

More capable, more innovative? An empirical inquiry into the effects of dynamic managerial capabilities on digital firms' innovativeness

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Abstract

Purpose – Managers play a critical role in shaping the development of firms due to the risky and long-term nature of innovation. Although the managerial effect on strategic change has long been factored into organizational theories, scholars still lack a complete understanding of the specific managerial capabilities that drive innovation in today's digital economy. The present study builds on dynamic managerial capabilities theory to close this research gap. The paper proposes managers' dynamic capabilities and their three underlying drivers – managerial human capital, social capital, and cognition – as a direct antecedent to digital firms' innovativeness.

Design/methodology/approach – The study draws on survey data from German Industry 4.0 manufacturing firms, which were analyzed using regression analysis.

Findings – The results confirm managers' dynamic capabilities as facilitators of innovation. In contrast to previous research on nondigital industries, the findings demonstrate that only the complete portfolio of managers' dynamic capabilities promotes innovativeness in digital firms. The study provides evidence for the importance of dynamic managerial capabilities in the digital economy yet contradicts previous research on nondigital industries related to the advantageousness of managers' human capital, social capital, and cognition for innovation.

Originality/value – The study contributes to the literature by being the first to holistically test the effects of dynamic managerial capabilities on innovation in digital firms. The results offer a nuanced account of managers' dynamic capabilities, thereby expanding dynamic managerial capabilities theory to the digital economy.

Keywords Digital transformation, Dynamic managerial capabilities, Human capital, Innovation, Managerial cognition, Social capital

Paper type Research paper

1. Introduction

The digital transformation of the economy continues to cause fundamental shifts in organizations' strategies due to the continuous emergence of new technologies (Bouncken *et al.*, 2021; Wallin *et al.*, 2022). Consequently, increasing competitive pressures force firms in digital industries to adapt their formerly valuable resources and capabilities to the transformed decision-making context and develop new strategies that simultaneously explore and exploit emerging commercial opportunities (Chen, 2017; Greenstein *et al.*, 2013; Matt *et al.*, 2015).

Notwithstanding early consideration of the managerial role in shaping organizational change, research has long neglected the pivotal role of individual managers and their



capabilities for innovation (Augier and Teece, 2009; Felin and Foss, 2005). This research gap is particularly alarming in the context of the digital economy, in which the individual-level capabilities of managers have become increasingly important to sustain competitive advantages (Teece, 2007a, b).

Building on dynamic managerial capabilities theory (Adner and Helfat, 2003), the research model posits that heterogeneity at the individual managerial level matters for organizational outcomes (Foss and Foss, 2000). Managers' dynamic capabilities comprise their human capital, social capital, and cognition and determine the managerial ability to "build, integrate, and reconfigure organizational resources and competences" (Adner and Helfat, 2003, p. 1012). Accordingly, individual managers drive innovation by exploring new ideas themselves or managing creativity in the organization. Dynamic managerial capabilities consequently constitute the individual-level capabilities required to sustain innovative activities, and different levels of firm innovativeness may hence originate from heterogeneity in the dynamic capabilities of particular managers (Adner and Helfat, 2003; Helfat and Martin, 2015a).

The study aims to close two main research gaps. First, managers are confronted with a fundamentally transformed decision-making context in digital industries where proven paths to success no longer apply (Wrede *et al.*, 2020; Wrede and Dauth, 2020). Therefore, empirical research must test whether individual managers also play a critical role in digital industries by promoting innovation, as demonstrated by earlier studies (e.g. Smith and Tushman, 2005; Tripsas and Gavetti, 2000). Second, previous studies primarily analyze top managers or top management teams (e.g. Barker and Mueller, 2002; Manev and Elenkov, 2005). Due to an ongoing shift toward flatter hierarchies (Rajan and Wulf, 2006), decision-making is influenced not only by top managers but also by middle managers, as the latter are in an increasingly influential position to shape the creation, development, and deployment of assets (Lee and Teece, 2012; Teece, 2016).

While an in-depth understanding of the managerial role in promoting innovation is required to gain more insights into the black box of decision-making underlying competitive advantages, it remains largely unclear whether and to what extent dynamic managerial capabilities and their three underpinnings influence firms' innovativeness in digital industries. From an academic perspective, this microlevel understanding is needed to determine whether current strategic management theories need to be adapted to the digital business environment. From a practical perspective, these findings may have significant implications for staffing management positions and determining how to develop managerial capabilities to drive innovation. The present study aims to advance the literature by answering the following three interrelated research questions:

RQ1. What role do dynamic managerial capabilities occupy in digital firms?

RQ2. How do the three underpinnings of dynamic managerial capabilities (i.e. managerial human capital, social capital, and cognition) affect digital firms' innovativeness individually?

RQ3. How do dynamic managerial capabilities jointly affect digital firms' innovativeness?

The paper is structured into six sections. Section 2 presents the theoretical background by defining innovation in the research context and outlining the concept of dynamic managerial capabilities and its three underpinnings. The research model and hypotheses are subsequently derived in Section 3. Next, Section 4 describes the research methodology employed, and Section 5 presents the empirical results. Section 6 discusses the findings and their theoretical and practical implications. The article concludes with an assessment of limitations and possible pathways for future researchers.

2. Theoretical background

2.1 *Innovation and Industry 4.0*

Due to largely unforeseeable and uncontrollable rates of competitive, technological, and societal shifts, constant innovation has become a central source of sustained competitive advantages in today's digital markets (Damanpour and Schneider, 2006; Weill and Woerner, 2015). Therefore, focusing solely on improving efficiency and effectivity is no longer sufficient to ensure organization survival in the long run (Adner and Kapoor, 2010; Hacklin *et al.*, 2018).

