

**Managing innovation in a globalized digital economy:
An empirical inquiry into managerial-, governance-, and firm-level
antecedents and contingencies**

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“Everybody can be great...because anybody can serve.

You don't have to have a college degree to serve.

You don't have to make your subject and verb agree to serve.

You only need a heart full of grace.

A soul generated by love.”

– Martin Luther King Jr.

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Abstract

As a source of superior performance, innovation has always been a central factor in developing and sustaining competitive advantage; however, sustained efforts that facilitate innovation are even more pivotal for organizational survival in the current hypercompetitive environment. The growing volatility, uncertainty, complexity, and ambiguity of the globalized digital economy continue exacerbating the inherently risky and long-term nature of research and development (R&D) investments, placing managers under mounting internal and external pressures to make timely, yet profound, decisions on innovation investments. Promoting high levels of innovation by identifying, creating, realizing, and maintaining unexplored and unexploited commercial opportunities has turned into *the* single most daunting, but integral, managerial challenge facing firms today.

Scholars have proposed and tested the mechanisms through which dynamic capabilities (DCs) shape the organizational ability to translate valuable, rare, inimitable, and non-substitutable resources into competitive advantage. Nevertheless, the inherent firm-level focus of the DC view neglects how a firm's ability to sense, seize, and reconfigure organizational resources for strategic change may also originate with the DCs of individual managers. Organizational theorists have long ignored the pivotal influence of individual-level managerial capabilities on organizational adaptation; the limitations of the dominant firm-level perspective on organizational change have sparked a growing interest in the individual-level antecedents to strategic adaptation. According to the micro-level perspective of dynamic managerial capability (DMC), managers are pivotal in shaping organizational strategies due to their responsibility for orchestrating a firm's asset portfolio. Consequently, DMCs at the individual level may represent central drivers of innovation. The key role of top-level managers in determining organizational outcomes, such as innovation strategies, is consistent with upper echelons theory (UET). Accordingly, top managers are tasked with making complex strategic decisions based on ambiguous information under the assumption of bounded rationality. Organizational strategies are, therefore, the result of executive decision-making that originates from the personal characteristics of top managers.

Although scholars have conceptually recognized the importance of individual-level capabilities in developing competitive advantage, the literature lacks a holistic understanding of the mechanisms DMCs use to directly and indirectly shape firms' innovativeness. Therefore, the first research goal of this thesis is to gain empirical insights into the individual-level interactions between the three DMC subcomponents—managerial human capital, social

capital, and cognition. The thesis subsequently draws on the findings related to the individual-level DMC interactions to empirically test the direct relationship between DMCs and innovation.

Besides substantial managerial capabilities, the innovation process also requires sufficient resources. Research has demonstrated that managers must have access to, and discretion over, sufficient resources to develop, initiate, and execute innovation strategies at the opportune moment. High-tech firms, in particular, have accumulated substantial excess financial resources that managers can redeploy toward risky investments, such as innovation. Accordingly, the third research goal is concerned with examining slack resources as firm-level antecedents to innovation in the highly dynamic and competitive environment of high-tech industries. To answer this research question, this thesis draws on a contingency perspective to conceptualize the underlying motives of managers that inform their decisions about how to deploy slack resources. The existing literature proposes organizational slack as a double-edged sword: some slack is integral for inducing creativity, while excessive slack may cause extensive inefficiencies. Thus, the relationship between slack resources and innovation will likely follow an inverted U-shaped progression in high-tech industries.

Subsequently, this thesis argues that governance-level factors shape the strength of the slack–innovation relationship, which is rooted in the overarching research goal of offering a holistic account of firm-level innovation behavior. The theoretical argument adopts a contingency perspective on this relationship, grounded in the seemingly conflicting, yet complementary, perspectives of agency and organizational theories. Therefore, the research model proposes that the nature of the organizational slack–innovation relationship in high-tech industries is shaped by the structural and demographic characteristics of the board, determining the efficacy of corporate governance.

This thesis will finally test the relationship between DMCs and R&D spending in a sample of NASDAQ 100 firms to gain insights into all three fundamental analysis levels prevalent within management literature. For this purpose, based on an initial analysis of the DMC–innovation relationship, the thesis will propose CEO founder status as a managerial-level moderator of this relationship. This argumentation is grounded in the notion that founder CEOs differ from professional CEOs in their time horizon, commitment, and motivation underlying their innovation investment decisions.

Strategic management theories have incorporated the micro-level origins of innovation from their beginning, albeit mostly implicitly. The piecemeal approach by which the antecedents of firm-level strategies are conceptualized has led to a pervasive disregard for individual-level capabilities in empirical research. Therefore, the ultimate goal of the present thesis is to bring together the three fundamental levels of strategic management—the managerial, governance, and firm levels—by developing comprehensive models of managerial decision-making within the unique context of innovation. A multi-theoretic approach is employed for this purpose. The complementary perspectives of DMC theory and UET are combined to propose that the specific DMCs of chief executive officers (CEOs)—so-called dynamic CEO capabilities (DCCs)—may be the central drivers of innovation due to the pivotal role of CEOs in designing, implementing, and transforming organizational strategies. The DCC concept proposes that CEOs' individual-level DMCs are conduits for firm-level innovation. This thesis will then expand the research model by proposing managerial-, governance-, and firm-level contingency factors of the DCC–innovation relationship. Altogether, the present thesis contributes to management literature by developing and testing multi-level models of the determinants of firms' innovativeness. Thus, besides contriving a holistic model of the determinants of firm-level innovation, this thesis will also explicitly take into account the transformed decision-making context of the current hypercompetitive economy in analyzing these relationships.

The thesis is structured as follows. Chapter 1 outlines the overarching research motivation by developing four interrelated research questions and summarizing the main research propositions of five research papers. Chapter 2 delves into strategic and innovation management theories relevant to the thesis. Chapters 3 to 8 present the individual research papers according to their level of analysis. More specifically, Research Paper 1 in Chapter 3 investigates the DMC subcomponent interactions in the context of digitalization-driven Industry 4.0 firms. Chapter 4, which includes Research Paper 2, proposes that individual-level DMCs and their subcomponents are direct antecedents of firm-level innovation in digital industries. Research Paper 3 in Chapter 5 expands the analysis to the governance level. The paper hypothesizes that board composition moderates the inverted U-shaped organizational slack–innovation relationship in high-tech firms. Research Paper 4 in Chapter 6 integrates the managerial, governance, and firm levels. This paper proposes that individual-level DCCs are critical drivers of firm-level innovation, and that this relationship is moderated by CEO power as a governance-level contingency. Subsequently, Research Paper 5 in Chapter 7 builds on the resource orchestration framework to hypothesize that individual-level DCCs may facilitate

firm-level innovation by determining slack resource orchestration. Therefore, this paper adopts a holistic and multidimensional perspective on the relationships between DCCs, the orchestration and deployment of different slack types, and innovation. The sixth and final research paper in Chapter 8 assesses the significance of DMCs in the specific context of today's hypercompetitive economy. The study draws on data from NASDAQ 100 firms to holistically analyze the significance of DMCs and their subcomponents for firm-level innovation strategies. Further, the paper proposes CEO founder status as a managerial-level moderator of the DMC–innovation relationship, because founder CEOs differ from professional CEOs in their investment behavior. The thesis concludes in Chapter 9 with a summary of its findings, a discussion of their research and practical implications, a description of limitations and recommendations for future research, and concluding remarks.

The present thesis contributes to the literature by empirically demonstrating that the DMCs of managers at different hierarchical levels are pivotal drivers of innovation. Beyond highlighting the role of managers in shaping organizational change, the findings show that the extent to which managers can promote innovation is dependent on managerial-, governance-, and firm-level factors. The results extend DMC literature to the decision-making context of today's globalized digital economy. More specifically, this thesis contributes to management literature by (1) developing novel, holistic operationalizations of DMCs; (2) empirically analyzing individual-level interactions between DMCs in Industry 4.0 firms; (3) assessing the mechanisms by which DMCs promote firm-level innovation in digital industries, and to what extent; (4) suggesting that board characteristics are a crucial influence on the slack–innovation relationship in high-tech industries; (5) examining whether the DMCs of CEOs are critical micro-level antecedents to innovation; (6) proposing CEO power as a contingency of the relationship between DCCs and innovation; (7) clarifying the mechanisms through which DCCs determine the orchestration and deployment of different types of slack resources for innovation; (8) assessing the relative significance of the DCC subcomponents for orchestrating different types of slack resources for innovation; (9) examining the role of DMCs in today's hypercompetitive economy; and (10) showing that the DCC–innovation relationship is affected by a CEO's status as founder or nonfounder. From a practical perspective, the findings highlight the importance of DMCs across various hierarchical levels. The evidence also cautions that firms must be attentive to management position staffing, and underscores the importance of appropriate governance mechanisms, organizational structures, and resource endowments as conduits for innovation.

Zusammenfassung

Innovation stellt einen zentralen Faktor bei der Entwicklung und Aufrechterhaltung von Wettbewerbsvorteilen dar. Allerdings verschärfen die zunehmenden Herausforderungen der heutigen globalisierten und digitalen Wirtschaft die risikoreiche und langfristige Natur von Investitionen in Forschung und Entwicklung (F&E). Dies setzt Manager*innen unter zunehmenden Druck, zeitnahe und dennoch fundierte Entscheidungen über Innovationsinvestitionen zu treffen. Die Förderung eines hohen Innovationsniveaus durch die Identifizierung, Schaffung, Realisierung und Aufrechterhaltung ungenutzter kommerzieller Möglichkeiten hat sich daher zu einer der größten – aber auch wichtigsten – Managementherausforderungen entwickelt.

