these organizational factors remained largely fragmented, Kindermann et al. (2021) have introduced the concept of digital orientation (DO) to denote the value of aligning four specific factors into a consistent theme. These factors are: digital technology scope, digital capabilities, digital ecosystem coordination, and digital architecture configuration. Despite a growing number of studies exploring the nomological net surrounding DO (Bendig et al., 2023; Liu et al., 2023; Maurer et al., 2023), empirical research on this concept remains constrained.

Specifically, previous measurement instruments for DO and its four dimensions rely on secondary data analysis and text-analytical approaches (e.g., Kindermann et al., 2021). While useful, these instruments restrict earlier DO research to contexts where textual data are readily available in abundance. Table 1 illustrates constraints prevalent in previous research. First, current measurement approaches largely preclude examining the DO of firms not subject to comprehensive reporting requirements, such as private or very young firms (with the exception of Maurer et al., 2023). For instance, in the context of new ventures, often established as digital-first firms, the lack of suitable measurement tools makes it difficult to assess the significance of DO in their development. Second, many of the models examined focus their analysis on the firm level, excluding relevant factors at individual or team levels.

To overcome this constraint and facilitate research on various types of organizations and on different levels of analysis, this study aims to develop a new scale for measuring DO using primary data analysis.[1] Devising such a measurement instrument faces the challenge that DO is still a relatively nascent concept, with the works of Quinton et al. (2018) and Kindermann et al. (2021) representing early attempts to advance it.

* Corresponding author.
E-mail address: bastian.kindermann@tu-dortmund.de (B. Kindermann).

[1] We acknowledge that earlier research has drawn on Khin and Ho (2018) for measuring DO in surveys. However, such previous conceptualizations largely diverge from the notion introduced by Kindermann et al. (2021) and, thus, do not reflect DO's dimensionality, as confirmed in later research.

https://doi.org/10.1016/j.jbusres.2024.114895
Received 31 August 2023; Received in revised form 30 July 2024; Accepted 9 August 2024
Available online 21 August 2024

While such research has substantially enhanced the conceptualization of DO, the precise theoretical nature of the concept and the processes underlying DO's performance-enhancing effects remain obscure. Thus, to create a new DO measurement tool, we will further delineate the concept and its potential impact to heighten our understanding of its exact qualities.

We operationalize and validate our new, multidimensional metric using rich multi-industry survey data from 1,488 top executives of German companies. Drawing on the resource-based view (RBV; Barney et al., 1991), we hypothesize and find evidence for the performance-enhancing effects of each of DO's four dimensions and the overall concept. This result not only replicates earlier findings on the performance implications of DO (e.g., Kindermann et al., 2021) but also confirms them in a new study context that goes beyond large and publicly listed firms. Thus, we are confident our new scale adequately captures the business-relevant facets of DO.

With the development of our new DO scale, we make at least two important contributions to research on DO and digital innovation and transformation. First, we complement Kindermann et al.'s (2021) text-based approach to measuring DO by devising and introducing a new scale. This scale allows researchers to measure DO in firms that do not publish comprehensive text materials and also significantly extends the range of concepts to which DO might be related. For instance, researchers using our scale can now more extensively examine the relationship between DO and constructs associated with key personnel psychology or firm-internal attributes. Second, we advance our understanding of the theoretical nature of DO by locating it as the organization element within the RBV's framework of valuable, rare, costly-to-imitate, appropriately organized resources (VRIO; Barney & Mackey, 2018). This extended conceptualization of DO allows us to explain better what DO is and what it is *not* (Osigweh, 1989). Further, we emphasize that pursuing a DO means creating consistency among the various organizational elements involved in digital transformation, thereby guiding future studies on DO.

Moreover, the results of this study have valuable implications for practitioners. First, our new measurement scale comprises clear and actionable items managers can use to understand better the requirements of being digitally oriented. Managers might, for example, refer to our scale to identify deficiencies in their firm's DO. More generally, practitioners can apply the scale as a monitoring tool to trace the development of their firms' DO over time. Second, our extended conceptualization of DO helps managers better comprehend the range of organizational domains they need to align to maximize the benefits of digital technologies. Knowing the need for consistency among these domains might become a critical factor in future decisions on digital technology investment.

2. Conceptual background

2.1. Digital orientation and its constituents

Digital technologies exhibit several features that differentiate them from other types of technologies (Yoo et al., 2010). Digitizing information—converting analog data into a binary language (Hinings et al., 2018)—allows the decoupling of a device's physical form from its functional logic, making digital technologies highly malleable and reprogrammable (Yoo et al., 2010). Since digitization effectively homogenizes all data, a wide range of data types can be transferred and combined easily (Hinings et al., 2018; Yoo et al., 2010). In view of these unique features, Nambisan et al. (2017, p. 223) note that using and integrating digital technologies in innovation processes "has radically changed the nature and structure of new products and services, [and] spawned novel value creation and value appropriation pathways." Beyond that, several digital innovations in concert can lead to a digital

Table 1
Overview of relevant previous DO literature (not exhaustive).

Authors	Title	Role of DO	Measurement approach	Basis for sample	Key findings on DO
Bendig et al., 2023	Digital orientation and environmental performance in times of technological change	Antecedent	Based on Kindermann et al., 2021	Cross-industry sample; S&P 500 index	DO is positively related to environmental performance. This relationship is moderated by technological turbulence.
Kindermann et al., 2021	Digital orientation: Conceptualization and operationalization of a new strategic orientation	Antecedent	Own scale development for secondary data	S&P 500 index	DO is positively related to firm performance.
G. Li and Shao, 2023	How do top management team characteristics affect digital orientation? Exploring the internal driving forces of firm digitalization	Outcome	Scale for secondary data	Chinese A-share listed companies	Top management team characteristics can be positively (e.g., education level diversity and average education level) and negatively (average age and tenure) related to DO.
Z. Li et al., 2023	Antecedent configurations and performance of business models of intelligent manufacturing enterprises	Antecedent (part of fsQCA analysis)	Scale for secondary data	Listed intelligent manufacturing enterprises from China	DO presents an important element of (some) business models within the area of intelligent manufacturing enterprises.
Liu et al., 2023	Effects of digital orientation on organizational resilience: a dynamic capabilities perspective	Antecedent	Scale for secondary data	Chinese A-share listed manufacturing firms	DO is positively related to organizational resilience. This relationship is moderated by human resource slack and the nature of enterprise ownership.
Maurer et al., 2023	Affiliation rhetoric and digital orientation in crowdfunding appeals	Antecedent/ Moderator	Scale for secondary data	Crowdfunding campaigns (Kickstarter)	DO (rhetoric) is positively related to crowdfunding success. Also, DO (rhetoric) acts as a moderator between affiliations and crowdfunding success.
Nasiri et al., 2022	Digital orientation, digital maturity, and digital intensity: determinants of financial success in digital transformation settings	Antecedent	Scale for secondary data	Finnish Talouselämä 500 list	No direct relationship between DO and financial success was detected.
Saesen et al., 2024	The more, the better: The influence of overconfident CEOs on their firms' digital orientation	Outcome	Based on Kindermann et al., 2021	S&P 500 index	CEO overconfidence is positively related to DO. This relationship is negatively moderated by market turbulence and technological dynamism.
Xu et al., 2024	Maturity mismatched investment, digital financial inclusion, and digital orientation: Evidence from China	Outcome	Scale for secondary data	Chinese A-share listed firms	Maturity mismatched investment is negatively related to digital orientation. This relationship is moderated by digital financial inclusion.

transformation (Hinings et al., 2018), defined 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" (Vial, 2019, p. 118). Given their disruptive impact on firms' value propositions, the effects of digital transformations might even exceed those of transformations enabled by information technology (Vial, 2019; Wessel et al., 2021). Specifically, Wessel et al. (2021) find that while information-technology-enabled transformations support existing value propositions, digital transformations can redefine value propositions. Wessel et al. (2021) also note that transformations based on information technology leverage existing organizational identity. Digital transformations, in contrast, require firms to develop a new organizational identity.

Recent review studies provide orientation in the burgeoning landscape of digital innovation and transformation research (Hund et al., 2021; Kohli & Melville, 2019; Vial, 2019). These studies all agree on the critical role internal organizational factors play in enabling the success of digital innovation and transformation processes. For instance, when introducing digital technologies, firms need to develop new capabilities (Hund et al., 2021), which requires an environment that fosters learning (Kohli & Melville, 2019). New infrastructures (Maedche, 2016; Sia et al., 2016; Vial, 2019) and leadership forms (Kohli & Melville, 2019; Lee et al., 2014) could also emerge, and firms might explore novel organization types, such as ecosystems (Hund et al., 2021; Lyytinen et al., 2016). Given the fragmented research on these organizational factors, Kindermann et al. (2021) proposed DO as a concept that integrates the various aspects involved in organizing firms toward digital innovation and transformation. As a strategic orientation, DO denotes "the strategic directions implemented by a firm to create the proper behaviors for the continuous superior performance of the business" (Gatignon and Xuereb, 1997, p. 78). In general, strategic orientations include broad guiding principles—for instance, on a firm's risk disposition and innovation propensity (Grover & Saeed, 2004)—and can thus "influence a firm's […] strategy-making activities" (Noble et al., 2002, p. 25). In that, DO differs from digital business strategies that focus more on the actual formulation and execution of distinct strategies (Bharadwaj et al., 2013). With its broad conceptualization, DO also diverges from the narrower concept of digital strategic postures (Mithas et al., 2013), which describes "a firm's engagement in a particular IT activity relative to the industry average of its competitors" (p. 512).

Conceptually, DO is based on Henderson and Venkatraman's (1999) strategic alignment model and its four dimensions. The DO concept emphasizes how critical it is for firms to integrate their external/internal and organizational/technological domains. Kindermann et al. (2021) draw on three key themes within digital transformation—openness, affordances, and generativity (Nambisan et al., 2019)—to expand the strategic alignment model of Henderson and Venkatraman (1999) and define four dimensions of DO. As firms can vary in the extent to which they cultivate each of these four dimensions within their organization, the degree of firms' DO moves on a continuum.

2.1.1. Digital technology scope

The first dimension, *digital technology scope* (external/technological domain), is defined as firms' efforts to integrate diverse digital technologies in their value creation and capture processes (Kindermann et al., 2021). Along with the technological artifact represented in digital technology come several functionalities and competencies that—individually or in combination—can increase the value space available and help firms explore new sources of value creation (Henfridsson et al., 2018). Firms that score high in this DO dimension typically have arranged their organization to accommodate a wide range of technologies they can leverage to provide customer value.