Innovations generally refer to innovation processes or outcomes (Drucker, 1985; McAdam and McClelland, 2002). The innovation process entails the development of new products or services, processes, or ways to capture value from existing or new value offerings (Damanpour, 1991; Gupta *et al.*, 2007; Ortt and van der Duin, 2008). An innovation may recombine or imitate existing ideas but must be new to the focal firm (Ojasalo, 2008; Van de Ven, 1986). The primary goal of the innovation process is to sustain competitive advantages or develop new competitive advantages by commercializing latent market opportunities (Covin and Miles, 1999; Ortt and van der Duin, 2008). Organizations consequently pursue innovation due to changes in the internal or external environment or as a preventive measure to shape their environment (Alegre *et al.*, 2006; Amara *et al.*, 2008; Damanpour, 1991).

The study examines the relationship between dynamic managerial capabilities and innovation in the context of Industry 4.0. The German government coined the term *Industry 4.0* in reference to the Fourth Industrial Revolution, which triggered various information technology-driven changes in manufacturing firms' business models (Ghobakhloo, 2020; Lasi *et al.*, 2014). At the core of Industry 4.0 is the implementation of the Internet of Things in the entire value chain. These *smart factories* aim to increase the efficiency, flexibility, decentralization, and individualization of the entire value chain (Lu, 2017; Wang *et al.*, 2015; Weyer *et al.*, 2015). The realization of Industry 4.0 thus allows firms to confront the challenges of today's digital economy, such as shortened product lifecycles and demand for customized products (Centobelli *et al.*, 2022; Naeem and Di Maria, 2021; Weyer *et al.*, 2015). Therefore, Industry 4.0 manufacturing firms have been at the apex of the digital economy and continue to take a leading role in implementing digital technologies in their business models (Breznitz, 2014; Kagermann *et al.*, 2013). For these reasons, the German Industry 4.0 sector serves as an appropriate setting in light of the proposed research question.

2.2 *Dynamic managerial capabilities*

The concept of dynamic managerial capabilities offers a fruitful perspective on innovation by explicitly relating managerial capabilities to organizational behavior in dynamic environments (Adner and Helfat, 2003). Dynamic capabilities originate from the interplay between managers' innate abilities and past experiences (Beck and Wiersema, 2013). More specifically, managers are responsible for coordinating and developing company assets, orchestrating complementary and cospecialized assets, developing new business models, and making critical investment decisions to drive innovation (Adner and Helfat, 2003; Helfat *et al.*, 2007). These managerial decisions consequently function as boundary conditions for company behavior, as they – at least in the short term – restrict the number of feasible pathways for corporate and competitive strategies (Beck and Wiersema, 2013; Helfat and Martin, 2015b). Therefore, dynamic managerial capabilities are the foundation of sustained competitive advantages and cause performance differences between firms (Helfat and Martin, 2015b).

2.2.1 *Managerial human capital.* The first component of dynamic managerial capabilities, managerial human capital, comprises managers' knowledge, expertise, and competencies. Human capital develops through informal training, such as work experience and trial-and-error learning, and formal training, such as education (Bailey and Helfat, 2003).

The present study distinguishes between two dimensions of managerial human capital explicitly related to innovation (Subramaniam and Youndt, 2005). First, entrepreneurial skills entail all skills related to the overall concept of corporate entrepreneurship, including both internally and externally oriented activities such as intrapreneurship and exopreneurship, respectively (Christensen, 2004, 2005). These skills determine the managerial ability to implement innovative ideas by identifying new markets, customers, and resources or combining these factors through innovative business models (Ireland *et al.*, 2001; Hornsby *et al.*, 1993; Smith and Gregorio, 2017). As these managers are vigilant of discontinuities within and beyond the firm's environment, managers equipped with an entrepreneurial skillset enable firms to develop new competitive advantages (Teece, 2007a). Especially in today's highly dynamic and competitive environments, an entrepreneurial skillset is indispensable for organizational survival (Smith and Gregorio, 2017). Second, human capital entails the leadership skills required to exploit entrepreneurial opportunities. Leadership skills consequently form the basis of current and future competitive advantages (Hitt *et al.*, 2017; Ireland *et al.*, 2001). Efficient management requires an ambidextrous skillset, ensuring the simultaneous exploitation of existing commercial potentials and the exploration of new opportunities (March, 1991). Therefore, neither leadership skills nor entrepreneurial skills are generally superior. They are both indispensable for promoting innovation in the digital marketplace.

2.2.2 Managerial social capital. The second component of dynamic managerial capabilities, managerial social capital, covers the various facets inherent to specific social contexts, such as shared views and social norms. The unique composition of the network promotes individual and collective action within socially defined boundaries (Adler and Kwon, 2000, 2002; Tsai and Ghoshal, 1998). Research has repeatedly demonstrated that social capital promotes innovation by improving the exchange of information, knowledge, and resources between actors (Gant *et al.*, 2002; Johnson *et al.*, 2013; Tsai and Ghoshal, 1998).

Following the most recent research on dynamic managerial capabilities (Heubeck and Meckl, 2021), social capital is analyzed from an internal perspective. Accordingly, managerial social capital is the goodwill that stems from formal and informal ties within an organization. Managers utilize their social capital to access the information required for their decision-making and mobilize the necessary resources to execute these decisions (Helfat and Martin, 2015b; Kor and Mesko, 2013).

The present study builds on Nahapiet and Ghoshal's (1998) tripartite division to conceptualize social capital. First, the structural dimension embodies the features of the particular social structure. This dimension describes which actors form these social systems and how they communicate. Second, the relational dimension reflects the interpersonal relationships within a social network. This form of social capital includes the various facets of historically developed relationships between people and ultimately shapes individual and collective behavior. Last, the cognitive dimension refers to the psychological features of the social network. This form of social capital establishes shared belief systems. Thus, the cognitive dimension of social capital is conducive to a common understanding between different actors, thereby promoting the realization of collective objectives (Granovetter, 1992; Nahapiet and Ghoshal, 1998).