Organisationstheoretiker haben lange Zeit den entscheidenden Einfluss von individuellen Managementfähigkeiten auf den strategischen Unternehmenswandel ignoriert. Gemäß der Perspektive der dynamischen Managerfähigkeiten (DMC) sind Manager*innen aufgrund ihrer Verantwortung für die Ressourcenorchestrierung von zentraler Bedeutung für die Gestaltung der Unternehmensstrategien. Obwohl die Wissenschaft die Bedeutung individueller Fähigkeiten für die Entwicklung von Wettbewerbsvorteilen konzeptionell erkannt hat, fehlt es in der Literatur an einem ganzheitlichen Verständnis der Mechanismen, mit denen DMC die Innovationsfähigkeit von Unternehmen beeinflussen. Das Ziel der vorliegenden Arbeit ist es, die drei grundlegenden Ebenen des strategischen Managements – die Management-, Governance- und Unternehmensebenen – zusammenzuführen, indem umfassende Modelle der Entscheidungsfindung von Managern im einzigartigen Kontext der Innovation entwickelt werden. Zu diesem Zweck wird ein multitheoretischer Ansatz verwendet.

Insgesamt leistet die vorliegende Arbeit einen Beitrag zur Managementliteratur, indem sie Mehrebenenmodelle zu den Determinanten der Innovationsfähigkeit von Unternehmen entwickelt und empirisch testet. Darüber hinaus wird in dieser Arbeit auch der veränderte Entscheidungskontext der heutigen hyperkompetitiven Wirtschaft bei der Analyse dieser Beziehungen explizit berücksichtigt. Die Ergebnisse der vorliegenden Arbeit weisen empirisch nach, dass DMC auf verschiedenen Hierarchieebenen zentrale Treiber für Innovationen sind. Weiterhin unterstreichen die Ergebnisse nicht nur die Rolle von Managern bei der Gestaltung des organisatorischen Wandels, sondern zeigen auch, dass das Ausmaß, in dem Manager Innovationen fördern können, von Faktoren auf Management-, Governance- und Unternehmensebene abhängt.

Die vorliegende Arbeit erweitert die DMC-Literatur auf den Entscheidungskontext der heutigen globalisierten und digitalen Wirtschaft, indem sie (1) eine neuartige, ganzheitliche DMC Operationalisierung entwickelt; (2) die Interaktionen auf individueller Ebene zwischen DMC beleuchtet; (3) die Mechanismen testet, durch die DMC Innovationen fördern; (4) Governance-Faktoren als Moderatoren der DMC–Innovationsbeziehung berücksichtigt; (5) untersucht, inwiefern DMC von CEOs kritische Antezedenzen für die Innovation sind; (6) die Macht von CEOs als Kontingenz für die DMC–Innovationsbeziehung berücksichtigt; (7) die Mechanismen analysiert, durch die DMC die Orchestrierung und den Einsatz verschiedener Arten von Slack Ressourcen für die Innovation bestimmen; (8) die relative Bedeutung der DMC-Subkomponenten für die Orchestrierung verschiedener Arten von Slack Ressourcen für die Innovation analysiert; (9) die Rolle von DMC in der heutigen hyperkompetitiven Wirtschaft untersucht; und (10) nachweist, dass die Beziehung zwischen DMC und Innovation durch den Status eines CEO als Gründer beeinflusst wird. Aus Sicht der Managementpraxis unterstreichen die Ergebnisse die Bedeutung von DMC über verschiedene Hierarchieebenen hinweg. Die Ergebnisse zeigen daher, dass Unternehmen auf die Besetzung von Führungspositionen achten müssen und untermauern die Bedeutung von spezifischen Governance-Mechanismen, Organisationsstrukturen und Ressourcenausstattungen im Kontext der Innovation.

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List of abbreviations

AVE	Average variance extracted
BTF	Behavioral theory of the firm
CEO	Chief executive officer
CFA	Confirmatory factor analysis
CPS	Cyber-physical systems
DC	Dynamic capability
DCC	Dynamic CEO capability
DCV	Dynamic capability view
DMC	Dynamic managerial capability
FL	Fornell-Larcker
IIoT	Industrial Internet of Things
IoT	Internet of Things
KG	Kaiser-Guttman
KMO	Kaiser-Mayer-Olkin
MBV	Market-based view
MSA	Measure of sample adequacy
RBV	Resource-based view
R&D	Research and development
RQ	Research question
SIC	Standard Industrial Classification
S&P	Standard and Poor's
TMT	Top management team
UET	Upper echelons theory
VRIN	Valuable, rare, inimitable, non-substitutable
VUCA	Volatility, uncertainty, complexity, ambiguity

Index of research papers

Table 1.1 provides an overview of the individual research papers, including authorship, publication outlet and status, and journal rankings.

Table 1.1 Index of research papers

Index	Title	Authors	Publication	Status	Journal rankings	
Research Paper 1	Antecedents to cognitive business model evaluation: A dynamic managerial capabilities perspective	Heubeck, Tim & Meckl, Reinhard	<i>Review of Managerial Science</i>	Published in 2021	SJR (2021) Impact factor (2021) Five-year impact factor (2021) CiteScore (2021) CiteScore rank (2021)	Q1/1.435 7.127 5.821 8.0 #14/216 (General Business, Management, and Accounting) VHB-JOURQUAL3 B H-Index 32
Research Paper 2	More capable, more innovative? An empirical inquiry into the effects of dynamic managerial capabilities on digital firms' innovativeness	Heubeck, Tim & Meckl, Reinhard	<i>European Journal of Innovation Management</i>	Published in 2022	SJR (2021) Impact factor (2021) Five-year impact factor (2021) CiteScore (2021) CiteScore rank (2021)	Q1/1.023 4.750 4.850 7.0 #41/271 (Management of Technology and Innovation) VHB-JOURQUAL3 C H-Index 67

Source: Author's representation

Notes: CEO = Chief executive officer, VHB = Verband der Hochschullehrer*innen für Betriebswirtschaftslehre, R&D = Research and development, SJR = Scimago Journal Ranking

Table 1.1 Index of research papers (continued)

Index	Title	Authors	Publication	Status	Journal rankings
Research Paper 3	Does board composition matter for innovation? A longitudinal study of the organizational slack–innovation relationship in NASDAQ 100 companies	Heubeck, Tim & Meckl, Reinhard	Scientific journal	Under review	Not applicable
Research Paper 4	Microfoundations of innovation: A dynamic CEO capabilities perspective	Heubeck, Tim & Meckl, Reinhard	Scientific journal	In review	Not applicable
Research Paper 5	Multi-level antecedents of innovation: Dynamic CEO capabilities and the mediating role of slack resources	Heubeck, Tim & Meckl, Reinhard	Scientific journal	Finished manuscript	Not applicable
Research Paper 6	Dynamic managerial capabilities and R&D spending: The role of CEO founder status	Heubeck, Tim & Meckl, Reinhard	Scientific journal	In review	Not applicable

Source: Author's representation

Notes: CEO = Chief executive officer, VHB = Verband der Hochschullehrer*innen für Betriebswirtschaftslehre, R&D = Research and development, SJR = Scimago Journal Ranking

Chapter 1 Introduction

1.1 Motivation and research context

Strategic management has long been interested in the origins of superior organizational performance. Even though different theoretical streams concur that competitive advantage is rooted in hard-to-imitate, value-creating strategies (e.g., Barney, 1991; Porter, 1985; Teece, Pisano, & Shuen, 1997), scholars still widely disagree on how these firm-specific advantages arise. This intellectual discourse has led to the development of two fundamentally opposing theories. One is the market-based view (MBV), which builds on the structure-conduct-performance paradigm of industrial economists (Bain, 1956, 1968). According to this outside-in perspective on competitive advantage, performance differentials between firms are primarily the result of external factors, such as industry structure (Porter, 1983, 1985). The other is the inside-out perspective of the resource-based view (RBV), which conversely proposes that competitive advantage originates from organizational resource endowments. The RBV departs from the fundamental assumptions of the MBV by considering resources as heterogeneously distributed and imperfectly transferrable between firms (Barney, 1991; Penrose, 1959). Both views propose conflicting managerial tasks for developing and sustaining competitive advantage. The MBV posits that firms need to occupy a unique, yet defensible, position in an attractive market segment, or enhance the attractiveness of their current market segment, in order to have a competitive advantage (Porter, 1983, 1985). The RBV argues that firms must possess a valuable, rare, inimitable, and non-substitutable (VRIN) resource portfolio to gain competitive advantage (Barney, 1991; Dierickx & Cool, 1989).

The ideological opposition of the MBV and the RBV has resulted in theories that fail to consider the dynamic nature of competition (Teece, 2009). In the current era of hypercompetition, sustainable competitive advantage has become a thing of the past (D'Aveni, 1994; Wiggins & Ruefli, 2005). A plethora of change drivers—notably globalization and digitalization—continues to challenge firms' competitive advantages by frequently changing the rules of competition (Acciarini, Brunetta, & Boccadelli, 2020; Penttilä, Ravald, Dahl, & Björk, 2020). These ongoing developments have accelerated through the advent and recombination of new technologies, pressuring managers to push constant strategic change while also considering the highly interrelated nature of their decisions (Acciarini et al., 2020; Kraus, Palmer, Kailer, Kallinger, & Spitzer, 2018; Pavlou & El Sawy, 2011; Teece, 2012b).

In order to ensure organizational survival in a fast-paced economy with ever shorter competitive cycles (Teece, 2012b), managers must continuously explore new commercial potential through innovation (Chesbrough, 2011; DaSilva & Trkman, 2014; Lee & Lee, 2015; J. A. Martin & Bachrach, 2018; Teece, 2010). The single most daunting, yet fundamental, managerial task is the continuous advancement of a firm's value offerings, as well as its underlying business model, to sustain a competitive advantage in the long run (Clauss, Bouncken, Laudien, & Kraus, 2019; Eppler, Hoffmann, & Bresciani, 2011; Teece, 2007).