2.1.2. Digital capabilities

From a technology affordances perspective (Majchrzak & Markus, 2013), technological artifacts are only part of the action potential digital technologies can offer. The value of digital technologies also depends on the individuals who engage with and use the technology. This notion is captured in the second dimension of DO—*digital capabilities* (internal/organizational domain). The digital capabilities dimension is defined as firms' efforts to organize for flexible adjustments of capabilities, and underlying routines, to fully leverage digital technologies. Depending on the set of technologies in use, employees will, for example, adjust existing routines bundled in organizational capabilities or even create new ones—which helps fully realize the technologies' action potential (Leonardi, 2011). Firms scoring high in the digital capabilities dimension have implemented mechanisms to adapt the routines underlying capabilities in a timely and smooth manner (e.g., by formalizing learning processes) or even acquire new employees to enhance their capability portfolio (Kindermann et al., 2021).

2.1.3. Digital ecosystem coordination

Digital innovation and transformation can be associated with unprecedented openness toward external actors (Nambisan et al., 2019). Consequently, the third dimension of the DO concept refers to *digital ecosystem coordination* (external/organizational domain). Digital ecosystem coordination is defined as firms' efforts to align the activities of external actors within their larger ecosystem. A typical feature of ecosystems is the presence of non-generic complementarities (Jacobides et al., 2018)—actors and products or services requiring close alignment (Adner, 2017) despite the possible lack of contractual arrangements among ecosystem members (Autio & Thomas, 2020). In this context, ecosystem coordination might differ from usual supply chain coordination (Kindermann, Salge, et al., 2022). Accordingly, a strategic orientation toward digital innovation and transformation requires firms to cultivate novel ways of orchestrating external actors—through technological tools such as boundary resources (Ghazawneh & Henfridsson, 2013) or behavior-oriented measures such as knowledge sharing (Dhanaraj & Parkhe, 2006). The more effectively firms implement these measures, the higher they score in this dimension.

2.1.4. Digital architecture configuration

We define the fourth DO dimension, *digital architecture configuration* (internal/technological domain), as firms' efforts to adapt internal structures to enhance managing the generativity of digital technologies. Generativity refers to a technology's "capacity […] to produce unprompted change (through 'blending' or recombination) by large, varied, unrelated, unaccredited and uncoordinated entities/actors" (Nambisan et al., 2019, p. 3). While recent literature suggests that generativity can result in unbounded growth (Fürstenau et al., 2023), it may also engender threats due to loss of control and entry of undesired features into innovation processes (Zittrain, 2007). Thus, generativity might also heighten the need to implement control systems such as cybersecurity (Kindermann et al., 2021). Accordingly, this fourth dimension of the DO concept pertains to firms' efforts to design internal architectures open to the innovation-inducing effect of generativity while safeguarding them against its drawbacks. Firms scoring high in this dimension usually feature organizational structures enabling them to sense opportunities for generative innovation and to establish mechanisms such as cybersecurity systems to control undesired influences (Kindermann et al., 2021).

2.1.5. Interplay of the four dimensions of digital orientation

While earlier research has validated individual aspects within these four dimensions, the DO concept integrates all dimensions into a coherent framework. Conceptual integrations are essential in advancing knowledge (Kindermann et al., 2023; MacInnis, 2011): They help elucidate that individual entities may not be distinct but intertwined. The dimensional structure of DO highlights that organizing for digital innovation and transformation requires firms to consider multiple closely interrelated facets. Fig. 1 shows the interrelation of the DO dimensions along with examples. Digital capabilities, for instance, are

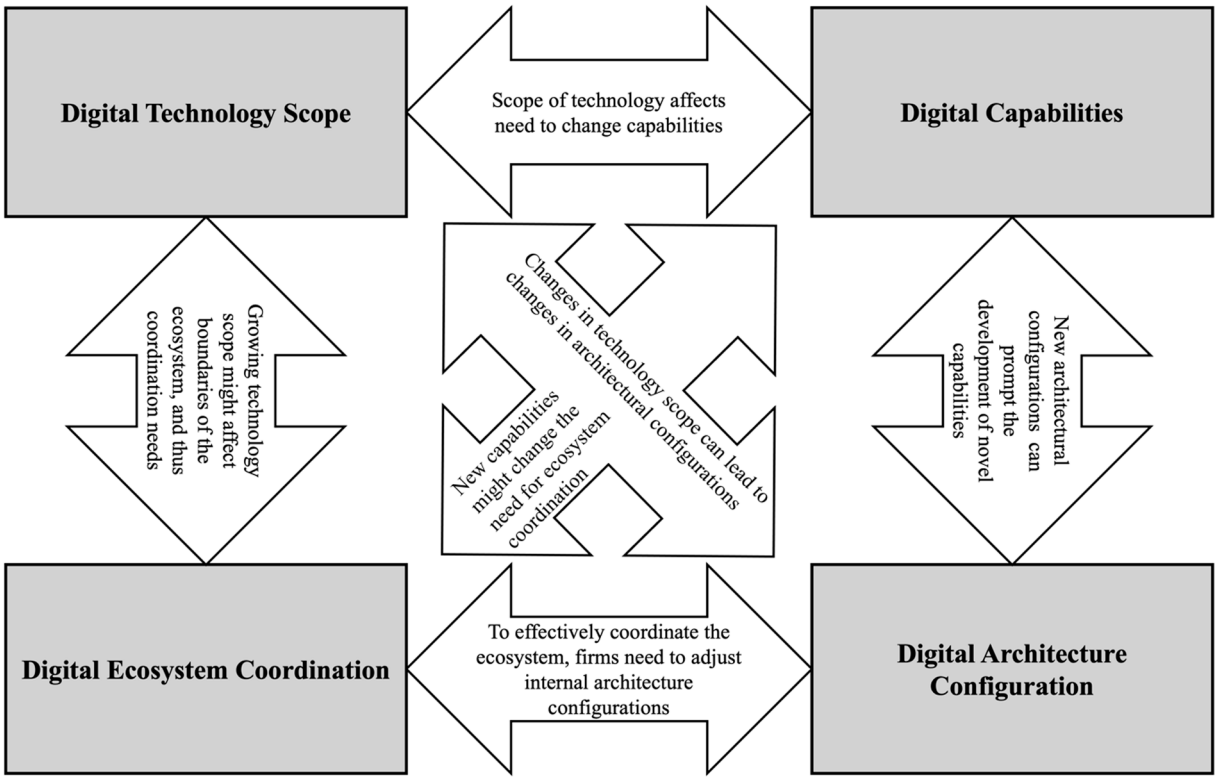

Fig. 1. Interrelation of DO dimensions (mutual relations, arrows contain only examples).

influenced by a firm's digital technology scope—which they, in turn, shape. This close interrelation between the material and the human side of technologies has also been referred to as an imbrication (Leonardi, 2011). At the same time, the effective coordination of digital ecosystems might also increase the need to reconfigure internal architectures toward generativity—and such changes might engender new capabilities at the human resource level, which again might result in adaptations. Accordingly, central to a firm's DO is the consistent alignment of specific factors (Henderson & Venkatraman, 1999; Wales et al., 2021) rather than merely considering a set of organizational factors relevant to digital innovation and transformation. Empirical analyses support this interrelation: Kindermann et al. (2021), for example, report positive correlations among the four dimensions of the concept when developing their text-based measurement approach to DO. Following previous conceptualizations of entrepreneurial orientation (Wales et al., 2021), we define DO as an organizational configuration that enables a consistent alignment of the organizational elements of digital technology scope, digital capabilities, digital ecosystem coordination, and digital architecture configuration—to promote digital innovations, and, eventually, digital transformation.

2.2. Performance implications of digital orientation

Several studies have recently explored how adopting a DO affects firm performance; they suggest that DO has a positive impact on firm performance (Kindermann et al., 2021), environmental performance (Bendig et al., 2023), and organizational resilience (Liu et al., 2023). Maurer et al. (2023) show that DO is an essential assisting factor in crowdsourcing success. To explain the performance-enhancing effect of DO theoretically, these works mainly draw on the RBV (Barney, 1991) or versions thereof (e.g., natural RBV; Hart, 1995). According to the RBV, firms can gain a sustained competitive advantage if they compile resources and capabilities that fulfill the VRIO criteria: resources and capabilities need to be valuable (V), rare (R), costly-to-imitate (I), and appropriately organized (O) (Barney, 1991, 1995; Barney & Mackey, 2018). Following previous research, we use the RBV to theorize our research model. However, drawing on and extending conceptualizations of other strategic orientations (Kindermann, Schmidt, et al., 2022; Wales et al., 2021), we specify DO as the organization element 'O' and firms' digital resources as the 'VRI' within the VRIO framework (cf. Wiklund and Shepherd, 2003). According to Barney (1995), the organization element (O) describes whether a firm is "organized to exploit the full competitive potential of its resources" (p. 56). This role of the organization as an "adjustment factor" (Barney and Mackey, 2018, p. 365) within the RBV's VRIO framework is also supported by Kim and Makadok (2021), who find that "even a single basic organizational characteristic […] can influence the relative value created by different types of resources" (p. 30). Thus, from an RBV perspective, DO describes an organization—more precisely, an organizational configuration (see also Wales et al., 2020)—that helps "define the resources to be used […] and unify the resources and capabilities into a *cohesive* whole (Day, 1994)" (Zhou et al., 2005, p. 45, italics added). The notion of cohesion or consistency of different elements is central to the concept of configurations (Hinings, 2018). Regarding Miller's (1996) understanding of consistency, Hinings (2018) states that "competitive advantage is gained because of the way in which all of the thematic elements work together" (p. 504). Barney and Mackey (2018) further suggest that consistency eventually unfolds its performance-related effects due to efficiency gains. As an organizational configuration, DO results in consistent firm resources, which, in turn, helps realize efficiency gains.

Against this backdrop, a firm's DO might influence which specific technologies the firm uses or invests in—but DO is not the same as these technologies. Research on digital technologies' performance-enhancing effect (Brynjolfsson & Hitt, 1996; Dewan et al., 2007; Dhyne et al., 2021) accordingly addresses a related but different phenomenon. For instance, firms might build unique sets of resources with novel combinations of artificial intelligence applications and related capabilities, which collectively are valuable, rare, and inimitable. Foregrounding consistency in our notion of DO, we focus on whether "conflicts between these attributes of a firm arise" (Barney, 2011, p. 144) and, if so, how firms can

overcome them. Such conflicts might result in inefficiencies, making it difficult for the firm to leverage the potential of novel technology combinations.

Based on this theoretical understanding, we first derive hypotheses on the relationships between each of the four DO dimensions and firm performance. We then formulate a final hypothesis on the association between DO and firm performance. While previous theory underlines that DO's dimensions unfold their performance-enhancing effect in conjunction (Kindermann et al., 2021), individually hypothesizing the dimensions' effects might help elucidate how each contributes to the overall impact of DO. Fig. 2 presents our research model.