2.2.3 Managerial cognition. Managerial cognition is the third and final dimension of dynamic managerial capabilities. This "cognitive capital" (Helfat and Martin, 2015a, p. 427) comprises two highly individual components that determine how information is processed. First, managers utilize distinct cognitive processes to recognize, absorb, and retain information (American Psychological Association, 2019; Ashcraft, 2006; Colman, 2015). Within these cognitive processes, managers also draw on cognitive structures. The historically developed mental representations of different choice situations increase the cognitive efficiency of managers by making sense of information. Thus, managers differ in their perceptions of

strategic issues due to differences in their cognitive capital (Schneider and Angelmar, 1993; Walsh, 1995).

Strategic decision-making is determined by how boundedly-rational managers interpret information from their firm's internal and external environment (Kaplan, 2011; Rouleau, 2005; Simon, 1976). Information processing generally occurs in two opposing ways. Managers are habitual "cognitive satisficers" (Corner *et al.*, 1994, p. 298) who expend their limited cognitive resources only in the most novel or challenging situations (March and Simon, 1958; Thorngate, 1980). Managers relate new information to past experiences in comparable situations in the dominant automatic processing mode. Therefore, the automatic processing mode primarily aims to increase cognitive efficiency. Conversely, information processing is tailored to the present situation in the controlled processing mode. Hence, the controlled processing mode necessitates the expenditure of limited cognitive capacities to enable a systematic and nonautomatic processing of information (Kahneman, 2012; Walsh, 1995).

3. Linking dynamic managerial capabilities to digital firms' innovativeness

The hypothesis model is deduced using the economic network approach (Håkansson, 2014, 2015; Håkansson and Snehota, 1995). This model proposes that innovation occurs in a network composed of three key elements: actors, activities, and resources (Oerlemans *et al.*, 1998). The model hence provides a holistic lens that explicitly links innovation to the networks in which it develops.

Taking a dynamic managerial capabilities perspective, the research model posits that managers are the main actors in this network, as they possess the necessary power over the firm's asset portfolio. Nevertheless, managers' knowledge of the asset portfolio is incomplete, while assets within the economic network are heterogeneously distributed and not freely transferrable between actors. Consequently, the mere possession of assets is insufficient to unleash their full potential. Managers need to understand how to employ the firm-specific asset portfolio, which requires constant learning and knowledge sharing within the economic network (Alchian and Demsetz, 1972; Håkansson, 1993).

In this study, innovation is viewed primarily as a firm-internal process whereby managerial knowledge, judgments, and expectations determine how managers transform their firm's asset portfolio into innovations (Dosi, 1988; Oerlemans *et al.*, 1998). External actors and their assets can play a role in this process (von Hippel, 2016). However, management's judgments, which originate from the interplay between managerial human capital, social capital, and cognition (Adner and Helfat, 2003), ultimately determine the decision for or against investments in innovation (Tripsas and Gavetti, 2000).

The following section derives three research hypotheses for the respective drivers of dynamic managerial capabilities. Subsequently, the argumentation is combined by proposing dynamic managerial capabilities as a direct antecedent to digital firms' innovativeness. Figure 1 summarizes the research model.

Human capital is an essential determinant of the managerial capacity to sense opportunities and threats, seize identified opportunities, and reconfigure a firm's asset portfolio (Helfat and

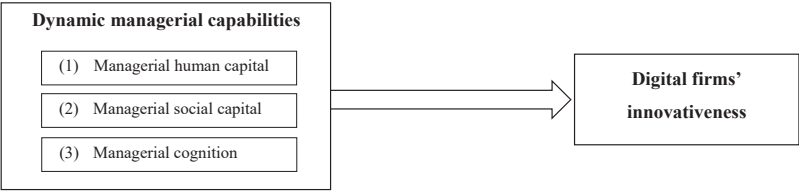


Figure 1.
Research model:
dynamic managerial
capabilities and digital
firms' innovativeness

Martin, 2015b). First, managers' knowledge and expertise may determine their ability to sense possible innovations. Managers with more human capital are more likely to perceive opportunities and threats (Bock *et al.*, 2012). In scanning and interpreting the environment, managers are prone to identify and comprehend information related to their existing knowledge (Cohen and Levinthal, 1989; Helfat and Martin, 2015a). Entrepreneurial skills shape decision-making by promoting the managerial ability to make sense of ambiguous information (Tang *et al.*, 2012; Tasheva and Nielsen, 2022). Second, managers draw on their human capital to seize identified opportunities through their investment decisions (Helfat and Martin, 2015a). Managers with more leadership skills are expected to be more proficient at exploiting innovations. Entrepreneurial skills will conversely allow managers to design novel mechanisms for exploration (Hitt *et al.*, 2017; Ireland *et al.*, 2001). Third, managerial human capital is critical for reconfiguration activities since managers with stronger leadership skills can effectively orchestrate a firm's asset portfolio (Guo *et al.*, 2013; Helfat and Martin, 2015a). Managerial human capital may represent a central source of innovation: entrepreneurial skills are crucial for sensing and seizing opportunities, while leadership skills supplement seizing activities and are critical for reconfiguring assets. This argumentation leads to the first hypothesis:

H1. Managers with more human capital promote digital firms' innovativeness.