Hambrick and Mason's (1984) upper echelons theory (UET) was the first theoretical framework to link organizational outcomes to identifiable characteristics of senior executives, such as knowledge, preferences, or values (A. A. Cannella & Holcomb, 2005; Hambrick, 2018; Hambrick & Mason, 1984). UET radically departs from deterministic strategic management theories that factor out managerial sway over organizational outcomes (e.g., DiMaggio & Powell, 1983; Hannan & Freeman, 1977; Lieberman & O'Connor, 1972). It also serves as a corrective to theories that neglect managerial influence on organizational behavior, such as the MBV and the RBV (e.g., Barney, 1991; Penrose, 1959; Porter, 1983, 1985).

UET generally posits that top managers—as suggested by strategic choice literature (e.g., Child, 1972a, 1972b)—make complex strategic decisions in information environments that are characterized by conflicting, dispersed, and plentiful information (A. A. Cannella & Holcomb, 2005; Hambrick, 2007; Hambrick & Mason, 1984). In these “weak situations” (Mischel, 1977, p. 347), managers are unable to make fully comprehensive decisions due to, for example, temporal pressures or cognitive limitations (Simsek, 2007). Hambrick and Mason (1984) proposed that organizational strategies result from top-level executive decision-making. Managerial decisions, conversely, originate from boundedly rational interpretations of the prevailing choice situation, with those imperfect interpretations shaped by the highly individual characteristics of top-level executives (Abatecola & Cristofaro, 2018; A. A. Cannella & Holcomb, 2005; Hambrick & Mason, 1984; Yamak, Nielsen, & Escribá-Esteve, 2014). In the innovation context, UET therefore provides high explanatory power due to its unstructured and failure-prone nature.

Notwithstanding early considerations of the role executives might play in shaping strategic change, organizational research has long neglected the significance of individual managers and their capabilities for innovation (Augier & Teece, 2009). In order to gain insights into the “elusive black box” (Pavlou & El Sawy, 2011, p. 239) of strategic decision-making processes,

scholars have developed new theories that explicitly address how and why firms survive under conditions of change (Pavlou & El Sawy, 2011).

Sparked by the inability of the RBV to explain the mechanisms through which VRIN resources translate into competitive advantage, scholars such as Eisenhardt and Martin (2000), Teece et al. (1997), and Zollo and Winter (2002) introduced the concept of dynamic capability (DC). The dynamic capability view (DCV) extends the fundamental assumption of the RBV to organizational capabilities in the context of inherently dynamic competitive environments, where sustainable competitive advantage is driven by the necessity for continuous innovation (Felin & Foss, 2005; Felin, Foss, Heimeriks, & Madsen, 2012; Williamson, 1999). According to this Schumpeterian worldview, the main task of management is the effective orchestration, development, and utilization of internal and external resources leveraged through DCs (Teece et al., 1997). Differences in organizational performance result from heterogeneously distributed firm-level capabilities that develop from continuous interactions between internal and external firm-level processes (Kogut & Zander, 1992; Nelson & Winter, 1982; Salvato, 2009).

The focus on collective capabilities at the firm level is one of the most significant limitations of the DCV (Felin & Foss, 2005; Felin et al., 2012). Research shows that heterogeneity at the firm level is essentially the result of individual-level differences that underlie managerial decision-making (Adner & Helfat, 2003; Aguinis et al., 2022; Argote & Ingram, 2000; Felin & Foss, 2005; Teece, 2012a). Therefore, strategic decisions originate not only from firm-level capabilities embedded in organizational routines and processes, but also from individual-level managerial capabilities (Adner & Helfat, 2003; Andrews, 1987; Child, 1972b; Hambrick & Mason, 1984).

Adner and Helfat (2003) introduced the concept of dynamic managerial capability (DMC) to highlight the role of individual-level managerial capabilities as antecedents to organizational strategies. The DMC perspective proposes that managers are the primary agents of change, whose decision-making is shaped by their idiosyncratic capabilities. Managers vary in their ability to “build, integrate, and reconfigure organizational resources and competences” (Adner & Helfat, 2003, p. 1012), owing to differences in their aptitude to sense opportunities and threats, seize identified opportunities, and reconfigure organizational assets (Adner & Helfat, 2003; Beck & Wiersema, 2013; Helfat & Martin, 2015a, 2015b).

Competitive advantage rests with the individual-level capabilities of managers as resource orchestrators, based on three distinct managerial resources: (1) managerial human capital, the knowledge and skill base of the individual; (2) managerial social capital, derived from social networks; and (3) managerial cognition, comprised of mental models and processes (Adner & Helfat, 2003; Beck & Wiersema, 2013; Helfat & Martin, 2015a, 2015b). These individual-level capabilities shape competitive advantage by materializing how managers orchestrate the firm's resource portfolio (Bantel & Jackson, 1989; Beck & Wiersema, 2013; Helfat & Martin, 2015a, 2015b; Tripsas & Gavetti, 2000).

Existing empirical research has largely neglected the microfoundational origins of organizational adaptation (Felin et al., 2012; Foss, 2016; Pavlou & El Sawy, 2011). Instead, studies tend to focus on firm-level antecedents of innovation, such as DCs (e.g., Augier & Teece, 2009; Ferreira, Coelho, & Moutinho, 2020) or slack resources (Bentley & Kehoe, 2020; Marlin & Geiger, 2015; Nohria & Gulati, 1997). This research gap is particularly alarming, since the pivotal role of micro-level antecedents to organizational behavior has already been incorporated into early management theories (e.g., Barnard, 1968; Cyert & March, 1963; March & Simon, 1958; Simon, 1947). Furthermore, research on the individual-level capabilities of managers remains primarily conceptual (e.g., Beck & Wiersema, 2013; Helfat & Martin, 2015a; Teece, 2012a). The few existing DMC studies in the context of innovation focus on single managerial resources (e.g., Åberg & Torchia, 2020; McDonald & Westphal, 2003; Tripsas & Gavetti, 2000), thereby omitting the interdependencies between managerial capabilities. Research has only recently started to progress from partial DMC analysis to holistic examinations of all three DMC subcomponents and their interrelationships (e.g., Holzmayer & Schmidt, 2020; Tasheva & Nielsen, 2022). Although these two studies have significantly contributed to DMC research, they face several shortcomings. Holzmayer and Schmidt (2020) present conflicting arguments by simultaneously proposing DMCs as antecedents to organizational behavior, as well as moderators of the relationship between organizational resources and business diversification. The authors also distort conceptual clarity by proxying individual psychological characteristics, using a mixture of observable individual- and collective-level measures (e.g., using Hofstede's collective-level cultural dimensions as proxies for individual-level cognitions). This dearth of holistic empirical research is startling in the increasingly complex decision-making context of hypercompetition. In this business environment, the organizational capacity to develop and sustain a competitive advantage is likely to rest on the individual-level capabilities of managers. Closing this research

gap is also highly relevant because the ability to recognize, design, and implement strategic change through innovation hinges on the aptitude of top-level managers to use their DMCs to orchestrate a firm's asset portfolio (Adner & Helfat, 2003; Beck & Wiersema, 2013; Helfat et al., 2007; Helfat & Martin, 2015a, 2015b).

Based on these research gaps, the overarching goal of the present thesis is to develop a holistic model of managerial decision-making that is related to today's innovation-driven, hypercompetitive economy. A multi-level approach will be employed to analyze managerial influence in and across three fundamental levels of strategic management—the managerial level, the governance level, and the firm level. The individual-level capabilities of managers at different hierarchical levels—from middle management up to the chief executive officer (CEO)—will be conceptualized by drawing on the complementary theories of DMCs and upper echelons. The thesis will further argue that the DMC–innovation relationship is moderated by managerial-, governance-, and firm-level factors. For this purpose, the thesis will analyze (1) CEO power as a governance-level moderator, (2) organizational slack as a firm-level moderator, and (3) CEO founder status as a managerial-level moderator. Thus, the degree to which CEOs can influence innovation through their DCCs is likely to depend on these contingency factors. These arguments lead to the following four interrelated research questions (RQs), which will be addressed over the course of six research papers:

RQ 1. How do DMCs interact at the managerial level?

RQ 2. Are managers drivers of innovation at the firm level through their DMCs/DCCs?

RQ 3. Which governance-level contingencies shape the relationships between different firm-level phenomena?

RQ 4. Do managerial-, governance- and firm-level contingencies transform the relationship between DMCs/DCCs and innovation?

1.2 Thesis structure and research papers

This thesis is structured into nine chapters. Chapter 2 outlines the underlying strategic and innovation management theories. More specifically, this chapter delves into the behavioral theory of the firm (BTF), the RBV, the UET, and the DCV as the foundation for DMC theory. The individual research papers are presented in Chapters 3 to 8. As summarized in Table 1.2, the papers span three interrelated levels of analysis. Research Paper 1 focuses on the individual-

level interactions between the DMCs of Industry 4.0 firms in the context of business model innovation. Research Papers 2 and 3 expand the level of analysis to the firm level and governance level, respectively. Research Paper 2 investigates the effect of DMCs and their three underlying drivers on the innovativeness of Industry 4.0 firms. Research Paper 3 analyzes the impact of board characteristics on the relationship between organizational slack and innovation in high-tech industries. The findings of the first three papers culminate in Research Papers 4, 5, and 6. Research Paper 4 combines all three levels of analysis into a multi-level model of the antecedents and contingencies of firm-level innovation. The research model tests the effect of individual-level, dynamic CEO capability (DCC) on firm-level innovation and proposes CEO power as a governance-level moderator of this relationship. Research Paper 5 builds on the DCC concept to empirically examine one of the cornerstones of DMC theory: the resource orchestration function of CEOs. For this purpose, the paper develops a holistic model that examines whether, and to what extent, DCCs enhance organizational innovativeness by orchestrating different types of slack resources. Finally, Research Paper 6 assesses the significance of DMCs in driving a firm's innovative capacities in the context of high-tech firms. The paper additionally proposes CEO founder status as a managerial-level moderator of the DMC–R&D spending relationship to account for top managers' propensity to make long-term investments.