3. Hypotheses development

3.1. Digital technology scope and firm performance

Drawing on the RBV (Barney, 1991), we argue that digital technology scope is associated with higher firm performance. Specifically, the organization enabled by this DO dimension ensures that firms not only accumulate digital resources that are valuable, rare, and inimitable, but also that firms can take advantage of such resources (Wiklund & Shepherd, 2003). Firms scoring high in this dimension integrate these digital technologies very efficiently, leveraging not only the potential of each technology but of all emerging synergies. These efforts help firms increase the likelihood of discovering novel ways of creating value with digital technologies, ultimately translating into higher firm performance.

Firms scoring lower in the digital technology scope dimension might also deploy a wide range of digital technologies; however, their technologies lack internal consistency (see Hinings, 2018). Such firms do not use individual resources to their full potential, and/or their different technologies do not interact smoothly and create friction in the value-creation process (cf. Lamarre et al., 2023). As a result, they are less likely to uncover new value-creation potentials, ultimately resulting in lower firm performance. Accordingly, we argue that firms with organizations fully geared toward leveraging the digital technology scope are more likely to create value from their digital technologies than firms without such an organization. We hypothesize:

Hypothesis 1a (H1a): Digital technology scope positively relates to firm performance.

3.2. Digital capabilities and firm performance

Drawing on Barney and Mackey's (2018) understanding of the organization element within the VRIO framework, we propose that firms cultivating appropriate digital capabilities will realize higher performance. Specifically, for any combination of and changes in digital technologies, employees need to develop capabilities to leverage the inherent action potential (Kohli & Melville, 2019; Majchrzak & Markus, 2013). Firms scoring high in the DO dimension of digital capabilities can continuously adjust their employees' competencies to the demands of new digital technology sets. These capabilities allow employees to engage actively with the value scope of digital technologies and connect digital resources in novel, value-enhancing ways (Henfridsson et al., 2018). In contrast, firms that lack such an organization for digital capabilities might face persisting resource inconsistencies. Moreover, firms have to ensure the alignment of the diverse capabilities they cultivate and actively manage potential inconsistencies to stay competitive (Raffaelli et al., 2019). Collis (1994) finds that "[b]etter capabilities, just like better technologies, allow firms to more efficiently or effectively choose and implement the activities necessary to produce and deliver a product or service to customers" (p. 145–146), reflecting that such an organization facilitates leveraging efficiency gains. Able to deliver high value to customers, firms with high levels of digital capabilities will achieve higher firm performance. We hypothesize:

Hypothesis 1b (H1b): Digital capabilities positively relate to firm performance.

3.3. Digital ecosystem coordination and firm performance

From the perspective of the RBV (Barney, 1991), resources relevant to firm performance include resources owned by partners in the wider interorganizational environment (Dyer & Singh, 1998). Thus, we propose that firms cultivating strong capacities to coordinate the digital ecosystem are better at realizing performance gains from digital technology. Close interdependencies among member organizations are characteristic of digital ecosystems (Adner, 2017). Accordingly, focal firms must align their production and innovation processes with diverse external actors—irrespective of the existence of contractual obligations (Autio & Thomas, 2020). If not managed appropriately, interdependencies might create bottlenecks delaying value creation and capture throughout the ecosystem (Kapoor, 2018). Put differently, we argue that firms need to apply the notion of resource consistency to all resources in their entire ecosystem. Firms scoring high in the dimension

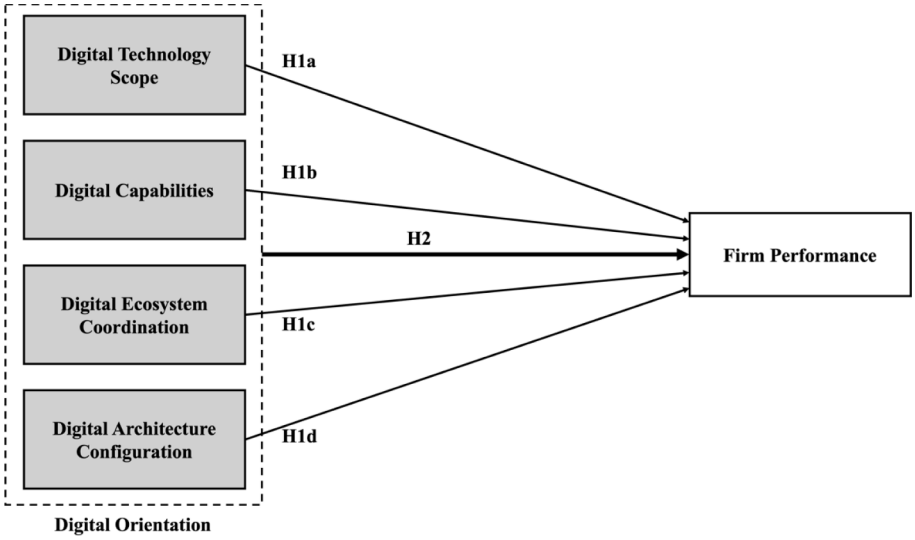

Fig. 2. Research model.

of digital ecosystem coordination successfully use interface elements, such as application programming interfaces, to facilitate interaction among ecosystem members (Kindermann, Salge, et al., 2022). Adner (2006) notes that improper coordination of the wider ecosystem can entail interdependence risks and integration risks; if not solved, these can lead to critical delays, efficiency losses, and, at worst, performance damage. Hence, firms that gear their organization toward efficient ecosystem coordination are better positioned to overcome bottleneck challenges, enabling customers to consume the ecosystem's value proposition more quickly. Against this backdrop, such firms will achieve higher performance than firms with low levels of digital ecosystem coordination. We hypothesize accordingly:

Hypothesis 1c (H1c): Digital ecosystem coordination positively relates to firm performance.

3.4. Digital architecture configuration and firm performance

Adopting the lens of the RBV (Barney, 1991), we argue that adequate digital architecture configuration enables firms to leverage generative processes and helps them achieve higher performance. While generativity can lead to unbounded growth (Fürstenau et al., 2023), it might also result in firms opening their digital resources to external actors. This opening might expose firms to threats, for instance, associated with cybersecurity (Kindermann et al., 2021). Moreover, excessive openness might tempt competitors to copy at least parts of a firm's digital resources (Karhu et al., 2018). In other words, internal (and external) consistency of resource sets might become impaired (see Hinings, 2018). A firm's inability to gear its infrastructure organization toward accommodating openness—for instance, by continually adjusting cybersecurity measures—can lead to low-quality outcomes (Van Alstyne et al., 2016), at worst translating into losses or at least high opportunity costs. Against this backdrop, we argue that firms with appropriate digital architecture configurations will realize higher value potential and, thus, performance than firms without suitable configurations. Firms scoring high in the dimension of digital architecture configuration successfully avoid undesired features of generativity and render innovation processes more controllable. Thereby, such firms can more efficiently use the benefits of generative processes and are more likely to create new value for customers, ultimately increasing firm performance. Accordingly, we argue that firms undertaking pronounced efforts toward a suitable digital architecture configuration will realize higher firm performance. We hypothesize:

Hypothesis 1d (H1d): Digital architecture configuration positively relates to firm performance.

3.5. Digital orientation and firm performance

Our previous hypotheses argue for a positive relationship between the individual DO dimensions and firm performance. Subsequently, we reason that these four dimensions collectively constitute a positive association between DO and firm performance. As outlined, the four dimensions of DO are interrelated and reinforce each other (Kindermann et al., 2021). Firms with high levels of DO thus more successfully create consistency in the activities they undertake in each of its four dimensions. For instance, changes in a firm's digital technology scope will inevitably prompt new demands on how the firm engages with external actors (digital architecture configuration) and coordinates them (digital ecosystem coordination). Failure to organize for the interrelatedness of these dimensions harbors the risk of friction. For instance, ecosystem partners might not be in tune with novel innovation processes enabled by changed digital technology scopes, and customers might face difficulties consuming the value proposition (Adner, 2006). In effect, such friction will cause inefficiencies, which eventually lead to performance losses. Supporting this notion, Barney and Mackey (2018) suggest that firms lacking proper organization might not be able to realize the full potential of their resources. In other words, while firms with low levels of DO might have successfully created valuable, rare, and inimitable sets of digital technologies, they have not sufficiently addressed conflicts that arise among those resources. Practitioner-oriented outlets also reflect the need for holistic consistency as a prerequisite for successful digital transformation (see, e.g., Lamarre et al., 2023). Arguing that firms with high levels of DO can realize higher performance than firms with lower levels of DO, we hypothesize accordingly:

Hypothesis 2 (H2): Digital orientation positively relates to firm performance.

4. Method

4.1. Data collection and sample

We gathered information from two of Germany's main professional industry databases, Dafne and Bisnode. These databases contain details on firm characteristics and contact information for top executives of German companies. To ensure the generalizability of findings, we included small and medium-sized companies as well as large enterprises from different industries in our sample frame; their staff numbers ranged between 10 and 10,000 employees (Subramaniam & Youndt, 2005). Given that the chief executive officer (CEO) has the best overview of the entire organization (Kumar et al., 1993), we identified the CEO of each company as a suitable key informant regarding the firm's digital stance and strategic behaviors. We invited 20,100 CEOs by e-mail to participate in our survey. The survey was fielded over two months, from the last quarter of 2020 to the first quarter of 2021. To increase the response rate of our survey, we explained the motivation for our study, assured confidentiality, offered individualized results reports, and sent two successive reminder −mails. We received 1,843 responses, corresponding to an effective response rate of about 10 %, which is typical for web-based surveys (Klassen & Jacobs, 2001). We excluded observations with unengaged answering habits (based on response times and standard deviation across key constructs). We also eliminated responses with missing values for relevant variables and unusable answers, resulting in 1,488 observations constituting our final sample—with a broad representation of firm sizes (most firms have between 50 and 1,000 employees) and firm ages. The sector distribution in our final sample reflects the overall industry distribution across Germany. Appendix A shows details on all sample characteristics.

4.2. Measures

To measure our variables, we relied on established constructs from the literature (Churchill, 1979). No prior survey scales existed to measure the independent variable DO and its dimensions; therefore, we developed a new survey scale following the process described by MacKenzie et al. (2011) and recommendations in the literature (Churchill, 1979; DeVellis, 2012; R. L. Johnson & Morgan, 2016; Netemeyer et al., 2003). Before sending out the surveys, all items were translated from English into German by professional translators and back-translated to ensure reliability and validity (Brislin, 1980). We thoroughly pretested the survey design and item wording with academics and practitioners. Except for some control variables, measures were evaluated on seven-point Likert scales (1 = strongly disagree; 7 = strongly agree) and are reflectively specified (Podsakoff et al., 2003). Appendices B and C present all measurement items.

4.2.1. Independent variable

Prior literature lacks validated multidimensional survey scales to measure the concept of DO. Existing measurement approaches rely on computer-aided text analysis (Kindermann et al., 2021), which limits their use to firms publishing comprehensive textual material. As this is not the case in our research context and model, we developed and validated a new suitable measurement scale following a ten-step process suggested in the literature (Churchill, 1979; DeVellis, 2012; R. L.