As the second driver of dynamic managerial capabilities, managerial social capital is also likely to promote innovation. First, social capital increases the sensing of opportunities by facilitating the exchange of information and resources (Alguezaui and Filieri, 2010; Manev and Elenkov, 2005). According to Burt's (1992) structural hole theory, managers in brokerage positions – i.e. between otherwise disconnected yet nonredundant actors – possess information and control benefits. Generating new ideas for innovation depends on the exchange of dispersed and heterogeneous information within a firm. Hence, the recombination of knowledge is likely to facilitate innovation (Kogut and Zander, 1992). Control benefits are also essential for seizing activities. Managers can utilize their power within a social network to mobilize the assets of actors within the network (Burt, 1992; Helfat and Martin, 2015a). Social capital gives managers power over other actors' tangible and intangible assets in reconfiguring assets (Helfat and Martin, 2015a). Innovation is altogether an inherently social process based on interactions between interdependent actors (Landry *et al.*, 2002). Managerial social capital facilitates this process by bridging formal and informal aspects (Sibindi, 2021). It hence increases the exchange of information and knowledge (Burt, 1992; Nahapiet and Ghoshal, 1998), provides access to resources and capabilities (Beck and Wiersema, 2013; Blyler and Coff, 2003), and promotes cooperation and collaboration (Fukuyama, 1996). In this vein, social capital expands the breadth and depth of assets available to managers and thus additionally reinforces their innovative capabilities (Zhou and Li, 2012). In today's hypercompetitive economy, goal-directed strategic reorientation requires a timely identification of emerging shifts within the environment and the subsequent implementation of appropriate strategic measures through seizing and reconfiguring a firm's asset portfolio. This argumentation leads to the [second hypothesis](#):

H2. Managers with more social capital promote digital firms' innovativeness.

The third component of dynamic managerial capabilities, managerial cognition, shapes strategic decision-making by serving as the cognitive foundation of information processing (Walsh, 1995). Managerial cognition is likely to significantly influence the managerial abilities for sensing, seizing, and reconfiguring. In identifying opportunities for innovation, managers must make sense of new information. Highly individualized cognitive processes and structures guide this subjective interpretation of information. Hence, cognition determines the direction and extent of information searching and the subsequent

interpretation of acquired information (Helfat and Martin, 2015a). Due to the highly complex and ambiguous nature of information in the digital economy, decision-making will be biased if managers primarily process it on a superficial level. Relatedly, managerial cognition is also likely to affect seizing and reconfiguring. Cognitive processes and structures are the basis of managers' dominant logic. This historically developed representation of the world determines how managers subjectively view their organization and consequently orchestrate their firms' asset portfolios (Prahalad and Bettis, 1986). Even though managers need to apply cognitive simplifications to make timely decisions (Gioia, 1986), changing conditions will render solidified representations of the environment inaccurate over time (Prahalad and Bettis, 1986). Therefore, managers must constantly align their mental processes and structures with objective reality through in-depth information processing (Walsh, 1995). In line with previous research (e.g. Gavetti, 2012; Tripsas and Gavetti, 2000), heterogeneity in managerial cognition is likely to cause differences in innovativeness between firms. More formally, the following is hypothesized:

H3. Managers with stronger cognitive abilities promote digital firms' innovativeness.

The three underpinnings of dynamic managerial capabilities are also likely to affect firms' innovativeness individually and through their interactions (Helfat and Martin, 2015a). Consequently, these interactions are an additional source of heterogeneities between managers (Adner and Helfat, 2003). As illustrated above, the managerial ability to identify commercial opportunities depends on previous knowledge acquired through, for example, work experience as part of managerial human capital. Managerial social capital can expand individuals' knowledge by making available the human capital of other actors within the network (Adner and Helfat, 2003). Regardless of its source, how managers process this knowledge is determined by their mental processes and structures. Managerial cognition consequently directs the storage and processing of knowledge (Helfat and Martin, 2015a). Additionally, managerial cognition shapes learning processes by making past experiences salient (Tversky and Kahneman, 1973). Social capital is also likely to be influenced by mental models. Subjective beliefs will determine which relationships managers view as significant and, therefore, which relationships they will strive to maintain in the long run (Helfat and Martin, 2015b). Last, higher levels of human capital may also reinforce managers' social capital by making them more attractive as relationship partners (Adner and Helfat, 2003). Dynamic managerial capabilities are also likely to determine the managerial capacity to seize and reconfigure, as managers draw on these capabilities to develop and implement innovations (Helfat and Martin, 2015a). Based on this argumentation, dynamic managerial capabilities are proposed as a crucial antecedent to firms' innovativeness. More formally, the following is hypothesized:

H4. Managers with more dynamic managerial capabilities promote digital firms' innovativeness.

4. Methodology

4.1 Data collection and sample

Following the key informant approach (Lechner *et al.*, 2006), the authors surveyed German-speaking managers throughout the last quarter of 2019 and contacted a total of 2,920 firms from the German Industry 4.0 sector. This approach led to 205 completed questionnaires (7.02% response rate). Contact information was obtained through exhibitor lists from the following international trade shows: *EuroShop* (focus: retail, trade), *Hannover Messe* (focus: industrial transformation and digitalization), *Medica* (focus: medical technology), *Photokina* (focus: digital photography, video, and imaging), and *Smart Production Solutions* (focus: smart and digital automation).

4.2 Dependent variable

In line with previous research, *firm innovativeness* is operationalized as research and development (R&D) intensity (Adams *et al.*, 2006). R&D intensity is indicative of a firm's technological input and captures the efforts directed toward developing new value offerings (Hagedoorn and Cloudt, 2003). The volume of financial resources devoted to R&D is consequently mainly shaped by the managerial intent to pursue innovation (Helfat and Martin, 2015a) and reflects the strategic importance attributed to innovation (Hill and Snell, 1988; Kor, 2006).

4.3 Independent variables

Heubeck and Meckl (2021) developed a multidimensional operationalization based on established measurement scales for the three dimensions underlying dynamic managerial capabilities, which were used to operationalize *dynamic managerial capabilities* (see Appendix 1). First, *managerial human capital* was measured using a reformulated version of the five-item measurement developed by Guo *et al.* (2013). Second, *managerial social capital* was measured using a version of the items formulated by Carr *et al.* (2011) matched to the individual level. Third, *managerial cognition* was operationalized as the extent to which managers consciously evaluate options for redesigning a firm's business model (Schrauder *et al.*, 2018). The business model is an appropriate level of analysis for the study, as it portrays a holistic account of the mechanism through which a firm proposes, creates, and captures value (Massa *et al.*, 2017; Morris *et al.*, 2005). The commercial success of innovations depends on a business model's ability to derive value from innovation (Chesbrough and Rosenbloom, 2002). Hence, particularly in dynamic environments, business model redesign is a fundamental task in orchestrating a firm's asset portfolio (Helfat *et al.*, 2007).