The findings of all six research papers cumulatively contribute to an in-depth empirical understanding of the multi-level antecedents to innovation in the current globalized, digital economy. The individual papers and their contributions to the literature are outlined in the following sections and summarized in Table 1.2.

The first research paper in Chapter 3, “Antecedents to cognitive business model evaluation: A dynamic managerial capabilities perspective,” was published in the *Review of Managerial Science*.

The paper argues that the current globalized, digital economy is causing an increasing misalignment between the technological and economic domains (Al-Debei, El-Haddadeh, & Avison, 2008; Clauss, Abebe, Tangpong, & Hock, 2019). Managers need to bridge this discrepancy by continuously redesigning the firm's business model to remain competitive (Acciarini et al., 2020; Kraus et al., 2018). The theoretical argument of the paper builds on Adner and Helfat's (2003) DMC theory, which proposes business model innovation at the heart of strategic change. To develop the hypotheses, the research model argues that business model innovation decision-making is driven by how managers cognitively process strategy-relevant

information. The research model hypothesizes that managerial human capital and managerial social capital positively reinforce each other, as well as contribute to the conscious evaluation of business model innovation. Despite the centrality of DMCs to sustained competitive advantage through business model innovation, there is still little knowledge about the mechanisms through which these capabilities affect organizational change. The existing research either focuses on individual DMC drivers (e.g., Åberg & Torchia, 2020; Tripsas & Gavetti, 2000) or resorts to readily observable and collectively oriented proxies to measure DMCs (e.g., Holzmayer & Schmidt, 2020; Tasheva & Nielsen, 2022). To address these research gaps, the paper develops a holistic DMC model, using the business model innovation context, that aims to answer the following two interrelated RQs:

RQ 1. How can the concept of DMCs be operationalized from a multidimensional perspective?

RQ 2. How do the three dimensions of DMCs interact in the context of business model innovation?

From a methodological perspective, the paper advances research by constructing a novel, survey-based multidimensional operationalization of DMCs. From a theoretical perspective, the paper provides new evidence that managerial human and social capital are two crucial antecedents to the cognitive evaluation of business model innovation. The findings also demonstrate that managerial human and social capital do not positively reinforce each other, as presumed within the literature (e.g., Santarelli & Tran, 2013). The study lends substantial support to individual-level DMC interactions. Finally, from a practical perspective, the findings highlight the importance of investments in managerial training and organizational structure design that is conducive to forming social relationships within the firm.

This research paper is authored by Tim Heubeck and Reinhard Meckl. Tim Heubeck was responsible for project administration, conceptualization/theory, data collection and analysis, methodology, original draft writing, and the review and editing stages. Reinhard Meckl supervised the project and was involved in the review and editing of the paper.

The second research paper in Chapter 4, “More capable, more innovative? An empirical inquiry into the effects of dynamic managerial capabilities on digital firms’ innovativeness,” was published in the *European Journal of Innovation Management*.

Although organizational theories have already factored in the managerial effect on strategic change (Augier & Teece, 2009; Felin & Foss, 2005), the literature still lacks a complete understanding of the specific managerial capabilities that are required to drive change in today's digital economy (Wrede & Dauth, 2020; Wrede, Velamuri, & Dauth, 2020). The study closes this research gap by developing a testable model of how individual-level DMCs translate into firm-level innovation. The research model hypothesizes that DMCs and their three underlying drivers—managerial human capital, social capital, and cognition (Adner & Helfat, 2003)—are direct facilitators of innovation in digital firms. Managers and, by extension, their capabilities likely occupy a critical role in the failure-prone context of innovation. This argument leads to the following three interrelated RQs:

RQ 1. Which role do DMCs occupy in digital firms?

RQ 2. How do the three underpinnings of DMCs (i.e., managerial human capital, social capital, and cognition) affect digital firms' innovativeness individually?

RQ 3. How do DMCs jointly affect digital firms' innovativeness?

The study draws on survey data from firms operating in the German Industry 4.0 sector to test the hypotheses. The findings contribute to the literature by offering a more nuanced account of how DMCs affect innovation in digital firms. The study provides novel evidence, demonstrating that managerial human capital, social capital, and cognition do not promote innovation separately. Instead, the data strongly indicates that only the entire DMC slate is beneficial for digital firm innovativeness. Therefore, the paper significantly advances academic understanding of DMCs. It is the first empirical study that holistically tests the effects of DMCs on firms' innovativeness in the transformed decision-making context of the digitalization-driven Industry 4.0. From a practical perspective, the findings serve as a precautionary tale for organizations, highlighting the need to holistically develop DMCs across different management levels, assign appropriately skilled managers to specific tasks, and utilize appraisal tools that explicitly enhance the entire DMC portfolio.

This research paper is authored by Tim Heubeck and Reinhard Meckl. Tim Heubeck was responsible for project administration, conceptualization/theory, data collection and analysis, methodology, original draft writing, and writing review and editing stages. Reinhard Meckl supervised the project and was involved in the review and editing of the paper.

The third research paper in Chapter 5, “Does board composition matter for innovation? A longitudinal study of the organizational slack–innovation relationship in NASDAQ 100 companies,” is currently in the review process for publication in a scientific journal.

Firms in high-tech industries accumulate increasing amounts of excess resources (Chireka & Fakoya, 2017). Previous evidence (e.g., Chiu & Liaw, 2009; G. George, 2005; Nohria & Gulati, 1996, 1997) paints an ambiguous picture of the value of these slack resources for innovation. Some slack is beneficial, fueling explorative behaviors in managers (Bourgeois, 1981; Bromiley, 1991; Cyert & March, 1963); excessive slack, however, provokes inefficiencies and managerial self-opportunism that is detrimental to innovation (Nohria & Gulati, 1996, 1997; Staw, Sandelands, & Dutton, 1981). The paper argues that the double-edged nature of slack is particularly pronounced in high-tech industries. The increased volatility, uncertainty, complexity, and ambiguity (VUCA) of these dynamic industries offer more opportunities for managers to harm the organization by prioritizing their self-interests over organizational goals (Chiesa & Frattini, 2011; Hacklin, Björkdahl, & Wallin, 2018). As the embodiment of corporate governance, a firm’s board of directors seems particularly decisive for instilling pro-organizational behavior in managers in the volatile context of high-tech firms.

Based on these arguments, the research model hypothesizes that board composition determines corporate governance efficacy, as board directors perform two crucial roles in high-tech industries. First, building on agency theory, directors are tasked by the shareholders to limit managerial self-opportunism by ensuring there is alignment between management decisions and organizational goals (D. R. Dalton, Hitt, Certo, & Dalton, 2007; Fama & Jensen, 1983; Kor, 2006). Second, building on resource dependency theory, directors are not merely monitors of executive behavior; they also provide valuable knowledge and resources to support managers in implementing innovations (Daily, Dalton, & Cannella, 2003; Kor, 2006; Pfeffer & Salancik, 1978; Sierra-Morán, Cabeza-García, González-Álvarez, & Botella, 2021). Therefore, board composition may determine the extent to which management engages in behaviors that are detrimental or beneficial to innovation. The study contributes to strategic and innovation management literature by answering the following RQ:

RQ. How does board composition influence the relationship between organizational slack and innovation in high-tech industries?

The findings from a sample of NASDAQ 100 firms between 2010 and 2020 extend the notion of slack resources as a double-edged sword for high-tech industries. The study also confirms

that the nature of the inverted U-shaped relationship is contingent on specific board characteristics—boards with a larger number of directors, or a higher share of independent directors, dampen this relationship, while boards with longer-tenured directors, higher numbers of directorial affiliations, and larger shares of female directors amplify it. From a practical perspective, the study cautions firms to balance the innovation-promoting qualities of slack resources with their propensity for driving down efficiency, providing essential guidance for how a firm should staff its board to ensure corporate governance mechanism efficacy.

This research paper is authored by Tim Heubeck and Reinhard Meckl. Tim Heubeck was responsible for project administration, conceptualization/theory, data collection and analysis, methodology, original draft writing, and the review and editing stages. Reinhard Meckl supervised the project and was involved in the review and editing of the paper.

The fourth research paper in Chapter 6, “Microfoundations of innovation: A dynamic CEO capabilities perspective,” is currently in the review process for publication in a scientific journal.

This paper combines all previously analyzed levels. At the managerial level, the paper develops the DCC concept by complementing DMC theory (Adner & Helfat, 2003) with UET (Hambrick, 2007; Hambrick & Mason, 1984). This refinement of DMCs is grounded in the observation that CEOs are the most pivotal change agents, as they design and implement both corporate strategies (i.e., target markets) and competitive strategies (i.e., market competition methods) by orchestrating a firm’s asset portfolio (Andrews, 1987; Beck & Wiersema, 2013; Quigley & Hambrick, 2015). Thus, the specific DMCs of CEOs may represent central drivers of innovation at the firm level. Based on this argument, the research model links the individual level to the firm level by hypothesizing that CEOs directly promote innovation through their DCCs. Finally, the paper merges the managerial, governance, and firm levels by proposing that CEO power, vis-à-vis the board, is a central contingency of the DCC–innovation relationship. The paper aims to answer the following two RQs:

RQ 1. To what extent do DCCs foster innovation?