Johnson & Morgan, 2016; MacKenzie et al., 2011; Netemeyer et al., 2003). The web appendix contains details on scale development and validation process. We developed a 19-item scale that we defined and statistically validated as reflective, second-order construct with the four dimensions of *digital technology scope*, *digital capabilities*, *digital ecosystem coordination*, and *digital architecture configuration*. Appendix B presents the complete scale.

4.2.2. Dependent variable

We measured firm performance by an aggregated performance index (Vorhies & Morgan, 2005). The second-order construct asks respondents to compare their firm to competitors regarding customer satisfaction, market effectiveness, and current profitability. Each of these dimensions consists of four items. To increase the robustness of our results, we followed the recommendations by Kumar et al. (1993) and used archival data to triangulate the subjective performance indications with a specific objective indicator. For a subset of 140 firms within our sample, we retrieved publicly available data from the Dafne database on firms' return on sales (ROS) over the past three years. We winsorized DO at the 1 % level to clean the data and ensure the results are not due to overly high- or low-performing firms or inaccuracies within the database. Using firms' industry classification and the three-year median ROS within the respective industries, we calculated a relative score for each of the 140 firms to compare their individual ROS to their industry competitors. This procedure allowed us to establish an objective relative measure that is comparable to the subjective performance index and supports the validity of our primary data. Analyzing the relationship between this objective relative ROS measure and the responses to the subjective relative ROS item within our questionnaire reveals a positive and significant correlation ($r. = 0.31$; $p = 0.00$). The correlation from this triangulation falls into Cohen's (1988) appropriate range and is in line with related studies employing a similar methodological approach (e.g., Engelen et al., 2014). To assess the validity of our performance measure further, we regressed DO on the objective relative measure of ROS in our model using Amos 29. The results show that this relationship is positive and significant (unstandardized path coefficient = 0.29; $p = 0.029$), emphasizing the performance relevance of DO and supporting the validity of our performance measure.

4.2.3. Control variables

We included several external and firm-specific factors as control variables that may influence the model under investigation to minimize the confounding effect of spurious correlation and to diminish the threat of endogeneity due to omitted variables. We controlled for the harmony of cross-functional relationships using the four-item scale by Song et al. (2000). Drawing on this control ensures that performance gains due to intra-firm characteristics are, indeed, associated with our two internally-focused DO dimensions (i.e., digital capabilities, digital architecture configuration) rather than other factors. We also control for relational embeddedness using the three-item scale by Lavie et al. (2012). Again, we use this control to accommodate performance associations of other inter-firm factors than our two externally-focused DO dimensions (i.e., digital technology scope, digital ecosystem coordination). Moreover, we controlled for market turbulence and technological turbulence as relevant environmental factors (both measured on seven-point Likert scales) (Jaworski & Kohli, 1993). Prior research suggests that a firm's performance is substantially affected by the relative influence of the environment, particularly by market uncertainties and technological change (e.g., Gatignon & Xuereb, 1997). We also controlled for firm size, measured by the number of employees, since larger firms can dedicate more resources to performance enhancements (Partanen et al., 2018; Sebastian et al., 2017). We further controlled for firm age, measured by years since founding and coded from 1 (0 to 10 years) to 13 (>120 years), since long-established and more static structures might foster inertia and harm cross-functional or even cross-company exchanges (D. Kim & Lee, 2010; Mithas & Rust, 2016). We included two sector-related dummy variables to account for industry idiosyncrasies. We controlled for customer type, accounting for whether the firm operates in a business-to-consumer (B2C) or business-to-business context (B2B), and for business type, accounting for whether the firm primarily operates as a producing or service business. The customer type variable was coded 1 for B2C customers and 0 if otherwise; the business type variable was coded 1 for producing businesses and 0 if otherwise.

5. Results

5.1. Method of analysis

Before examining our hypotheses, we conducted several tests to analyze the psychometric properties of our measurement model. We assessed reliability and validity of the measurement approach and tested for potential biases. To examine our hypotheses, we applied the covariance-based approach of structural equation modeling (SEM) (Fornell & Bookstein, 1982) because it delivers better results than variance-based approaches regarding parameter consistency and accuracy (Reinartz et al., 2009).

5.1.1. Measurement reliability and validity

To assess the convergent validity of all constructs used in our research, we ran an exploratory factor analysis (EFA) with promax rotation in Stata 16. All items load on their respective constructs and exhibit high and significant factor loadings (Hair et al., 2009) (see Appendices B and C for details). We also conducted a confirmatory factor analysis (CFA) using Amos 29 to assess the fit between measurement model and data (Homburg & Pflesser, 2000). Common model fit indices indicate very good model fit (CFI=0.95; TLI=0.95; $\chi 2/df = 3.02$; RMSEA=0.04; SRMR=0.05) (Brown, 2015; Hu & Bentler, 1999). To test for reliability, we calculated whether our constructs meet the common thresholds for Cronbach's alpha $\geq$ 0.70 (Nunnally, 1978), CR$\geq$0.60 (Bagozzi & Yi, 1988), and AVE$\geq$0.50 (Bagozzi & Yi, 1988; Fornell & Larcker, 1981). To assess our second-order constructs, we aggregated the different dimensions on a mean level to a composite score. We find that all constructs exceed the thresholds. Table 2 presents the detailed results of these calculations.

Next, we analyzed our measures for discriminant validity. Table 3 shows the results. The square root of the AVE is larger than the correlations of the construct with all other measures, indicating discriminant validity for all used measures (Fornell & Larcker, 1981). To control for potential issues of multicollinearity, we first assessed variance inflation

Table 2
Validity and reliability indicators.

Constructs	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)
(1) Digital technology scope	0.78	0.93	0.77
(2) Digital capabilities	0.80	0.93	0.77
(3) Digital ecosystem coordination	0.82	0.96	0.86
(4) Digital architecture configuration	0.83	0.92	0.73
(5) Digital orientation[a]	0.84	0.90	0.72
(6) Firm performance	0.73	0.85	0.70
(7) Harmony of cross-functional relationships	0.88	0.92	0.77
(8) Relational embeddedness	0.81	0.89	0.76
(9) Market turbulence	0.80	0.86	0.62
(10) Technological turbulence	0.93	0.95	0.84

[a] = Digital orientation is a second-order construct comprising the four dimensions (1)-(4).

Table 3
Correlation matrix.

Constructs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Digital technology scope	**0.88**											
(2) Digital capabilities	0.63***	**0.88**										
(3) Digital ecosystem coordination	0.61***	0.48***	**0.93**									
(4) Digital architecture configuration	0.60***	0.61***	0.51***	**0.86**								
(5) Digital orientation[a]	0.87***	0.80***	0.82***	0.80***	**0.85**							
(6) Firm performance	0.23***	0.30***	0.21***	0.30***	0.31***	**0.83**						
(7) Harmony of cross-functional relationships	0.21***	0.44***	0.12***	0.30***	0.31***	0.30***	**0.88**					
(8) Relational embeddedness	0.38***	0.40***	0.34***	0.38***	0.45***	0.27***	0.36***	**0.87**				
(9) Market turbulence	0.35***	0.25***	0.37***	0.28***	0.39***	0.17***	0.05	0.22***	**0.80**			
(10) Technological turbulence	0.50***	0.40***	0.47***	0.38***	0.54***	0.12***	0.53***	0.26***	0.53***	**0.92**		
(11) Firm age	−0.11***	−0.17***	−0.07*	−0.06*	−0.12***	−0.11***	−0.10***	0.06*	−0.10***	−0.12***	–	
(12) Firm size	0.05	0.00	0.08**	0.01	0.05	−0.01	0.04	0.04	0.04	0.01*	0.14***	–

Note: Values in bold on the diagonal are the square root of the average variance extracted (AVE).
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
[a] = Digital orientation is a second-order construct comprising the four dimensions (1)-(4).

factors (VIFs) and found them all below 1.79, lower than the threshold of 10 (Aiken & West, 1991). Next, following Kalnins (2018), we compared correlations and beta coefficients of DO as a second-order construct and the core constructs; the results indicate that multicollinearity is not a concern in our study.

5.1.2. Assessment of potential biases

In line with Armstrong and Overton (1977), we tested our sample for nonresponse bias. We observe no significant differences between early and late respondents and conclude that nonresponse bias does not affect our results. As we included dependent and independent variables in one study questionnaire, we tightly controlled for common method bias and followed recommended procedures (Podsakoff et al., 2003). While designing our survey instrument, we implemented several steps to diminish common method bias. We ensured our study participants' anonymity, adapted our survey design through several pretests, tried to avoid ambiguous wording, considered the order of used constructs within the survey flow, and emphasized that there were no right or wrong answers. Further, we included a three-item marker variable for respondents' preference for the color blue (R. E. Johnson et al., 2011). The marker variable fulfils the criteria recommended by Simmering et al. (2015). The partial correlation marker variable test by Lindell and Whitney (2001) does not reveal significant differences in correlation coefficients and significance levels compared to the partial correlations among the core constructs. Last, we used the comprehensive CFA marker technique developed by Williams et al. (2010) to test for common method bias. We assessed the model fit comparisons among a baseline model, a model with constrained (Method-C) and unconstrained (Method-U) method factor loadings, and fixed-factor correlations (Method-R), concluding that common method bias does not distort the relationships within our measurement model. Table 4 lists the detailed test results. Given the procedural remedies and the statistical test, we are confident that common method bias is not a problem in our study. Triangulating our subjective performance data with objective archival data (see above) also helped diminish the threat of key informant bias (Kumar et al., 1993).

5.2. Hypotheses testing

To examine our hypotheses empirically, we used SEM in Amos 29 (see Table 5). We started by assessing the direct effect of each dimension of DO on firm performance. We find that the direct effect of *digital technology scope* is significantly positive (unstandardized path coefficient = 0.036; p = 0.002); model fit indices are very good (CFI=0.96; TLI=0.95; $\chi 2/df = 3.32$; RMSEA=0.04; SRMR=0.04). Hence, H1a is supported. We also find that the direct effect of *digital capabilities* is significantly positive (unstandardized path coefficient = 0.064; p = 0.000); model fit indices are very good (CFI=0.96; TLI=0.95; $\chi 2/df = 3.35$; RMSEA=0.04; SRMR=0.05). Hence, H1b is supported.

Table 4
Chi-square and model comparison tests with marker variable.

Models	χ2	df	CFI	
1. CFA Model	1203.36	489		0.98
2. Baseline Model	1217.06	501		0.98
3. Method-C	1209.01	500		0.98
4. Method-U	1175.20	470		0.98
5. Method-R	1209.08	521		0.98
χ2-Model comparison tests	**Δ χ2**	**Δ df**	**X2-critical value:**	**0.05**
1. Baseline vs. Method-C	8.05*	1		3.84
2. Method-C vs. Method-U	33.81	30		43.77
3. Method-C vs. Method-R	0.07	21		32.67

* $p < 0.05$.