4.4 Control variables

The model considered a total of six control variables. First, it included *gender* coded as a binary variable. Prior research has shown that gender impacts strategic decision-making by causing differences in the propensity for risk-taking between male and female managers (Croson and Gneezy, 2009). The second control, *management level*, captured the tripartite hierarchy of owners/shareholders, top management, and middle management. Past research has demonstrated that the hierarchical position influences managerial decision-making by shaping the extent of information exchange within firms (Ethiraj and Levinthal, 2004). Third, the model controls for *functional background*, which comprises output, throughput, and peripheral functions (Hambrick and Mason, 1984). The functional background shapes managerial decision-making by being the source of highly personal experiences and perceptions (Boone and Hendriks, 2008; Waller *et al.*, 1995). Fourth, *firm size* was included as a control for company characteristics and was measured as the natural logarithm of the number of employees (Leiponen and Helfat, 2010). Firm size captures the possible effects of scale differences between firms on their innovativeness (Traore, 2004). Fifth, *firm age* was incorporated into the research model to account for temporal effects on firms' innovativeness, such as the increasing formalization of processes, bureaucratization of organizational structures, and obsolescence of products (Audia and Greve, 2006). Finally, the model controlled for *firm performance*. Companies with more financial success possess a larger pool of readily available resources (Bourgeois, 1981). Therefore, performance may affect firms' innovativeness by causing differences in the availability of resources. Firm performance was measured using the widely employed indicator of return on equity (Richard *et al.*, 2009).

4.5 Statistical procedure

Principal axis confirmatory factor analysis (CFA) using varimax rotation was performed to conduct factor analysis. The Bartlett test of sphericity, Measure-of-Sample-Adequacy (MSA) criterion, and Kaiser–Mayer–Olkin (KMO) criterion were used to assess the eligibility of the data for factor analysis (Hair *et al.*, 2014). The Kaiser–Guttman (KG) criterion was employed to determine the appropriate number of factors and evaluate their robustness using the scree test (Thompson, 2004). All factors must include at least three variables, while individual factor loadings need to exceed 0.30 (Hair *et al.*, 2014). In the second step, the factors' quality criteria were assessed. Cronbach's alpha coefficients exceeding 0.70 indicate reliability (Hair *et al.*, 2014), and validity is fulfilled if the average variance extracted (AVE) of factors exceeds 0.50, factor loadings surpass 0.50, and the Fornell–Larcker (FL) criterion is met (Fornell and Larcker, 1981). In the third step, test objectivity was ensured through an unbiased application, analysis, and interpretation of data (Payne and Payne, 2004; Resnik, 2001). Two regression analyses were performed in the final step. Model 1 analyzed the three drivers of dynamic managerial capabilities individually, and Model 2 tested their combined effect on digital firms' innovativeness.

5. Results

5.1 Measurement model

The basic eligibility of the data for factor analysis was confirmed using the Bartlett test of sphericity before performing CFA (for this and the following, see Appendix 2). The MSA and KMO criteria validated these results.

Managerial human capital: The leadership dimension is composed of items 2, 4, and 5. Item 3 was excluded due to a low factor loading, and Item 1 was excluded due to cross-loading on a second factor. The measurement scale of the entrepreneurial dimension was not modified. These results were validated using the KG criterion and scree test.

Managerial social capital: The initial CFA confirmed the theoretically deduced division into the structural, relational, and cognitive dimensions. After removing three items due to a low factor loading, a second CFA indicated a better fit using a two-factorial solution. These results were validated using the KG criterion and scree test.

Managerial cognition: The CFA for managerial cognition validated its tripartite structure. All value offering and value capture items fulfilled the quality criteria. Items 1 and 5 of the architectural dimension were removed due to low factor loadings. These results were validated using the KG criterion and scree test.

Next, the quality criteria of the extracted factors were assessed. The standardized test situation, objective analysis, and unbiased interpretation of data were ensured at all times. All factors can be classified as reliable, convergent valid, and discriminant valid. Despite falling short of the cutoff value, managerial human capital and managerial social capital are convergent valid, as their AVE is between 0.40 and 0.50, and Cronbach's alpha coefficients surpass 0.60 (Fornell and Larcker, 1981).

5.2 Descriptive statistics, bivariate results, and regression results

Managers within the sample have served at their current companies for an average of 14.72 years. This long tenure confirms their qualification as key informants. Table 1 summarizes the demographic characteristics of the respondents. Table 2 displays the descriptive statistics, means, and correlations of all variables. Regression analysis was performed on two statistical models. Model 1 tested the effects of the three underlying managerial resources on innovation separately, while Model 2 analyzed the composite effect of dynamic managerial capabilities on innovation. Table 3 compiles the regression results.