RQ 2. How does CEO power shape the relationship between DCCs and innovation?

The study tests the hypotheses using a sample of manufacturing firms from Standard & Poor’s (S&P) 900 Index between 2016 and 2020. The findings contribute to the literature by showing that higher levels of DCCs directly promote innovation at the firm level. Additionally, the data

confirms that CEO power from structural sources (i.e., CEO duality, CEO discretion, board independence) impacts the strength of the DCC–innovation relationship, while expert power gained during a CEO’s tenure has no significant effect on this relationship. The findings caution firms that the individual-level DCCs of their CEOs are integral for promoting innovation, and that the extent to which CEOs can promote innovation through their DCCs is contingent on their structural power. The results emphasize the importance of CEOs with high DCC levels for enabling long-term organizational survival through sustained competitive advantage, demonstrating that organizational structures can create a climate that is conducive to innovation.

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The fifth research paper presented in Chapter 7, “Multi-level antecedents of innovation: Dynamic CEO capabilities and the mediating role of slack resources,” is currently in preparation for submission to a scientific journal.

Adner and Helfat (2003) argued that managers are the primary agents of organizational change due to their role as resource orchestrators. Accordingly, the aptitude of managers to design and deploy organizational resources is determined by their ability to sense and seize opportunities and threats, as well as reconfigure a firm’s resources; all of this hinges on individual-level DMCs (Adner & Helfat, 2003; Teece, 2016; Teece et al., 1997).

Organizational slack is a highly debated part of a firm’s resource portfolio that has been extensively studied in the context of innovation (e.g., Geiger & Cashen, 2002; Geiger & Makri, 2006; Kim, Kim, & Lee, 2008; Marlin & Geiger, 2015; Nohria & Gulati, 1996, 1997). Although slack is recognized as a multidimensional resource, composed of distinguishable subcomponents that differ in characteristics and effect on organizational outcomes (Bourgeois & Singh, 1983; Geiger & Cashen, 2002; Geiger & Makri, 2006; Marlin & Geiger, 2015; Sharfman, Wolf, Chase, & Tansik, 1988), scholars have focused on the most discretionary forms of slack as determinants of innovation (e.g., Ashwin, Krishnan, & George, 2016; Bentley & Kehoe, 2020; Nohria & Gulati, 1996; Tabesh, Vera, & Keller, 2019).

Research Paper 5 combines the previously separated research fields of DMC, UET, and organizational slack. The research model delves into the DCC mechanisms that can enhance a firm's innovativeness by equipping top managers with the capabilities to orchestrate different slack types—a potentially critical component of a firm's resource portfolio concerning innovation. The paper aims to assess the significance of individual-level DMCs as antecedents to firm-level innovation. The hypotheses propose that DCCs and their underlying drivers determine the level of internal slack resources (i.e., available and recoverable slack). In contrast, it is argued that DCCs, neither individually through the three subcomponents, nor combined through the interactive effects of these managerial resources, affect the orchestration of external slack resources (i.e., potential slack). Thus, the proposed research model empirically examines whether, and to what extent, DCCs collectively, and with their underlying drivers, contribute to higher innovation levels by determining slack orchestration. The paper aims to advance microfoundational strategic and innovation management literature by answering the following two RQs:

RQ1. How do CEOs orchestrate different forms of organizational slack through their DCCs?

RQ2. Which underlying drivers of DCCs are most critical for CEOs' ability to orchestrate and deploy different types of slack resources for innovation?

The findings from a longitudinal sample of S&P 900 manufacturing firms provide support for the significance of DCCs in determining the ability of CEOs to orchestrate different slack types to enhance innovation. The results demonstrate that DCCs and two of their underlying drivers—managerial human capital and cognition—are critical individual-level capabilities for orchestrating and deploying available slack resources. Contrary to expectations, managerial cognition is the only antecedent for the orchestration of recoverable slack. Further, the results confirm that DCCs and their three underlying drivers do not influence externally-located potential slack. Research Paper 5 significantly promotes the microfoundational management literature by examining the linkages between managerial- and firm-level antecedents to innovation. The research model provides the first holistic account of the extent to which DCCs enhance innovation through the orchestration of different slack resources. The results also generate valuable insights into the significance of DCCs in the context of resource orchestration and innovation. Altogether, the paper reveals that neither the superordinate construct of DCCs and their underlying drivers—managerial human capital, social capital, and cognition—nor organizational slack and its different forms—available, recoverable, and potential—should be considered as uniform individual- and firm-level antecedents to innovation. Both scholars and

practitioners are instead advised to examine the impacts of these two constructs by explicitly taking their multidimensional nature into account.

This research paper is authored by Tim Heubeck and Reinhard Meckl. Tim Heubeck was responsible for project administration, conceptualization/theory, data collection and analysis, methodology, original draft writing, and the review and editing stages. Reinhard Meckl supervised the project and was involved in the review and editing of the paper.

The sixth research paper presented in Chapter 8, “Dynamic managerial capabilities and R&D spending: The role of CEO founder status,” is currently in the review process for publication in a scientific journal.

The integrality of sufficient R&D investments for developing and sustaining competitive advantage is accentuated in today’s hypercompetitive economy, in which the constant emergence and recombination of technologies place managers under mounting pressure to sustain their firm’s innovative capacity (Acciarini et al., 2021; Heij, Volberda, Van den Bosch, & Hollen, 2020; Martin & Bachrach, 2018; Penttilä et al., 2020). Thus, although R&D projects jeopardize short-term performance, and are inherently risky and failure-prone, they are a prerequisite to a firm’s long-term survival (Baysinger, Kosnik, & Turk, 1991; Klein & Sorra, 1996; Lavery, 1996; Rosenbusch, Brinckmann, & Bausch, 2011). Nonetheless, the existing literature omits the agency of R&D strategies by adopting a firm-level perspective on these critical investment decisions (Ahuja, Lampert, & Tandon, 2008). Based on these arguments, Research Paper 6 builds on Adner and Helfat’s (2003) DMC theory to argue that superior individual-level managerial DCs are integral to the pursuit of innovation, as these managers are more skilled to sense opportunities and threats, seize their commercial potential, and efficiently reconfigure a firm’s resource portfolio (Heubeck & Meckl, 2022; Teece, 2007; Wach, Maciejewski, & Głodowska, 2022). The paper further argues that CEOs differ in their investment decisions due to their status as founder or nonfounder. Superior DMCs of founder CEOs are likely to cause increased R&D investments, as founder CEOs possess the necessary entrepreneurial mindset, making them highly risk-taking and persistent in pursuing their firm’s long-term goals (Arthurs & Busenitz, 2003; Deb & Wiklund, 2017; Fahlenbrach, 2009). Therefore, founder CEO status will likely amplify the DMC–R&D spending relationship. These arguments lead to the following two research questions.

RQ1. Do CEOs with higher DMC levels allocate more resources toward R&D?

RQ 2. Do founder CEOs contribute to higher levels of R&D spending through their DMCs than nonfounder CEOs?

The results from a sample of high-tech firms from the NASDAQ 100 Index confirm theoretical arguments that CEOs with high DMC levels allocate significantly more resources toward R&D than their less-skilled counterparts. At the same time, the findings offer a nuanced account of the underlying effect mechanisms by demonstrating that, of the three DMC subcomponents, only managerial social capital is a direct facilitator of R&D spending. Regarding the moderation effect of CEO founder status, the study confirms the benefits of founder CEOs in pursuing innovation, as founder CEOs significantly contribute to higher R&D investments through their DMCs than professional CEOs. In conclusion, Research Paper 6 reaffirms that DMCs are a source of competitive advantage for high-tech firms, while founder-led firms can benefit even more from the innovation-enhancing DMC effects.

This research paper is authored by Tim Heubeck and Reinhard Meckl. Tim Heubeck was responsible for project administration, conceptualization/theory, data collection and analysis, methodology, original draft writing, and the review and editing stages. Reinhard Meckl supervised the project and was involved in the review and editing of the paper.

Chapter 9 summarizes the findings of the thesis, discusses their theoretical and practical implications, and provides recommendations for future research. The thesis concludes with a summary note.

Table 1.2 Overview of the research papers and their level of analysis, research propositions, and underlying sample

	Managerial level	Governance level	Firm level	Sample
<p>Research Paper 1 Antecedents to cognitive business model evaluation: A dynamic managerial capabilities perspective</p>	<p>(1) Developing a holistic, survey-based operationalization of dynamic managerial capabilities</p> <p>(2) Empirically examining individual-level interactions between dynamic managerial capabilities in the context of business model innovation</p>			Industry 4.0
<p>Research Paper 2 More capable, more innovative? An empirical inquiry into the effects of dynamic managerial capabilities on digital firms' innovativeness</p>	<p>(1) Building a comprehensive model of individual-level interactions between the three subcomponents of dynamic managerial capabilities</p>		<p>(2) Empirically examining the individual and composite effects of dynamic managerial capabilities on the innovativeness of digital firms</p>	Industry 4.0
<p>Research Paper 3 Does board composition matter for innovation? A longitudinal study of the organizational slack–innovation relationship in NASDAQ 100 companies</p>		<p>(1) Empirically assessing the nature of the slack–innovation relationship in high-tech industries</p> <p>(2) Empirically analyzing the effect of board composition as a determinant of corporate governance efficacy on the relationship between organizational slack and innovation in high-tech industries</p>		NASDAQ 100

Table 1.2 Overview of the research papers and their level of analysis, research propositions, and underlying sample (continued)