We find that the direct effect of *digital ecosystem coordination* is significantly positive (unstandardized path coefficient = 0.045; p = 0.000); model fit indices are very good (CFI=0.96; TLI=0.96; $\chi 2/df = 3.31$; RMSEA=0.04; SRMR=0.04). Hence, H1c is supported. Finally, we find that the direct effect of *digital architecture configuration* is significantly positive (unstandardized path coefficient = 0.084; p = 0.000); model fit indices are very good (CFI=0.96; TLI=0.95; $\chi 2/df = 3.35$; RMSEA=0.04; SRMR=0.05). Hence, H1d is supported.

Next, we assess the effect of DO as a second-order construct on firm performance. We find that the path of *DO* is significantly positive (unstandardized path coefficient = 0.098; p = 0.000); model fit indices are very good (CFI=0.95; TLI=0.95; $\chi 2/df = 3.02$; RMSEA=0.04; SRMR=0.05). Hence, H2 is supported.

Given the cross-sectional nature of our dataset, we acknowledge the potential existence of endogeneity issues. To account for endogeneity issues, we conducted a two-stage least squares (2SLS) regression analysis and applied an instrumental variable approach (Bascle, 2008; Sande & Ghosh, 2018) by instrumenting DO with two variables. As instrumental variables, we selected technological intensity—the degree to which a firm classifies itself as a low- or high-tech firm—and industry sector, the latter indicating whether a firm operates in a technological (such as IT or

Table 5
Results of structural equation modeling.

	Dependent variable: Firm Performance									
	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Independent variable	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Digital technology scope	0.036	0.002								
Digital capabilities			0.064	0.000						
Digital ecosystem coordination					0.045	0.000				
Digital architecture configuration							0.084	0.000		
Digital orientation[a]									0.098	0.000
Controls										
Harmony of cr.-func. rel.	0.099	0.000	0.081	0.000	0.104	0.000	0.086	0.000	0.079	0.000
Rel. embed.	0.102	0.000	0.099	0.000	0.099	0.000	0.093	0.000	0.073	0.001
Market turbulence	0.078	0.000	0.084	0.000	0.073	0.000	0.077	0.000	0.071	0.001
Technological turbulence	−0.037	0.006	−0.043	0.001	−0.038	0.003	−0.042	0.002	−0.058	0.000
Firm age	−0.011	0.007	−0.010	0.015	−0.011	0.006	−0.012	0.004	−0.010	0.013
Firm size	0.000	0.865	0.000	0.982	0.000	0.755	0.000	0.948	0.000	0.834
Customer type dummy	0.048	0.252	0.056	0.176	0.056	0.170	0.042	0.313	0.054	0.194
Business type dummy	0.002	0.958	−0.015	0.629	−0.002	0.955	−0.015	0.632	0.018	0.587

Note: Unstandardized path coefficients are reported; Coeff. = Coefficient.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
[a] = Digital orientation is a second-order construct comprising four dimensions; Harmony of cr.-func. rel. = Harmony of cross-functional relationships; Rel. embed. = Relational embeddedness.

telecom) or a different industry sector. The first-stage regressions show that the instruments are valid at the 1 % significance level since they significantly relate to DO but can be assumed to be unrelated to the error term, that is, performance beyond the effects of DO and other controls in our study (Papies et al., 2017). The Sargan statistic and endogeneity tests are both insignificant ($p = 0.66$; $p = 0.06$), indicating that endogeneity is not an issue (Larcker & Rusticus, 2010). Last, we winsorized DO at the 1 % level on both tails on the item level and second-order construct level. The results remain robust compared to our main analysis, suggesting that our findings are not due to highly digital firms.

6. Contributions

6.1. Theoretical contributions

Our study offers at least two significant contributions to research on DO and digital innovation and transformation. First, we considerably extend previous research on DO and its four dimensions by developing and validating a new scale for primary data research. Most earlier studies examining DO apply Kindermann et al.'s (2021) text-based measure and use computer-aided text analysis for scanning different types of communication firms publish. While such content-analytical approaches certainly offer valuable advantages in terms of processing capacity and speed (Morris, 1994; Short et al., 2010), they are bound to contexts in which firms disseminate relevant texts. This limits measurement to a specific type of firm—typically public companies with reporting requirements. Our new DO scale complements previous measurement approaches and is applicable to a broad range of firms. It might, for example, help future research establish how DO implementation unfolds in private firms that do not produce a vast body of publications.

Moreover, our new survey scale will enable researchers to analyze the relationship between DO and a considerably larger set of constructs, such as psychological or behavioral variables. While researchers have used secondary data proxies for many psychologically-based variables (e.g., drawing on annual reports), such measurements are not free of biases. Using the example of CEO narcissism, Wales et al. (2013) note: "Several individuals may be involved in preparing shareholder letters or grooming CEOs for interviews, and further, the content analysis used to develop proxies for CEO prominence may introduce researcher bias" (pp. 1050–1051). Hence, applying primary data measurement approaches can yield critical insights, especially for psychologically-based variables. Such approaches, however, often also require primary data measurement instruments for other model variables. For the case of another strategic orientation, that is, entrepreneurial orientation, Simsek et al. (2010), for instance, use primary data measurement instruments to analyze the "impact of CEO core self-evaluation on the firm's entrepreneurial orientation" (p. 110). Our new survey scale allows similar explorations of DO. In addition to investigating the influence of psychological aspects, related research on entrepreneurial orientation has also examined relationships of this strategic orientation with firm-internal attributes, such as leadership styles. Engelen et al. (2015), for example, found that some transformational leadership behaviors moderate the link between entrepreneurial orientation and firm performance. Again, using our scale now facilitates similar studies on DO. In summary, our new scale provides a complementary, if not superior, instrument to analyze DO's relationship with constructs relating to psychology and firm-internal attributes.

Furthermore, our new survey scale complements secondary data instruments (Kindermann et al., 2021) with a more technology-agnostic measurement approach. Overall, the survey items we developed for the scale do not rely on specific digital technologies. Indeed, we recommend an initial remark providing examples for specific digital technologies when administering the survey to respondents. However, researchers can also easily adjust such examples to changes in the technological landscape. This technology agnosticism has two important implications. We believe our new DO scale and its items will remain valid without requiring updates or extensions and can hopefully support research projects for many years. Moreover, applying our survey scale is not limited to specific technological or industrial contexts since it does not presume the type of digital technology used. This openness widens the scope of contexts and disciplines for the research applicability of our scale. Hence, the new survey instrument will help expand our knowledge of the nomological net surrounding the DO concept.

Second, our study helps advance the theoretical development of the DO concept. In addition to the word lists included in previous DO measures (Kindermann et al., 2021), the new DO scale comprises 19 statement-like, actionable items. We validated these items with practitioners and are confident they can help further fine-tune DO's conceptualization. Moreover, to create a sound basis for our scale development, we significantly extend the understanding of the nature of DO and its performance-enhancing effect. Earlier studies have drawn on the RBV (Barney, 1991) to motivate their prediction of DO's association with performance (e.g., Kindermann et al., 2021). In contrast, we locate DO

farther within the VRIO framework and define it as representing the organization element, more precisely, an organizational configuration. This specification offers two benefits for the future development of the DO concept. First, it helps differentiate DO from related concepts, such as the mere use of technology or combinations of technologies. Put differently, our extended conceptualization clarifies what DO is *not*, thereby underlining its unique value within the landscape of concepts addressing digital innovation and transformation (Osigweh, 1989). Second, we theorize that firms with a high DO focus on creating consistency among their digital resources to reap efficiency gains, which can help researchers shape future studies on this concept. The next step in advancing the concept might be unraveling how such consistency emerges and thus investigating the micro-foundations of the smooth interplay between the four DO dimensions. Exploring factors that induce or interrupt this consistency might also bring forward the concept.

6.2. Opportunities for future research

6.2.1. Opportunities from exploring new research contexts

Our newly developed measure enables further exploration of DO in specific contexts. Smaller firms, such as start-ups, usually have no reporting requirements; thus, their DO is difficult to ascertain. Start-ups often possess limited resources, which might prevent them from developing a DO with all its dimensions. Some dimensions, such as digital ecosystem coordination, may not be relevant at the new venture stage. Similarly, using our newly developed scale can enable scholars to explore DO in the context of small and medium-sized firms or even public administration. Such research might help unravel the specificities of DO and its development across various organizational forms, with a clear focus on individual dimensions. Eventually, researchers might explicitly explore how the emergence of DO unfolds in large, listed firms compared to smaller firms. Such insights can generate a more nuanced picture of how DO manifests in diverse organizational forms.

6.2.2. Opportunities from broadening the nomological net

The new DO scale allows scholars to analyze DO's relationship with concepts usually measured as latent variables (see Fengel et al., 2022). Such explorations can span various levels of analysis. At the individual level, researchers should focus on the cognitive dispositions of key personnel within the firm and, for instance, examine relationships with entrepreneurial opportunity recognition or employees' broader social competence. Research could work to understand whether factors located at the team level (e.g., team creativity) can affect the development of a firm's overall DO. Last, exploring combinations of individual- and team-level concepts that influence or result from DO could be worthwhile. Here, a differentiated view that includes in its relationship analysis both the overall construct of DO and its four dimensions offers a promising direction for further research.

6.2.3. Opportunities from extending empirical approaches

Future research should measure firms' DO in more multi-faceted ways by surveying focal firms' partners within the broader digital ecosystem. This approach could help scholars triangulate individual firms' DO by including measurements from ecosystem firms. In addition, our new scale allows measuring how the DO of a focal firm interacts with that of related ecosystem partners, even if partner firms are not subject to reporting requirements. Again, exploring differences at the level of DO's dimensions might yield rich research perspectives.

6.3. Practical contributions

Our findings offer valuable insights to practitioners who implement DO within their firms. Since the DO concept has also spurred interest in practitioner-oriented outlets (Yokoi, 2023), a discussion of the practical implications of our findings is particularly warranted.

First, our new DO measurement scale provides clearly formulated, actionable statements that may enhance practitioners' understanding of the precise changes required to increase their firms' DO. If practitioners detect deficiencies in their firms' DO, they can use our items as a checklist to discern in which domain and to what extent their firms need improvement. For instance, firms facing serious challenges initiating digital transformation processes could administer our measurement scale to several key employees to find out in which domain further efforts need to be made. It could be the case that a firm has made large investments to purchase digital technologies but does not see corresponding performance gains materialize. In this case, using our scale could reveal that the firm still lacks the architectural configurations (dimension 4) required to leverage the investment potential. Apart from such case-specific applications, we believe, however, that our scale is most useful when administered regularly to trace developments over time. Thereby, firms have a tool to monitor not only deficiencies in their DO but also the fruitfulness of their efforts to mitigate potential weaknesses. Yet, independent of any deficiencies, the technological landscape is constantly changing, with the quest to become digitally oriented continuing indefinitely. As new digital technologies enter the market, new requirements may arise, for instance, for ecosystem coordination. Against this backdrop, regular use of our scale can constitute a powerful tool for firms to monitor the status of their DO.