Variable	N	Percentage	Effects of dynamic managerial capabilities
<i>Gender</i>			
Male	58	86.57	
Female	9	13.43	
<i>Management level</i>			
Owners/shareholders	24	35.82	
Top management	28	41.79	
Middle management	15	22.39	
<i>Functional background</i>			
Output function	62	92.54	
Throughput function	2	2.98	
Peripheral function	3	4.48	

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Table 1.
Demographic
characteristics of the
study participants

The results of the hypothesis tests are summarized in Table 4. Hypothesis 1 proposed a positive effect of managerial human capital on digital firms' innovativeness. The coefficient is positive but statistically insignificant ($b = 1.421$, $\beta = 0.108$, $se = 1.725$, $p = 0.413$). Thus, Hypothesis 1 is rejected. Hypothesis 2 presumed a positive effect of managerial social capital on digital firms' innovativeness. The analysis shows a positive though significant coefficient, providing no support for Hypothesis 2 ($b = 2.820$, $\beta = 0.240$, $se = 1.527$, $p = 0.070$). Hypothesis 3 predicted a positive relationship between managerial cognition and digital firms' innovativeness, which is not supported by the data ($b = 2.482$, $\beta = 0.155$, $se = 2.179$, $p = 0.259$). Consequently, Hypothesis 3 is rejected. Hypothesis 4 anticipated a positive effect of dynamic managerial capabilities on digital firms' innovativeness. The data support this positive relationship, thereby confirming Hypothesis 4 ($b = 6.803$, $\beta = 0.364$, $se = 2.202$, $p = 0.003$).

6. Discussion and contributions

6.1 Discussion

Digital transformation continues to fundamentally call into question firms' existing competitive advantages, placing managers under mounting internal and external pressures to confront the new challenges of the digital economy (Wrede *et al.*, 2020). At the same time, the empirical literature has lost touch with the new challenges that managers are confronted with in today's digital marketplace. The present study built on the dynamic managerial capabilities perspective and the economic network model to close this research gap by hypothesizing that managers facilitate innovation through their individual-level dynamic capabilities. Accordingly, managers are firms' key decision-makers and thus directly influence their innovativeness (Adner and Helfat, 2003; Helfat *et al.*, 2007).

Four hypotheses were proposed to test the research model. The theoretical argumentation fundamentally proposed that the managerial ability to sense opportunities and threats, seize identified opportunities, and reconfigure a firm's asset portfolio is contingent on managers' dynamic capabilities. Consequently, Hypotheses 1–3 postulated that the three underlying drivers of dynamic managerial capabilities – managers' human capital, social capital, and cognition – individually promote digital firms' innovativeness. Subsequently, Hypothesis 4 combined this argumentation by positing that managers may also stimulate digital firms' innovativeness through their entire portfolio of dynamic managerial capabilities.

The study provides novel empirical evidence that dynamic managerial capabilities are significant drivers of digital firms' innovativeness. Hence, differences in innovation between

Table 2.
Descriptive statistics:
Means, standard
deviations, and
correlations

	Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1	Firms' innovativeness	8.305	8.054	1										
2	Managerial human capital	0.138	0.610	0.141	1									
3	Managerial social capital	0.024	0.685	0.321**	0.093	1								
4	Managerial cognition	0.038	0.503	0.261*	0.423***	0.348**	1							
5	Dynamic managerial capabilities	0.066	0.431	0.338**	0.686***	0.710***	0.773***	1						
6	Gender	0.132	0.341	0.308*	-0.186	0.074	-0.048	-0.067	1					
7	Management level	1.881	0.764	0.091	-0.153	-0.126	-0.148	-0.197	0.118	1				
8	Functional background	1.132	0.454	0.011	0.008	-0.214	0.053	-0.089	-0.115	0.304*	1			
9	Firm size	4.174	2.234	0.077	-0.117	-0.002	-0.026	-0.067	0.107	0.561***	0.291*	1		
10	Firm age	43.897	39.024	-0.161	-0.190	-0.225	-0.050	-0.228	-0.068	0.233	0.246*	0.394***	1	
11	Firm performance	7.864	5.085	-0.018	0.004	-0.004	0.004	0.002	-0.016	-0.108	-0.141	0.116	-0.131	1
Note(s): *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; SD = Standard deviation; $N = 68$														

Dependent variable	Independent variable	<i>b</i>	β	<i>se</i>
<i>Firms' innovativeness</i>				
$R^2 = 0.257^*$; Corrected $R^2 = 0.142^*$; $F(df = 9; 58) = 2.228$				
	Constant	4.002		3.712
	Managerial human capital	1.421	0.108	1.725
	Managerial social capital	2.820	0.240	1.527
	Managerial cognition	2.482	0.155	2.179
	Gender	7.136*	0.302*	2.802
	Management level	1.235	0.073	1.529
	Functional background	1.303	0.117	2.271
	Firm size	0.070	-0.112	0.561
	Firm age	-0.023	0.019	0.028
	Firm performance	-0.012	-0.007	0.191
<i>Firms' innovativeness</i>				
$R^2 = 0.252^*$; Corrected $R^2 = 0.164^*$; $F(df = 7; 60) = 2.882$				
	Constant	4.041		3.605
	Dynamic managerial capabilities	6.803**	0.364**	2.202
	Gender	7.433**	0.315**	2.723
	Management level	1.208	0.114	1.508
	Functional background	1.102	0.062	2.174
	Firm size	0.108	0.030	0.549
	Firm age	-0.023	-0.112	0.027
	Firm performance	-0.017	-0.011	0.188

Note(s): $N = 68$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; b = unstandardized coefficient; β = standardized coefficient; df = degrees of freedom; R^2 = coefficient of determination; se = standard error

Table 3.
Regression results

Hypotheses	Result
<i>Hypothesis 1:</i> Managers with more human capital promote digital firms' innovativeness	Not supported
<i>Hypothesis 2:</i> Managers with more social capital promote digital firms' innovativeness	Not supported
<i>Hypothesis 3:</i> Managers with stronger cognitive abilities promote digital firms' innovativeness	Not supported
<i>Hypothesis 4:</i> Managers with more dynamic managerial capabilities promote digital firms' innovativeness	Supported

Table 4.
Summary of
hypothesis tests

digital firms can be attributed to heterogeneities in the individual-level capabilities of managers. Thus, this paper sheds light on managers' pivotal role in nurturing innovation through their specific dynamic managerial capabilities. Managers and the dynamic capabilities they possess consequently represent valuable resources for their organizations, decisively shaping digital firms' current and future competitive advantages.