	Managerial level	Governance level	Firm level	Sample
Research Paper 4 Microfoundations of innovation: A dynamic CEO capabilities perspective	(1) Developing the concept of dynamic CEO capabilities by building on dynamic managerial capabilities theory and upper echelons theory (2) Empirically linking individual-level dynamic CEO capabilities to firm-level innovation (3) Analyzing CEO power as a moderator of the dynamic CEO capabilities–innovation relationship (4) Inclusion of multi-level controls to account for potential managerial-, governance-, and firm-level influences on innovation			S&P 900 manufacturing firms
Research Paper 5 Multi-level antecedents of innovation: Dynamic CEO capabilities and the mediating role of slack resources	(1) Empirically examining the resource orchestration function of CEOs (2) Holistically testing the effect of dynamic CEO capabilities and their three subcomponents on innovation by shaping a slack resource orchestration as a critical part of a firm’s resource portfolio (3) Inclusion of multi-level controls to account for potential managerial-, governance-, and firm-level influences on innovation			S&P 900 manufacturing firms
Research Paper 6 Dynamic managerial capabilities and R&D spending: The role of CEO founder status	(1) Empirically testing whether, and to what extent, superior dynamic managerial capabilities contribute to higher R&D investments (2) Examining the moderative role of CEO founder status (3) Inclusion of multi-level controls to account for potential managerial-, governance-, and firm-level influences on innovation			NASDAQ 100

Source: Author’s representation

Notes: CEO = Chief executive officer, R&D = Research and development, S&P = Standard and Poor’s

Chapter 2 Theoretical background

2.1 Theories of strategic management

2.1.1 *Toward a behavioral theory of the firm*

Chandler (1992) posits that the notion of the firm across different theories essentially boils down to four fundamental attributes. First, firms are *legal entities* that enter into contractual agreements with various stakeholders, such as employees, suppliers, or customers. Second, firms are *administrative entities* that resort to agents for coordinating, monitoring, and performing interrelated activities, such as producing goods or offering services. Third, firms become *unique resource bundles* by accumulating, acquiring, and combining tangible resources (e.g., physical production facilities or capital) and intangible resources (e.g., knowledge or routines). Fourth, firms are *allocative entities* that turn input factors into output factors (e.g., products or services), determining future production and resource endowments within their boundaries or between different firms in the environment.

Economic theories consider firms as discrete entities that utilize idiosyncratic resources and production factors to create value (Todeva, 2007). Under these assumptions, organizational behavior predominantly results from environmental contingencies, which determine resource allocation and demand conditions through equilibrium states (Colander, 2000; Robbins, 1945). Market exchanges naturally yield profit-maximizing situations because firms operate under perfect competition and managers make entirely rational decisions with complete information (Chandler, 1977, 1992; Hart, 1989; Schumpeter, 1961). Accordingly, economic theories presume that all managers make complete, unbiased, and comprehensive decisions based on full information in every situation. The rationality assumption omits the possibility that firms might differ in their ability to produce value, and that managers may not be equally capable or entirely rational in their decision-making (Bertrand & Schoar, 2003; Teece, 2016; Teece & Winter, 1984).

Economic theories paint an overly simplified—or at least abstract—account of organizational and managerial behavior (Chandler, 1992). The Carnegie School was motivated to fill this void in the literature with Simon's (1947) *Administrative Behavior*, March and Simon's (1958) *Organizations*, and Cyert and March's (1963) *A Behavioral Theory of the Firm*. The basic idea of these scholars was to open the black box of organizational decision-making by merging existing theories of economics, sociology, and strategic management into a holistic, theoretical framework that addresses the multi-level linkages between individuals, groups, and entire

organizations (Gavetti, Greve, Levinthal, & Ocasio, 2012; Todeva, 2007). The BTF, consequently, highlights the complex interrelationships between these often formally separated levels by proposing organizations as unique decision-making contexts (Gavetti et al., 2012; Gavetti, Levinthal, & Ocasio, 2007; Simon, 1947).

Departing from the rationality assumption, the BTF rests on three fundamental leitmotifs. To start, a firm is an inherently social institution, driven by human decisions in specific social contexts (Gavetti et al., 2007; March & Simon, 1958). Tied to this understanding, social relationships within and between firms shape the distribution and flow of information, providing managers with highly firm-specific information for decision-making (Simon, 1947). Thus, the BTF highlights the social and psychological processes that shape individual- and group-level decision-making (Gavetti et al., 2007; Simon, 1947). Finally, the BTF advances understanding of organizational behavior through normative and descriptive analyses of firms' actual strategic behavior (Gavetti et al., 2007; Machlup, 1967).

From the perspective of the Carnegie School, decision-making is only boundedly rational. Decision-makers are not rational economic agents but “rule-based actors who solve pressing problems, search their local environment, and adopt solutions that rarely violate the *status quo*” (Gavetti et al., 2012, p. 5). Although managers intend to make rational decisions based on their best knowledge, the human decision-making process is subject to inherent constraints, such as limited or fragmentary information, selective attention, and incomplete preferences (Gavetti et al., 2007; Simon, 1947). Therefore, the BTF should not be regarded as a simple modification of existing theories on firm behavior, as it proposes an alternative rationality model that contradicts the assumptions of economic theories. The model of bounded rationality proposed by the BTF can be summarized in three aspects (Gavetti et al., 2012).

- (1) *Satisficing*: Profit maximization entails decision-makers identifying all possible information and opportunities, fully considering the implications, and selecting the option that promises the highest value. Accordingly, in every situation—as complex and ambiguous as it may be—managers select the optimal choice alternative. Behavioral theorists have demonstrated that real-world decision-making is shaped by historically developed target levels or success criteria. Hence, decision-makers are satisficers—they reduce their efforts after achieving satisfactory results (Gavetti et al., 2012; March, 1994; Thompson, 1967).

- (2) *Search processes*: Information search is not explicitly considered within profit maximization because it is assumed that decision-makers can readily access all information at no cost. Real-world decision-making, however, is fundamentally shaped by resource-consuming information search processes. Managers terminate their information search once they have reached a satisfactory level of knowledge for making a sufficiently informed decision. In contrast to the profit maximization assumption, individuals consider only a limited number of alternatives when making decisions (Cyert & March, 1963; Gavetti et al., 2012; March, 1994; Simon, 1947).
- (3) *Rules, standard operating procedures, and status quo*: Managers default to existing decision-making rules or standard operating procedures, especially in uncertain or unfamiliar situations, when they want to reduce a large amount of information to a more manageable size. As a result, the final decision seldom departs from established rules or standard operating procedures, instead tending to reinforce the status quo (Cyert & March, 1963; Gavetti et al., 2012; March & Shapira, 1987, 1992).

It can be concluded that the BTF is a radical departure from previously dominant theories of organizational behavior. The Carnegie School takes a holistic perspective on firms and their behavior, prompting a paradigm shift within organizational theories by considering the underlying decision-making processes at both the managerial and firm levels, instead of conceptualizing firms as homogenous administrative entities. Furthermore, the BTF opens organizational boundaries by explicitly considering firms within a larger social context, such as industry or the economy. For example, aspiration levels develop not only internally, but also through target level assessments of competitors (Argote & Greve, 2007; Gavetti et al., 2012, 2007).

Based on this argumentation, the present dissertation will draw on BTF-based theories to conceptualize the managerial effect on firm-level outcomes (Chandler, 1992), because an inquiry into organizational behavior should not be built on economic theories that are “ill-equipped to deal with the complexity and diversity of management problems” (Teece & Winter, 1984, p. 117). Relying on theories grounded in the BTF accelerates the aim of developing a nuanced understanding of real-world decision-making processes within and beyond organizational boundaries by empirically testing theoretical models (Cyert & March, 1963).

2.1.2 The resource-based view of the firm

Strategic management scholars have long tried to pin down the catalysts for sustained competitive advantage. As previously illustrated, two highly influential but competing perspectives have emerged from this academic discourse: the RBV (e.g., Barney, 1991; Dierickx & Cool, 1989; Kor & Mahoney, 2004; Mahoney & Pandian, 1992; Penrose, 1959; Prahalad & Hamel, 1990; Wernerfelt, 1984) and the MBV (e.g., Bain, 1956, 1968; E. S. Mason, 1949; Porter, 1983, 1985). This section outlines the RBV in more detail, since it serves as the foundation for DC and DMC theories.

The term *strategy* generally comprises corporate strategy (i.e., the market a firm intends to serve) and competitive strategy (i.e., how a firm aims to compete in those markets) (Andrews, 1987). Competitive advantage, conversely, originates from value-promising or value-creating strategies (Barney, 1991; Barney, McWilliams, & Turk, 1989; Baumol, Panzar, & Willig, 1982; Jacobsen, 1988) that cannot be imitated by any current or future competitor (Hirshleifer, 1980; Lippman & Rumelt, 1982; Rumelt & Wensley, 1981).

The RBV revived Penrose's (1959) notion that managers "are motivated by the struggle for survival and by the need for achievement and recognition to generate both creative innovations and adaptive responses via new resource combinations" (Kor & Mahoney, 2000, p. 114). Penrose's (1959) theory of firm growth builds on the BTF (Cyert & March, 1963; March & Simon, 1958; Simon, 1947) by arguing that firms are not merely administrative entities but idiosyncratic resource bundles (Kor & Mahoney, 2000; Kor, Mahoney, Siemsen, & Tan, 2016). Rather than following the equilibrium approach propagated by neoclassical economists, Penrose (1959) draws on a disequilibrium approach that explicitly considers the dynamic nature of fully or partially unexploited resources as antecedents to organizational growth (Kor & Mahoney, 2004; Kor et al., 2016). The *Penrosian theorem* highlights that the capabilities of managers are integral to organizational growth (Kor et al., 2016), because managers function as both catalysts and inhibitors of superior performance by selecting, developing, and allocating organizational resources (Starbuck, 1965).