Second, our extended conceptualization of DO can have important implications for firms planning to intensify their efforts in this strategic orientation. With our emphasis on consistency, we clarify that it does not suffice for firms to invest heavily in new digital technologies to become truly digitally oriented: The changing technology portfolio requires corresponding adjustments, for instance, of a firm's digital capabilities. If firms do not holistically implement DO throughout their organization, the results likely fall short of expectations. Acknowledging the interrelations among the four dimensions of DO can thus become a critical factor in decisions on digitalization investments. Whenever a firm adds digital technology to its technology portfolio, it is essential to determine whether such changes interact, for example, with its ecosystem coordination. If firms neglect the possibility of emerging conflict among these dimensions and fail to recognize the criticality of consistency, they might risk competitive disadvantages, eventually weakening their performance potential.

7. Limitations and conclusion

Despite its merits, our study might be limited in two ways. First, our research used single key informants within the firms to assess the constructs under investigation. While we reduced the risk of biases and compared subjective performance measures with objective data, future research could enrich data points by surveying additional actors for further triangulation. Second, although we could empirically support our hypothesized research model, cross-sectional data analyses might not fully capture causal mechanisms in the performance implications of DO. This issue is prevalent in extant literature due to the difficulty to establish, for instance, exact time lags between independent and dependent variables. Hence, future studies should thoroughly investigate longitudinal data to better establish the direction of relationships. Such analyses might also help uncover whether past firm behaviors influence the present development of firms' DO.

In conclusion, our research offers a newly developed measurement instrument for DO and provides a basis for future empirical research to advance this study's findings. The scale development and its underlying theoretical development advance the cross-disciplinary discourse on digital innovation and digital transformation. Our guiding insights help managers understand and respond to the novel challenges in an increasingly digital era.

CRediT authorship contribution statement

Bastian Kindermann: Writing – original draft, Supervision, Formal

analysis, Conceptualization. **Corinna Vera Hedwig Schmidt:** Methodology, Formal analysis, Data curation. **Florian Fengel:** Writing – original draft, Project administration, Methodology, Formal analysis, Conceptualization. **Steffen Strese:** Supervision, Methodology, Conceptualization.

Appendix A. Sample composition (n = 1,488)

Firm statistics:					
Industry		**Firm size** *(# of employees)*		**Firm age** *(founding year)*	
Automotive	4.2 %	10–49	15.4 %	After 2010	5.1 %
Construction and Real Estate	9.7 %	50–99	26.9 %	2001–2010	13.5 %
BioTech and MedTech	1.2 %	100–249	26.7 %	1990–2000	24.5 %
Chemicals and Pharma	3.0 %	250–499	11.5 %	1980–1989	10.9 %
Electronics	4.5 %	500–999	7.5 %	1970–1979	8.3 %
Energy and Raw Materials	3.2 %	≥ 1,000	12.0 %	1960–1969	6.5 %
Finance and Insurance	2.4 %			1950–1959	4.8 %
Retail and Wholesale	5.8 %			1940–1949	4.6 %
Packaging and Production	4.6 %			1930–1939	2.8 %
IT, Software, and Internet	8.1 %			1920–1929	3.6 %
Consumables and Food	3.7 %			1910–1919	2.4 %
Machine/Plant Manufacturing	11.0 %			1900–1909	2.8 %
Media	1.9 %			Before 1900	10.3 %
Medical and Health	6.7 %				
Public Sector	3.3 %				
Professional Services	6.4 %				
Telecommunication	0.5 %				
Transport and Logistics	4.8 %				
Other	15.2 %				
Customer type		**Business type**		**Tech intensity**	
B2C customers	13.0 %	Producing business	28.0 %	High-tech	34.0 %
B2B customers	65.5 %	Service business	56.3 %	Low-tech	66.0 %
Combination	21.4 %	Combination	15.8 %		
Respondent statistics:					
Respondent role		**Respondent function**		**Respondent age**	
Executive Board	76.2 %	General Management	51.2 %	20 or younger	0.0 %
One below Executive Board	14.9 %	Digital	2.6 %	20–29	2.4 %
Management	9.0 %	Finance	5.2 %	30–39	10.4 %
		R&D	2.6 %	40–49	22.0 %
		IT	4.1 %	50–59	47.4 %
		Logistics	0.7 %	60–69	17.0 %
		Marketing	2.0 %	69 or older	0.7 %
		Operations	2.4 %		
		Law	0.1 %		
		Strategy	18.2 %		
		Sales	7.2 %		
		Other	3.7 %		

Appendix B. Final survey scale for digital orientation (DO)

Dimensions of the DO scale		**Factor loading**
(1) – Digital technology scope		
Scope 1	*Our company uses digital technologies to offer a larger portfolio of products/services.*	**0.86**
Scope 2	*Our company uses digital technologies to add new functionalities to our products/services.*	**0.88**
Scope 3	*Our company uses digital technologies as key asset in expanding our product/service offering.*	**0.85**
Scope 4	*Our company uses digital technologies to create additional value for our customers.*	**0.76**
Scope 5	*Our company generates new revenue streams through the use of digital technologies.*	**0.69**
(2) – Digital capabilities		
Capabilities 1	*The employees of our company understand the potential uses and consequences of digital technologies.*	**0.79**
Capabilities 2	*The employees of our company are enabled to use digital technologies to realize the company's goals.*	**0.81**
Capabilities 3	*The employees of our company overcome potential challenges arising from the use of digital technologies.*	**0.82**
Capabilities 4	*The employees of our company use all functionalities of the digital technologies used in our company to perform their tasks.*	**0.89**
Capabilities 5	*The employees of our company have a technology-savvy mindset.*	**0.70**
(3) – Digital ecosystem coordination		

(*continued on next page*)

(*continued*)

Dimensions of the DO scale		Factor loading
Ecosystem 1	*Our company is able to coordinate digital partner networks that extend our company's range of products/services.*	**0.77**
Ecosystem 2	*Our company successfully integrates external partners with different objectives into our digital ecosystems in order to offer products/services in bundled form.*	**0.93**
Ecosystem 3	*Our company is able to attract partners to our digital ecosystems that create a value-add for us and the entire ecosystem.*	**0.94**
Ecosystem 4	*Our company creates the right incentives for our partners in the digital ecosystem to share their competencies.*	**0.93**
(4) – Digital architecture configuration		
Architecture 1	*In response to digital change, our company continuously adapts organizational structures.*	**0.76**
Architecture 2	*Our company's business processes are adaptable to digital change.*	**0.76**
Architecture 3	*Our company digitizes internal processes with digital technologies (e.g., automation).*	**0.89**
Architecture 4	*Our company uses digital tools to promote and enhance internal collaboration.*	**0.83**
Architecture 5	*Our IT infrastructure and IT systems offer a wide range of potential uses.*	**0.74**
Remark preceding all questions:	Digital technologies include, but are not limited to: smart applications (apps), big data, cloud services, internet of things (IoT), artificial intelligence (AI), mobile internet, software solutions, social media, robotics, (high-speed) Wi-Fi, etc.	

Notes: All items are measured on a 7-point Likert scale ranging from 1 (does not apply at all) to 7 (fully applies); standardized EFA factor loadings are reported

Appendix C. Further measurement scales

Construct	Factor loading
Firm performance (Vorhies & Morgan, 2005)	
Please evaluate the performance of your business over the past 3 years relative to your major competitors in regards to …	
Customer satisfaction	
… customer satisfaction.	**0.84**
… delivering value to your customers.	**0.73**
… delivering what your customers want.	**0.88**
… retaining valued customers.	**0.83**
Market effectiveness	
… market share growth.	**0.90**
… growth in sales revenue.	**0.87**
… acquiring new customers.	**0.83**
… increasing sales to existing customers.	**0.58**
Profitability	
… business unit profitability.	**0.92**
… return on investment (ROI).	**0.96**
… return on sales (ROS).	**0.95**
… reaching financial goals.	**0.84**
Harmony of cross-functional relationships (Song et al., 2000)	
All departments in our organization try their best to carry out the responsibilities and commitments made to each other.	**0.81**
There is a give-and-take relationship among all departments in our organization.	**0.86**
All departments in our organization volunteer information and ideas that they feel affect others.	**0.87**
There is open communication among all departments in our organization.	**0.86**
Relational embeddedness (Lavie et al., 2012)	
Our employees …	
… engage in joint field activities with business partners (e.g., trade shows, marketing campaigns, conferences, coordinated presale, training).	**0.85**
… meet frequently with business partners to work together on joint activities.	**0.91**
… have developed good interpersonal relationships (chemistry) with business partners that facilitate joint activities.	**0.75**
Market turbulence (Jaworski & Kohli, 1993)	
In our kind of business, customers' product preferences change quite a bit over time.	**0.58**
Our customers tend to look for new products all the time.	**0.59**
We witness demand for our products/services from customers who never bought them before.	**0.71**
New customers tend to have product-related needs that differ from those of existing customers.	**0.84**
We cater to many of the same customers that we used to in the past. (R)	**0.81**
Technological turbulence (Jaworski & Kohli, 1993)	
The technology in our industry is changing rapidly.	**0.90**
Technological changes provide big opportunities in our industry.	**0.87**
A large number of new product ideas have been made possible through technological breakthroughs in our industry.	**0.91**
Technological developments in our industry are rather minor. (R)	**0.94**

Note: All items are measured on a 7-point Likert scale ranging from 1 (does not apply at all) to 7 (fully applies); standardized EFA factor loadings are reported; (R) = reverse-coded items were rephrased in German translation

Appendix D. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbusres.2024.114895.

References

Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. *Harvard Business Review, 84*(4), 98–107.

Adner, R. (2017). Ecosystem as structure. *Journal of Management, 43*(1), 39–58. https://doi.org/10.1177/0149206316678451

Aiken, L., & West, S. (1991). *Multiple Regression Testing and Interpreting Interactions*. Sage Publications.

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research, 14*(3), 396–402.

Autio, E., & Thomas, L. D. W. (2020). Value co-creation in ecosystems: Insights and research promise from three disciplinary perspectives. In *Handbook of Digital Innovation, edited by Satish Nambisan, Kalle Lyytinen, and Youngjin Yoo*. Edward Elgar Publishing Limited.

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structure equation models. *Journal of the Academy of Marketing Science, 16*(1), 74–94.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Barney, J. B. (1995). Looking inside for competitive advantage. *Academy of Management Perspectives, 9*(4), 49–61. https://doi.org/10.5465/ame.1995.9512032192

Barney, J. B. (2011). *Gaining and Sustaining Competitive Advantage* (4th ed.). Pearson: Prentice-Hall.