The presented findings extend the notion of dynamic managerial capabilities as facilitators of innovation to the digital economy by highlighting the significance of individual-level capabilities for organizational adaptation. Although previous research points to the central role of management in shaping organizational change (e.g. [Smith and Tushman, 2005](#); [Tripsas and Gavetti, 2000](#)), the digitally transformed decision-making context has not yet been explicitly factored into empirical research. The evidence provided by this study shows that dynamic managerial capabilities are a direct facilitator of greater innovativeness in digital firms. The paper advances the literature by re-emphasizing the importance of individual managers for innovation in the digital context. Thus, the evidence

extends the fundamental notion of dynamic managerial capabilities to digital firms. Differences in innovation between digital firms hence originate from heterogeneities in the individual-level dynamic capabilities of managers.

Furthermore, the results paint a more nuanced picture of the effect of individual-level managerial capabilities on innovation than presumed within the literature. Although the findings support the basic principles of the dynamic managerial capabilities perspective, the data provide evidence that managers' human capital, social capital, and cognition alone are insufficient to drive innovation in digital industries. In truth, dynamic managerial capabilities only promote innovativeness if they are applied in their entirety. Thus, the present study advances understanding of dynamic managerial capabilities by providing novel empirical evidence for more complex interrelationships between dynamic managerial capabilities than previously presumed within the literature. Although this study did not explicitly address the relationships between the underlying drivers of dynamic managerial capabilities, the evidence can indicate how these three components interact in shaping digital firms' innovativeness. The results suggest that managers' human and social capital are positively related to their cognitions, while the data show no significant relationship between managerial human and social capital. These findings indicate that managerial cognition could be the most significant driver underlying dynamic managerial capabilities and that managerial human and social capital may enhance the cognitive abilities of managers. Conversely, the findings oppose previous research showing a positive relationship between managers' human and social capital, thereby contradicting suggestions of previous research that the two managerial resources reinforce each other or can act as substitutes (e.g. [Ployhart and Moliterno, 2011](#); [Santarelli and Tran, 2013](#)). Consequently, future research can build on these insights to elucidate how managerial human capital, social capital, and cognition interact in shaping dynamic managerial capabilities in digital firms.

6.2 Theoretical contributions

The present article advances scholarly understanding of the microfoundational origins of organizational adaptation in digital firms and provides empirical support for Barnard's fundamental notion that "the individual is always the basic strategic factor of organization" (1968, p. 139). Furthermore, the paper adapts the dynamic managerial capabilities perspective to the idiosyncrasies of the digital economy by including middle managers. The study consequently offers a more holistic perspective on the role of managerial capabilities in shaping the adaptability of digital firms. The findings confirm the significance of middle and top managers by demonstrating that dynamic managerial capabilities directly promote digital firms' innovativeness. Thus, in the digital economy, dynamic managerial capabilities have become integral for firms to sustain high levels of innovation by improving the managerial ability to sense opportunities and threats, seize detected opportunities, and appropriately reconfigure a firm's asset portfolio. Hence, the present study answers the call of [Helfat and Martin \(2015b\)](#) for research on the combined effect of dynamic managerial capabilities on strategic change, thereby advancing the microfoundational literature on innovation.

Furthermore, the study extends the empirical literature on dynamic managerial capabilities by providing novel evidence of how the three components affect the innovativeness of digital firms. The evidence provides no support for the isolated impact of managers' human capital, social capital, and cognition on the innovativeness of digital firms. This finding contradicts the theoretical assumptions of the dynamic managerial capabilities perspective (e.g. [Adner and Helfat, 2003](#); [Helfat and Martin, 2015a, b](#)) and is inconsistent with previous research on nondigital industries (e.g. [Bock et al., 2012](#); [Tasheva and Nielsen, 2022](#); [Tripsas and Gavetti, 2000](#)). Hence, this study provides a more nuanced

account of how the dynamic capabilities of individual managers affect innovation at the firm level by holistically testing the effect of dynamic managerial capabilities on digital firms' innovativeness. Nevertheless, the findings show that dynamic managerial capabilities are a significant individual-level antecedent to digital firms' innovativeness, while their underlying components do not promote innovation individually.

To the best of the authors' knowledge, the present study provides the first empirical evidence of how dynamic managerial capabilities and their three underlying drivers – managerial human capital, social capital, and cognition – are related to digital firms' innovativeness. First, the paper advances the literature by confirming that dynamic managerial capabilities also contribute to shaping digital firms' innovativeness. In line with the theoretical arguments, the results demonstrate that the dynamic capabilities of middle and top managers directly facilitate higher levels of innovation in their firms. Second, the findings contradict the previous literature by showing that dynamic managerial capabilities only promote digital firms' innovativeness compositely and not through their three underlying components. These results stand in contrast to the theoretical assumptions proposed by dynamic managerial capabilities scholars (e.g. [Adner and Helfat, 2003](#); [Helfat and Martin, 2015a, b](#)) and to the empirical evidence provided by studies that focus on the individual underpinnings of dynamic managerial capabilities (e.g. [Bock *et al.*, 2012](#); [Tasheva and Nielsen, 2022](#); [Tripsas and Gavetti, 2000](#)).

6.3 Managerial implications

The study also has important implications for managerial practice. First, the findings can serve as a cautionary tale for organizations because they show that managers need to develop their entire portfolio of dynamic capabilities to promote innovation. Thus, decision-makers are advised to facilitate the holistic development of dynamic capabilities throughout all management levels. In the context of innovation, management should design and implement measures through which both managers themselves and other managers can enhance their dynamic capabilities. It does not seem fruitful to fixate on isolated measures, such as investing in managerial education only.

In this vein, the findings suggest that managerial cognition might be the most central underlying component of dynamic managerial capabilities, which is positively related to higher levels of human and social capital. Thus, the results demonstrate that firms should make investments in the human and social capital of their middle and top managers to improve managers' cognitive abilities for strategic decision-making.