The RBV proposes a different conceptualization of resources with a firm's resource portfolio comprised of its "assets, capabilities, organizational processes, firm attributes, information, [and] knowledge" (Barney, 1991, p. 101). Resources contain not only physical resources, such as capital or production factors, but also intangible resources, such as human capital or tacit knowledge (Barney et al., 1989; Daft, 1989). The resource configuration enables firms to

devise and implement strategies (Daft, 1989), which means a firm's resource portfolio is the foundation for competitive advantage, enabling the implementation of superior organizational strategies (Daft, 1989; Learned, Christensen, & Andrews, 1965; Porter, 1981).

The literature distinguishes between two main types of organizational resources: (1) *tangible* or *material resources* and (2) *intangible* or *immaterial resources* (Collis & Montgomery, 2005, 2008; Ford & Mahieu, 1998). Tangible resources refer to a firm's physical production or input factors for the production process, such as machinery, raw materials, production facilities, or capital (Barney, 1991; Collis & Montgomery, 2008; Wernerfelt, 1984). Intangible resources are capabilities or disposal rights (R. Hall, 1992). A firm's capabilities determine resource deployment efficiency and are embedded in organizational structures, such as routines or standard operating procedures (Day, 1994). Non-codified routines are particularly integral to strategic management, as competitors cannot simply acquire them but must develop and hone them over time (Helfat et al., 2007; Leonard-Barton, 1992; Polanyi, 2015; Teece et al., 1997).

The RBV posits that sustainable competitive advantage is derived from a firm's unique resource endowments (Barney, 1991; Barney et al., 1989; Hatten & Hatten, 1987; Wernerfelt, 1984). The RBV breaks with the fundamental assumptions of the MBV by presuming that resources are heterogeneously distributed and imperfectly transferrable between firms. Thus, competitive advantage originates from differences in the resource endowments between firms and prevents firms from replicating the successful strategies of their competitors (Barney, 1991; Barney & Hoskisson, 1990; Foss, 1997, 1998). Barney (1991) identifies valuable resources that may result in competitive advantage using the VRIN criteria: (1) *valuable resources* allow firms to exploit and explore opportunities or counter threats from the external environment; (2) *rare resources* are hard to acquire for current or potential competitors; (3) *inimitable resources* are difficult to replicate by other firms; and (4) *non-substitutable resources* have no strategic equivalent.

Since the RBV proposes that resources are—contrary to the assumptions of the MBV—heterogeneously distributed and imperfectly transferrable between firms, resource heterogeneities can persist over time (Barney, 1991; Dierickx & Cool, 1989; Foss, 1998; Mahoney & Pandian, 1992; Rumelt, 1984). The RBV implies that managers should focus not only on facilitating and defending a value-creating position within the industry, but also on managing the firm's resource portfolio (Dierickx & Cool, 1989). Nevertheless, managerial decision-making is, as stated in the BTF, not entirely rational; it is the result of three interdependent managerial processes: (1) perceiving and defining a situation; (2) learning from

the results of specific managerial activities; and (3) assessing the behavior of external actors from the firm's environment (Barney, 1991; Foss, 1998; March & Simon, 1958; Wernerfelt, 1984). Hence, the central managerial task lies in identifying, creating, exploiting, and refining a firm's resources to sustain a competitive advantage (Barney, 1991; Dyer & Singh, 1998; Grant, 1996; Wernerfelt, 1984).

2.1.3 Upper echelons theory

Assessments of how long-term competitive advantage emerges essentially boil down to two fundamental questions:

- (1) *Strategic appropriability*: Which strategies are most appropriate given a firm's specific circumstances (Tushman & Romanelli, 1985)?
- (2) *Organizational behavior*: What are the reasons behind specific organizational behaviors (Hambrick & Mason, 1984)?

These two lines of inquiry point to one quintessential question:

- (3) *Responsibility/agency*: Who is ultimately responsible for how firms behave?

This pivotal question in the study of management has been examined from a multitude of perspectives (e.g., Davis, Schoorman, & Donaldson, 1997; DiMaggio & Powell, 1983; Donaldson & Davis, 1991; Fama & Jensen, 1983, 1983; Finkelstein & Hambrick, 1996; Hambrick & Mason, 1984; Hannan & Freeman, 1977; Lieberman & O'Connor, 1972; Machlup, 1967). Out of all these theories, Hambrick and Mason's (1984) UET remains the dominant framework for conceptualizing the managerial effect on organizational outcomes (Kurzahls, Graf-Vlachy, & König, 2020).

UET builds on early strategic choice literature (Child, 1972a, 1972b) and the BTF (Cyert & March, 1963; March & Simon, 1958; Simon, 1947). It fundamentally proposes that boundedly rational senior executives shape organizational outcomes through selective perceptions of the strategic choice situation, which are determined by the observable background characteristics of top-level managers, such as age, education, or functional experience (A. A. Cannella & Holcomb, 2005; Hambrick, 2007). UET ultimately posits that a firm becomes a "reflection of its top managers" (Hambrick & Mason, 1984, p. 193) because managerial background characteristics manifest in distinct strategic choices and behaviors (A. A. Cannella & Holcomb, 2005; Hambrick, 2007; Hambrick & Mason, 1984; Yamak et al., 2014).

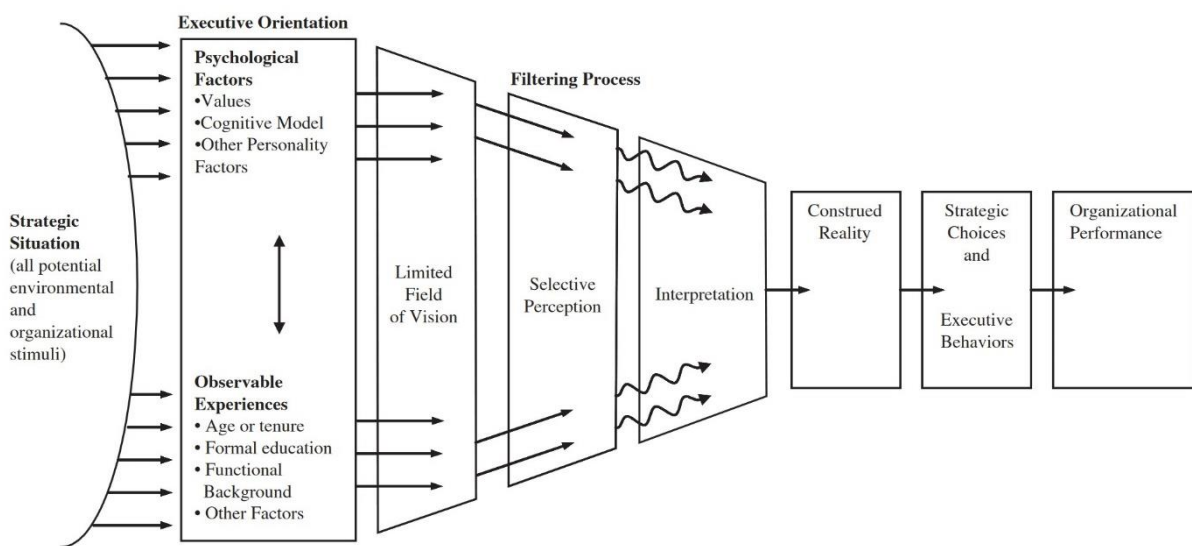
Hambrick (2018) argues that UET is a radical departure from deterministic theories that disregard the managerial effect on strategic change (e.g., DiMaggio & Powell, 1983; Hannan & Freeman, 1977; Lieberman & O'Connor, 1972), serving as a corrective for strategic management theories that do not explicitly consider the role of managers (e.g., Barney, 1991; Peteraf, 1993; Porter, 1983, 1985). Thus, UET bridges the dominant divide between micro research—the rational actor—and macro research—the dominant coalition—by proposing that a firm's strategy and performance mirror the characteristics of its upper echelons (A. A. Cannella & Holcomb, 2005). For this purpose, UET draws on a multi-theoretical approach to explicitly examine the linkages between individuals, organizations, and the larger competitive environment in which individuals and organizations are embedded (Hambrick & Mason, 1984).

Figure 2.1 depicts the model of organizational behavior proposed by UET (Finkelstein & Hambrick, 1996; Hambrick & Mason, 1984). As suggested by strategic choice literature (Child, 1972a, 1972b), top managers are tasked by shareholders to make comprehensive strategic decisions. However, information in strategic choice situations is plentiful, dispersed, and ambiguous, making it impossible for individual managers, or even management teams, to perceive and assess the breadth of information (Hambrick & Mason, 1984; Hambrick & Snow, 1977). The middle of Figure 2.1 illustrates the highly subjective information filtering process. First, managers only have access to a finite scope of information. Then, the information filtering process imposes even more restrictions, as a manager's limited field of vision is only selectively perceived. In the final step, this highly selective perception of information is interpreted through idiosyncratic mental processes and structures that are shaped by managerial background characteristics. This perceptual process informs executive decision-making with a personal worldview that determines managerial behaviors and choices as antecedents to organizational outcomes (Hambrick, 2007; Hambrick & Mason, 1984).