Barney, J. B., & Mackey, A. (2018). Monopoly profits, efficiency profits, and teaching strategic management. *Academy of Management Learning & Education, 17*(3), 359–373. https://doi.org/10.5465/amle.2017.0171

Bascle, G. (2008). Controlling for endogeneity with instrumental variables in strategic management research. *Strategic Organization, 6*(3), 285–327.

Bendig, D., Schulz, C., Theis, L., & Raff, S. (2023). Digital orientation and environmental performance in times of technological change. *Technological Forecasting and Social Change, 188*, Article 122272. https://doi.org/10.1016/j.techfore.2022.122272

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly, 37*(2), 471–482.

Brislin, R. (1980). Translation and content analysis of oral and written materials. In *Handbook of Cross-cultural Psychology* (pp. 389–444). Allyn & Bacon.

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). The Guilford Press.

Brynjolfsson, E., & Hitt, L. (1996). Paradox lost? Firm-level evidence on the returns to information systems spending. *Management Science, 42*(4), 541–558. https://doi.org/10.1287/mnsc.42.4.541

Churchill, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research, 16*(1), 64–73.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Collis, D. J. (1994). Research note: How valuable are organizational capabilities? *Strategic Management Journal, 15*, 143–152.

Day, G. S. (1994). The capabilities of market-driven organizations. *Journal of Marketing, 58*(4), 37.

Deist, M. K., McDowell, W. C., & Bouncken, R. B. (2023). Digital units and digital innovation: Balancing fluidity and stability for the creation, conversion, and dissemination of sticky knowledge. *Journal of Business Research, 161*, Article 113827.

DeVellis, R. (2012). *Scale Development: Theory and Applications* (3rd ed.). Sage Publications.

Dewan, S., Shi, C., & Gurbaxani, V. (2007). Investigating the risk-return relationship of information technology investment: Firm-level empirical analysis. *Management Science, 53*(12), 1829–1842. https://doi.org/10.1287/mnsc.1070.0739

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review, 31*(3), 659–669.

Dhyne, E., Konings, J., Van den bosch, J., & Vanormelingen, S. (2021). The Return on Information Technology: Who Benefits Most? *Information Systems Research, 32*(1), 194–211. DOi: 10.1287/isre.2020.0960.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review, 23*(4), 660–679. https://doi.org/10.5465/AMR.1998.1255632

Engelen, A., Gupta, V., Strenger, L., & Brettel, M. (2015). Entrepreneurial orientation, firm performance, and the moderating role of transformational leadership behaviors. *Journal of Management, 41*(4), Article 4. https://doi.org/10.1177/0149206312455244

Engelen, A., Kube, H., Schmidt, S., & Flatten, T. C. (2014). Entrepreneurial orientation in turbulent environments: The moderating role of absorptive capacity. *Research Policy, 43*(8), 1353–1369.

Fengel, F.-M., Kindermann, B., & Strese, S. (2022). The Dual Imperative of Digital Transformers – The Relationship between a Firm's Digital Orientation and Innovation Ambidexterity. *ECIS 2022 Research Papers*. https://aisel.aisnet.org/ecis2022_rp/95.

Fornell, C., & Bookstein, F. L. (1982). Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research, 19*(4), 440–452.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Fürstenau, D., Baiyere, A., Schewina, K., Schulte-Althoff, M., & Rothe, H. (2023). Extended generativity theory on digital platforms. *Information Systems Research*. https://doi.org/10.1287/isre.2023.1209

Gatignon, H., & Xuereb, J.-M. (1997). Strategic orientation of the firm and new product performance. *Journal of Marketing Research (JMR), 34*(1), 77–90.

Ghazawneh, A., & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: The boundary resources model. *Information Systems Journal, 23*(2), 173–192. https://doi.org/10.1111/j.1365-2575.2012.00406.x

Grover, V., & Saeed, K. A. (2004). Strategic orientation and performance of internet-based businesses. *Information Systems Journal, 14*(1), 23–42. https://doi.org/10.1111/j.1365-2575.2004.00161.x

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *Multivariate Data Analysis* (7th ed.). Pearson.

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of Management Studies, 58*(5), 1159–1197. https://doi.org/10.1111/joms.12639

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986–1014. https://doi.org/10.5465/amr.1995.9512280033

Henderson, J. C., & Venkatraman, H. (1999). Strategic alignment: Leveraging information technology for transforming organizations. *IBM Systems Journal, 38*(2.3), 472–484. https://doi.org/10.1147/SJ.1999.5387096

Henfridsson, O., Nandhakumar, J., Scarbrough, H., & Panourgias, N. (2018). Recombination in the open-ended value landscape of digital innovation. *Information and Organization, 28*(2), 89–100. https://doi.org/10.1016/j.infoandorg.2018.03.001

Hinings, B. (2018). Why should we bother? What are configurations for? *Strategic Organization, 16*(4), 499–509. https://doi.org/10.1177/1476127018804796

Hinings, B., Gegenhuber, T., & Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization, 28*(1), 52–61. https://doi.org/10.1016/j.infoandorg.2018.02.004

Homburg, C., & Pflesser, C. (2000). A multiple-layer model of market-oriented organizational culture: Measurement issues and performance outcomes. *Journal of Marketing Research, 37*(4), 449–462.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55.

Hund, A., Wagner, H.-T., Beimborn, D., & Weitzel, T. (2021). Digital innovation: Review and novel perspective. *The Journal of Strategic Information Systems, 30*(4), Article 101695. https://doi.org/10.1016/j.jsis.2021.101695

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal (John Wiley & Sons, Inc.), 39*(8), 2255–2276. https://doi.org/10.1002/smj.2904

Jaworski, B. J., & Kohli, A. K. (1993). Market orientation: Antecedents and consequences. *Journal of Marketing, 57*(3), 53–70.

Johnson, R. E., Rosen, C. C., & Djurdjevic, E. (2011). Assessing the impact of common method variance on higher order multidimensional constructs. *Journal of Applied Psychology, 96*(4), 744–761.

Johnson, R. L., & Morgan, G. B. (2016). *Survey Scales: A Guide to Development, Analysis, and Reporting* (1st ed.). The Guilford Press.

Kalnins, A. (2018). Multicollinearity: How common factors cause Type 1 errors in multivariate regression. *Strategic Management Journal, 39*(8), 2362–2385.

Kapoor, R. (2018). Ecosystems: Broadening the locus of value creation. *Journal of Organization Design, 7*(1), 1. https://doi.org/10.1186/s41469-018-0035-4

Karhu, K., Gustafsson, R., & Lyytinen, K. (2018). Exploiting and defending open digital platforms with boundary resources: Android's five platform forks. *Information Systems Research, 29*(2), 479–497. https://doi.org/10.1287/isre.2018.0786

Khin, S., & Ho, T. C. (2018). Digital technology, digital capability and organizational performance: A mediating role of digital innovation. *International Journal of Innovation Science, 11*(2), 177–195. https://doi.org/10.1108/IJIS-08-2018-0083

Kim, D., & Lee, R. P. (2010). Systems collaboration and strategic collaboration: Their impacts on supply chain responsiveness and market performance: Systems collaboration and strategic collaboration. *Decision Sciences, 41*(4), 955–981.

Kim, J., & Makadok, R. (2021). Unpacking the "O" in VRIO: The role of workflow interdependence in the loss and replacement of strategic human capital. *Strategic Management Journal*, *n/a*(n/a). DOi: 10.1002/smj.3358.

Kindermann, B., Beutel, S., Garcia de Lomana, G., Strese, S., Bendig, D., & Brettel, M. (2021). Digital orientation: Conceptualization and operationalization of a new strategic orientation. *European Management Journal, 39*(5), 645–657. https://doi.org/10.1016/j.emj.2020.10.009

Kindermann, B., Salge, T. O., Wentzel, D., Flatten, T. C., & Antons, D. (2022). Dynamic capabilities for orchestrating digital innovation ecosystems: Conceptual integration and research opportunities. *Information and Organization, 32*(3), Article 100422. https://doi.org/10.1016/j.infoandorg.2022.100422

Kindermann, B., Schmidt, C. V. H., Pulm, J., & Strese, S. (2022). The double-edged sword of entrepreneurial orientation: A configurational perspective on failure in newly public firms. *Entrepreneurship Theory and Practice.* , Article 10422587221111724. https://doi.org/10.1177/10422587221111724