Furthermore, the findings advise decision-makers to design and implement appraisal tools for performance measurement explicitly designed to promote dynamic managerial capabilities. Managers should conduct appraisals not only to assess employee performance and derive a basis for payment decisions ([Cleveland *et al.*, 1989](#)) but also to improve organizational outcomes, such as innovation and performance ([DeNisi and Sonesh, 2011](#)). Accordingly, management appraisal tools should ideally be constructed to reinforce the development of dynamic capabilities through all management levels. Designing appropriate appraisal tools involves the alignment of what is appraised and how it is appraised ([Fletcher, 2001](#)) with the overall goal of promoting innovation through the development of dynamic managerial capabilities. At the same time, organizations should offer beneficial training opportunities to managers and give them appropriate leeway to express their dynamic capabilities.

6.4 Limitations and recommendations for future research

In addition to its contributions to the literature and managerial practice, this study faces several limitations. However, these limitations may provide fruitful avenues for future research.

First, the study did not consider any time effects. Future researchers could analyze if the influence of dynamic managerial capabilities on innovation varies over time. Second, the study's conceptualization of dynamic managerial capabilities focused on the individual level. Hence, the presented model does not describe the mechanisms through which managerial capabilities aggregate at the collective level. Future studies can integrate the present study's findings into their theorizing of dynamic managerial capabilities at both the individual and collective levels. Third, the sample used primarily consists of German firms. Cultural factors might impair the generalizability of results across cultures. Subsequent studies could include cultural variables to test whether, for example, culture-specific management styles affect the relationships between dynamic managerial capabilities and firms' innovativeness. Fourth, the research sample employed is composed of companies operating predominantly in digital industries. Future studies could replicate the current study in different industries and compare how findings might differ between more and less digitalized industries. Fifth, the study participants are primarily male and perform an output function. Although the sample composition is not surprising, as male executives continue to dominate in the manufacturing industries of developed economies (Cropley and Cropley, 2017; Reshef *et al.*, 2021), future research could test whether gender or functional differences between managers translate into differences in innovativeness between firms. Sixth, the study faces limitations from a conceptual point of view as it relied on self-reported measures for data collection. This approach might have biased the results. Future studies could supplement self-reported measures with objective measures. Additionally, the employed study design led to a relatively small sample size.

Future works can build on the present study's novel findings in deriving and testing a holistic model of dynamic managerial capabilities in the context of innovation. In conclusion, the present study may put research on the right track to better understand the microlevel antecedents to organizational behavior.

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Appendix 1

Construct	Dimension	Item
Managerial human capital	Leadership skills	One of my greatest strengths is getting results by organizing and motivating people One of my greatest strengths is organizing resources and coordinating tasks One of my greatest strengths is my ability to delegate effectively One of my greatest strengths is my ability to monitor, influence, and lead people I make resource allocation decisions that achieve maximum results with limited resources
	Entrepreneurial skills	I like to think about new ways to do business I frequently identify opportunities to start new businesses (although I may not pursue them) I often identify ideas that can be turned into new products or services I keep my eyes open for previously unnoticed entrepreneurial opportunities I see myself as a creator of entrepreneurial opportunities (entrepreneur)
Managerial social capital	Structural dimension	I always communicate openly and honestly with other company members As a rule, I completely disclose my plans and intentions I willingly share information with other company members When exchanging information, I draw on my internal company relationships
	Relational dimension	I always have the utmost trust in other company members and their actions/decisions I always act with integrity in my dealings with other company members In general, I have a high level of trust with other company members I am always considerate of the feelings and sensibilities of other company members
	Cognitive dimension	I feel committed to the goals of the company I share a common purpose with other company members I see myself as a discussion partner in determining the company's direction My vision for the future of the company is in line with that of other company members
Managerial cognition	Value offering evaluation	When redesigning the business model in part or in whole, I consciously evaluate alternatives to a very high extent alternatives with regard to ... customer problems and needs ... value propositions ... relationships between value propositions and customer problems/needs
	Value architecture evaluation	... sales and distribution channels ... business transactions and the ways of collaborating with partners ... linking business participants together in novel ways ... taking over new value propositions or substituting existing parts of the value chain ... applying new revenue streams
	Value capture evaluation	... resource requirements for all business aspects ... the financial benefits for our company ... all the business-related costs of the project

Source(s): Heubeck and Meckl (2021)

Table A1.
Questionnaire items
translated from
German

Table A2.
Results of the
confirmatory factor
analysis

Appendix 2

Constructs and dimensions	Item	Std. FL
<i>Managerial human capital</i> (KMO = 0.775; AVE = 0.436; FL = 0.817; α = 0.773; N = 111)		
Leadership skills	2	0.594
	4	0.611
	5	0.573
Entrepreneurial skills	1	0.615
	2	0.659
	3	0.653
	4	0.725
	5	0.689
<i>Managerial social capital</i> (KMO = 0.773; AVE = 0.479; FL = 0.968; α = 0.801; N = 109)		
Structural dimension	2	0.617
	3	0.787
Relational dimension	1	0.687
	2	0.545
	3	0.541
Cognitive dimension	1	0.581
	2	0.687
	4	0.644
<i>Managerial cognition</i> (KMO = 0.743; AVE = 0.570; FL = 0.956; α = 0.800; N = 105)		
Value offering	1	0.768
	2	0.697
	3	0.614
Value architecture	2	0.731
	3	0.952
	4	0.500
Value capture	1	0.563
	2	0.701
	3	0.801
Note(s): α = Cronbach's alpha; AVE = average variance extracted; FL = Fornell–Larcker; KMO = Kaiser–Meyer–Olkin; N = sample size; Std. FL = standardized factor loadings		

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Effects of
dynamic
managerial
capabilities

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