Kindermann, B., Wentzel, D., Antons, D., & Salge, T.-O. (2023). Conceptual contributions in marketing scholarship: Patterns, mechanisms, and rebalancing options. *Journal of Marketing, 00222429231196122*. https://doi.org/10.1177/00222429231196122
Klassen, R. D., & Jacobs, J. (2001). Experimental comparison of Web, electronic and mail survey technologies in operations management. *Journal of Operations Management, 19*(6), 713–728.
Kohli, R., & Melville, N. P. (2019). Digital innovation: A review and synthesis. *Information Systems Journal, 29*(1), 200–223. https://doi.org/10.1111/isj.12193
Kumar, N., Stern, L. W., & Anderson, J. C. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal, 36*, 1633–1651.
Lamarre, E., Smaje, K., & Zemmel, R. (2023). *How to implement an AI and digital transformation | McKinsey*. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/rewired-to-outcompete#/.
Larcker, D. F., & Rusticus, T. O. (2010). On the use of instrumental variables in accounting research. *Journal of Accounting and Economics, 49*(3), 186–205.
Lavie, D., Haunschild, P. R., & Khanna, P. (2012). Organizational differences, relational mechanisms, and alliance performance. *Strategic Management Journal, 33*(13), 1453–1479. https://doi.org/10.1002/smj.1987
Lee, J., Elbashir, M. Z., Mahama, H., & Sutton, S. G. (2014). Enablers of top management team support for integrated management control systems innovations. *International Journal of Accounting Information Systems, 15*(1), 1–25.
Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly, 35*(1), 147–168. https://doi.org/10.2307/23043493
Li, G., & Shao, Y. (2023). How do top management team characteristics affect digital orientation? Exploring the internal driving forces of firm digitalization. *Technology in Society, 74*, Article 102293. https://doi.org/10.1016/j.techsoc.2023.102293
Li, Z., Xie, W., Wang, Z., Wang, Y., & Huang, D. (2023). Antecedent configurations and performance of business models of intelligent manufacturing enterprises. *Technological Forecasting and Social Change, 193*, Article 122550. https://doi.org/10.1016/j.techfore.2023.122550
Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology, 86*(1), 114–121.
Liu, Y., Guo, M., Han, Z., Gavurova, B., Bresciani, S., & Wang, T. (2023). Effects of digital orientation on organizational resilience: A dynamic capabilities perspective. *Journal of Manufacturing Technology Management, 35*(2), 268–290. https://doi.org/10.1108/JMTM-06-2023-0224
Lyytinen, K., Yoo, Y., & Boland, R. J. (2016). Digital product innovation within four classes of innovation networks. *Information Systems Journal, 26*(1), 47–75. https://doi.org/10.1111/isj.12093
MacInnis, D. J. (2011). A framework for conceptual contributions in marketing. *Journal of Marketing, 75*(4), 136–154. https://doi.org/10.1509/jmkg.75.4.136
MacKenzie, S. B., Podsakoff, P. M., & Podsakoff, N. P. (2011). Construct measurement and validation procedures in mis and behavioral research: Integrating new and existing techniques. *MIS Quarterly, 35*(2), 293–A5. https://doi.org/10.2307/23044045
Maedche, A. (2016). Interview with Michael Nilles on "What makes leaders successful in the age of the digital transformation?". *Business & Information Systems Engineering, 58*(4), 287–289. https://doi.org/10.1007/s12599-016-0437-1
Majchrzak, A., & Markus, M. L. (2013). Technology affordances and constraints in management information systems (MIS). In E. Kessler (Ed.), *Encyclopedia of Management Theory* (pp. 832–836). Sage Publications.
Maurer, J. D., Creek, S. A., Allison, T. H., Bendickson, J. S., & Sahaym, A. (2023). Affiliation rhetoric and digital orientation in crowdfunding appeals. *Technological Forecasting and Social Change, 190*, Article 122441. https://doi.org/10.1016/j.techfore.2023.122441
Miller, D. (1996). Configurations Revisited. *Strategic Management Journal, 17*(7), 505–512. https://doi.org/10.1002/(SICI)1097-0266(199607)17:7<505::AID-SMJ852>3.0.CO;2-I
Mithas, S., & Rust, R. T. (2016). How information technology strategy and in- vestments influence firm performance: Conjecture and empirical evidence. *MIS Quarterly, 40*(1), 223–246.
Mithas, S., Tafti, A., & Mitchell, W. (2013). How a Firm's competitive environment and digital strategic posture influence digital business strategy. *MIS Quarterly, 37*(2), 511–536.
Morris, R. (1994). Computerized content analysis in management research: A demonstration of advantages & limitations. *Journal of Management, 20*(4), 903–931. https://doi.org/10.1177/014920639402000410
Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. *MIS Quarterly, 41*(1), 223–238.
Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes, 103773-103773 *Research Policy, 48*(8). https://doi.org/10.1016/j.respol.2019.03.018.
Nasiri, M., Saunila, M., & Ukko, J. (2022). Digital orientation, digital maturity, and digital intensity: Determinants of financial success in digital transformation settings. *International Journal of Operations & Production Management, 42*(13), 274–298. https://doi.org/10.1108/IJOPM-09-2021-0616
Netemeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling procedures: Issues and applications*. Sage Publications.
Noble, C. H., Sinha, R. K., & Kumar, A. (2002). Market orientation and alternative strategic orientations: A longitudinal assessment of performance implications. *Journal of Marketing, 66*(4), 25–39.
Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). McGraw-Hill Book Company.
Opland, L. E., Pappas, I. O., Engesmo, J., & Jaccheri, L. (2022). Employee-driven digital innovation: A systematic review and a research agenda. *Journal of Business Research, 143*, 255–271. https://doi.org/10.1016/j.jbusres.2022.01.038
Osigweh, C. A. B. (1989). Concept fallibility in organizational science. *Academy of Management Review, 14*(4), 579–594. https://doi.org/10.5465/AMR.1989.4308390
Papies, D., Ebbes, P., & van Heerde, H. J. (2017). Addressing endogeneity in marketing models. In P. S. H. Leeflang, J. E. Wieringa, T. H. A. Bijmolt, & K. H. Pauwels (Eds.), *Advanced methods for modeling markets* (pp. 581–627). Springer International Publishing.
Partanen, J., Kauppila, O., Sepulveda, F., & Gabrielsson, M. (2018). Turning strategic network resources into performance: The mediating role of network identity of small- and medium-sized enterprises. *Strategic Entrepreneurship Journal, 14*(2), 178–197.
Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903.
Quinton, S., Canhoto, A., Molinillo, S., Pera, R., & Budhathoki, T. (2018). Conceptualising a digital orientation: Antecedents of supporting SME performance in the digital economy. *Journal of Strategic Marketing, 26*(5), 427–439.
Raffaelli, R., Glynn, M. A., & Tushman, M. (2019). Frame flexibility: The role of cognitive and emotional framing in innovation adoption by incumbent firms. *Strategic Management Journal, 40*(7), 1013–1039. https://doi.org/10.1002/smj.3011
Reinartz, W., Haenlein, M., & Henseler, J. (2009). An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing, 26*(4), 332–344.
Saesen, J., Schmidt, C. V. H., & Strese, S. (2024). The more, the better: The influence of overconfident CEOs on their firms' digital orientation. *Journal of Business Research, 183*, 114809. https://doi.org/10.1016/j.jbusres.2024.114809
Sande, J. B., & Ghosh, M. (2018). Endogeneity in survey research. *International Journal of Research in Marketing, 35*(2), 185–204.
Sebastian, I., Ross, J., Beath, C., Mocker, M., Moloney, K., & Fonstad, N. (2017). How big old companies navigate digital transformation. *MIS Quarterly Executive, 16*(3), 197–213.
Short, J. C., Broberg, J. C., Cogliser, C. C., & Brigham, K. H. (2010). Construct validation using computer-aided text analysis (CATA): An illustration using entrepreneurial orientation. *Organizational Research Methods, 13*(2), 320–347. https://doi.org/10.1177/1094428109335949
Sia, S. K., Soh, C., & Weill, P. (2016). How DBS bank pursued a digital business strategy. *MIS Quarterly Executive, 15*(2), 105–121.
Simmering, M. J., Fuller, C. M., Richardson, H. A., Ocal, Y., & Atinc, G. M. (2015). Marker variable choice, reporting, and interpretation in the detection of common method variance: A review and demonstration. *Organizational Research Methods, 18*(3), 473–511.
Simsek, Z., Heavey, C., & Veiga, J. (Jack) F. (2010). The impact of CEO core self-evaluation on the firm's entrepreneurial orientation. *Strategic Management Journal, 31*(1), 110–119. DOi: 10.1002/smj.800.
Song, X. M., Xie, J., & Dyer, B. (2000). Antecedents and consequences of marketing managers' conflict-handling behaviors. *Journal of Marketing, 64*(1), 50–66. https://doi.org/10.1509/jmkg.64.1.50.17989
Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal, 48*(3), 450–463.
Van Alstyne, M. W., Parker, G. G., & Choudary, S. P. (2016). Pipelines, platforms, and the new rules of strategy. *Harvard Business Review, 94*(4), 54–62.
Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003
Vorhies, D. W., & Morgan, N. A. (2005). Benchmarking marketing capabilities for sustainable competitive advantage. *Journal of Marketing, 69*(1), 80–94.
Wales, W., Kraus, S., Filser, M., Stöckmann, C., & Covin, J. G. (2021). The status quo of research on entrepreneurial orientation: Conversational landmarks and theoretical scaffolding. *Journal of Business Research, 128*, 564–577. https://doi.org/10.1016/j.jbusres.2020.10.046
Wales, W., Patel, P. C., & Lumpkin, G. T. (2013). In pursuit of greatness: CEO narcissism, entrepreneurial orientation, and firm performance variance. *Journal of Management Studies, 50*(6), 1041–1069. https://doi.org/10.1111/joms.12034
Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Jensen, T. B. (2021). Unpacking the difference between digital transformation and it-enabled organizational transformation. *Journal of the Association for Information Systems, 22*(1), 102–129. https://doi.org/10.17705/1jais.00655
Wiklund, J., & Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal, 24*(13), 1307–1314. https://doi.org/10.1002/smj.360
Williams, L. J., Hartman, N., & Cavazotte, F. (2010). Method variance and marker variables: A review and comprehensive CFA marker technique. *Organizational Research Methods, 13*(3), 477–514.
Xu, M., Yang, Z., Lin, Y.-E., & Li, G. (2024). Maturity mismatched investment, digital financial inclusion, and digital orientation: Evidence from China. *International Review of Financial Analysis, 91*, Article 102957. https://doi.org/10.1016/j.irfa.2023.102957
Yokoi, T. (2023). *Leveraging Digital Towards Improving Sustainability*. Forbes. https://www.forbes.com/sites/tomokoyokoi/2023/03/02/leveraging-digital-towards-improving-sustainability/.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). The new organizing logic of digital innovation: An agenda for information systems research. *Information Systems Research, 21*(4), 724–735. https://doi.org/10.1287/isre.1100.0322

Zhou, K., Yim, C. K. (Bennett), & Tse, D. K. (2005). The Effects of Strategic Orientations on Technology- and Market-Based Breakthrough Innovations. *Journal of Marketing, 69*(2), 42–60.

Zittrain, J. (2007). Saving the Internet. *Harvard Business Review, 85*(6), 49–59.

Bastian Kindermann. Bastian Kindermann is an Assistant Professor of Technology Management at TU Dortmund University, Germany. He completed his PhD at RWTH Aachen University, Germany, and gained practical experience in the South American retail sector. In his research, he explores the role of strategic orientations in digital innovation. His research has been published in various outlets, including *Journal of Marketing*, *Entrepreneurship Theory and Practice*, *Journal of Management Studies*, *Journal of Business Research*, *Information and Organization*, *European Management Journal* and *Business Strategy and the Environment*.

Corinna Vera Hedwig Schmidt. Corinna V. H. Schmidt is an Assistant Professor of Technology Management at TU Dortmund University, Germany. She received her doctoral degree from TU Dortmund University, and gained practical experience in strategy consultancy and entrepreneurship. Her research examines positive organizational behavior, sustainability, and entrepreneurship, and has been published in leading journals, including *Entrepreneurship Theory and Practice*, *Journal of Organizational Behavior, Journal of Business Research,* and *Business Strategy and the Environment*. She has presented her research at leading international conferences, including the Annual Meeting of the Academy of Management and the Babson College Entrepreneurship Research Conference.

Florian Fengel. Florian Fengel is a Research Associate of Technology Management at TU Dortmund University, Germany. In his research he focuses on digital orientation and its strategic outcomes. He presented his research at conferences such as the Annual Meeting of the Academy of Management as well as the European Conference on Innovation and Entrepreneurship.

Steffen Strese. Steffen Strese is Professor of Innovation Management and Co-director of the Institute of Technology, Innovation, and Entrepreneurship at TU Dortmund University, Germany. He received his doctoral degree from RWTH Aachen University and is co-founder of a technology-based startup. His research focuses on innovation management and entrepreneurship. He has published his work in academic journals such as *Journal of Business Venturing, Entrepreneurship Theory and Practice, Journal of Marketing, and Journal of Product Innovation Management.*