UET draws on the bounded rationality concept of the BTF to conceptualize the information filtering process that underlies strategic decision-making (Cyert & March, 1963; March & Simon, 1958; Simon, 1947). Additionally, it explains differences in perceptions of strategic choice between managers (A. A. Cannella & Holcomb, 2005; Hambrick & Mason, 1984). UET posits that observable managerial characteristics serve as proxies for unobservable properties that influence managerial decision-making by informing strategic judgments with specific *givens*, such as knowledge of alternatives and their consequences or presumptions about future events (Hambrick & Mason, 1984; March & Simon, 1958). This cognitive base serves “to filter

and distort the decision maker's perception of what is going on and what should be done about it" (Hambrick & Mason, 1984, p. 195). In sum, UET proposes that strategic decisions are not made under rational calculation but instead are based on behavioral factors. UET explicitly considers how bounded rationality influences strategic decision-making and how personal values and perceptions influence the decisions of top managers (Abatecola & Cristofaro, 2018; A. A. Cannella & Holcomb, 2005; Hambrick, 2007).

Figure 2.1 Upper echelons perspective on organizational behavior



Source: A. A. Cannella and Holcomb (2005)

The conceptual assumptions of Hambrick and Mason's UET (1984) have been the subject of vivid academic discussion (e.g., Abatecola & Cristofaro, 2018; A. A. Cannella & Holcomb, 2005; Carpenter, Geletkanycz, & Sanders, 2004; Markóczy, 1997; Neely, Lovelace, Cowen, & Hiller, 2020; Priem, Lyon, & Dess, 1999). One of the central criticisms of UET concerns the collectively-focused perspective on strategic decision-making. UET examines top management team (TMT) decision-making processes as the dominant coalition within a firm (Hambrick, 2007, 2018; Hambrick & Mason, 1984). Although this perspective is not unique to UET (e.g., Cyert & March, 1963; March & Simon, 1958; Weick, 1979b), and has influenced large parts of strategy research (e.g., Amason, 1996; Bantel & Jackson, 1989; Finkelstein, 1992; Finkelstein & Hambrick, 1990, 1996; Finkelstein, Hambrick, & Cannella, 2009; Haleblan & Finkelstein, 1993; Keck, 1997; Olson, Parayitam, & Twigg, 2006; Thomas & McDaniel, 1990; Wiersema & Bantel, 1992, 1993), even the original upper echelons model of strategic choice

was essentially conceptualized at the individual level (A. A. Cannella & Holcomb, 2005). As depicted in Figure 2.1, the upper echelons model does not explicitly distinguish between individual- and group-level processes. This lack of separation presents an overly simplistic account of strategic decision-making. UET applies the same logic to both levels, suggesting that individual-level decision-making processes do not differ from group-level decision-making processes. Although UET proposes that managerial background characteristics shape how information is filtered, the lack of separation between individual- and group-level processes implies that top managers are homogenous in their limited fields of vision, selective perceptions, and resulting interpretations (A. A. Cannella & Holcomb, 2005). This implicit assumption is not only refuted by intuition, but also by empirical evidence (Chattopadhyay, Glick, Miller, & Huber, 1999; Dearborn & Simon, 1958; Ma, Kor, & Seidl, 2022; Starbuck & Milliken, 1988; Walsh, 1988). Additionally, structural contexts such as dual leadership structures may shift decision-making power away from the TMT toward individual managers (A. A. Cannella & Holcomb, 2005).

It can be concluded that UET is more applicable to the strategic decision-making process of individual managers than groups of managers (A. A. Cannella & Holcomb, 2005; Starbuck & Milliken, 1988). Information processing is an individual-level phenomenon. Even if groups make sense of information collectively, the initial recognition and final assessment of information occur within an individual (American Psychological Association, 2019; Ashcraft, 2006; Colman, 2015; Neisser, 1976). These realizations are also at the heart of strategic issue diagnosis literature (e.g., Dutton, 1993; Dutton & Ashford, 1993; Dutton & Duncan, 1987; Dutton, Fahey, & Narayanan, 1983; Dutton, Walton, & Abrahamson, 1989; Dutton & Jackson, 1987). According to this perspective, individual CEOs perceive, interpret, and frame strategic information, subsequently presenting limited aspects of highly processed information to the TMT. Thus, CEOs act as information gatekeepers who set the TMT's agenda (A. A. Cannella & Holcomb, 2005).

Although the field of strategic management has decisively progressed by adopting an upper echelon perspective on organizational behavior, scholars need to expand on Hambrick and Mason's (1984) initial formulation of UET in order to gain a more in-depth understanding of the complexities of real-world decision-making processes. Based on the preceding arguments, the present thesis will build on the basic notions of UET—and, by extension, the BTF—to examine the individual-level mechanisms that underlie strategic decision-making.

2.1.4 *The dynamic capability view*

Although the RBV of the firm has decisively shaped strategy research by considering resource heterogeneities as the foundation for sustained competitive advantage (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984), it does not explicitly clarify the mechanisms through which the highly idiosyncratic resource endowments of firms develop and transform. The RBV thereby omits how competitive advantage, rooted in VRIN resources, emerges, and how it can be influenced by a firm and its management (Helfat & Peteraf, 2003; Teece et al., 1997).

The work of Penrose (1959), Williamson (1975, 1985), Nelson and Winter (1982), Teece (1988), and Teece et al. (1994) have laid the theoretical foundation for the DCV. According to this Schumpeterian worldview (e.g., Schumpeter, 1934, 1939, 1961), competitive advantage emerges from the creative destruction of existing resources and the recombination of different capabilities (Pavlou & El Sawy, 2011). Teece and Pisano (1994) put forth the notion of DC to spotlight two key aspects that are central to organizational survival and competitive advantage in dynamic marketplaces and previously omitted by strategic management theories. First, *dynamism* pertains to the ongoing globalization and technological advancement that is reshaping the competitive environment (Teece & Pisano, 1994). These environmental shifts introduce significant VUCA (Cai, 2022; Liu, 2022), thereby pressuring firms to take appropriate strategic countermeasures and to pursue constant innovation to ensure future adaptability (Teece & Pisano, 1994). Second, *capabilities* refer to the fundamental role of strategic management in “appropriately adapting, integrating, and re-configuring internal and external organizational skills, resources, and functional competences toward changing environment” (Teece & Pisano, 1994, p. 538).

Eisenhardt and Martin (2000), Winter (2003), Teece et al. (1997), and Zollo and Winter (2002) later refined the DCV. According to the most cited definition (N. George, Karna, & Sud, 2022), DC is comprised of a “firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al., 1997, p. 516). The DCV proposes that firms can only develop, sustain, and protect competitive advantage if they possess the necessary capabilities to swiftly react to changes in an inherently dynamic environment, continually nurture innovative capabilities, and effectively coordinate and redeploy internal and external competencies. In his later development of the theory, Teece (2007) broke down DC into three distinct subdimensions that firms need to adopt in order to continuously (1) *sense* emerging opportunities and threats, (2) *seize* identified opportunities, and (3) *reconfigure* their resource portfolio to meet the changing needs of the environment. Hence, the DCV contradicts

the RBV by arguing that the mere possession of VRIN resources is insufficient for competitive advantage (Augier & Teece, 2009; Helfat et al., 2007; Teece et al., 1997). Competitive advantage does not emerge from the selection and retention of VRIN resources, as subsumed by the RBV, but from the effective and efficient development and allocation of resources in conjunction with organizational processes (Amit & Schoemaker, 1993; Jacobides & Winter, 2005; Makadok, 2001; Teece, 2007). Thus, DC has been defined from two complementary perspectives (Cai, 2022): a *capability perspective* (e.g., Teece, 2007; Teece & Pisano, 1994; Teece et al., 1997; Zahra, Sapienza, & Davidsson, 2006) and a *process perspective* (e.g., Ambrosini & Bowman, 2009; Eisenhardt & Martin, 2000; Zollo & Winter, 2002).

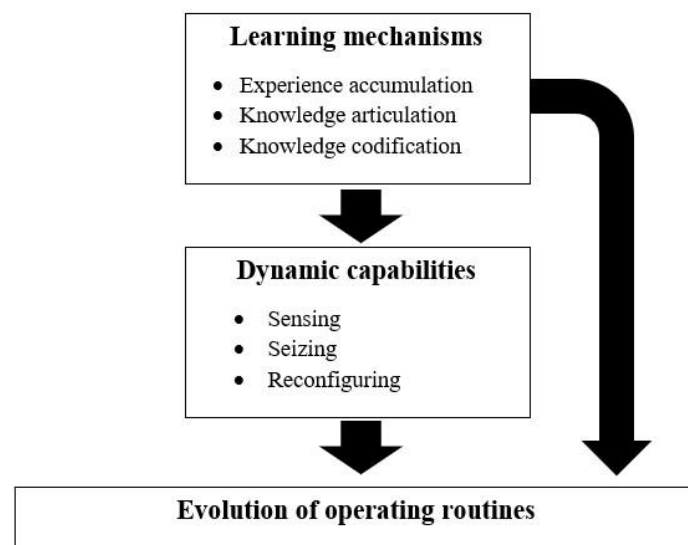
The study of DCs has garnered significant attention among researchers due to their proposed linkage to critical firm-level outcomes (Fainshmidt, Pezeshkan, Lance Frazier, Nair, & Markowski, 2016; Teece, 2014). Scholars have shown that DC may enhance firm performance through different mechanisms (for a comprehensive review, see Schilke, Hu, & Helfat, 2018). One body of research focuses on the direct performance-enhancing effect of DC through the competitive advantage it infers (e.g., Desyllas & Sako, 2013; Shamsie, Martin, & Miller, 2009; Teece & Leih, 2016; Wang, Senaratne, & Rafiq, 2015; Zott, 2003). In contrast, other scholars propose that DCs indirectly enhance organizational performance through their effect on intervening factors, such as a firm's resource portfolio (e.g., Ambrosini, Bowman, & Collier, 2009; Fainshmidt et al., 2016; Helfat & Martin, 2015b; Karimi & Walter, 2015; Protogerou, Caloghirou, & Lioukas, 2012), strategy (e.g., Augier & Teece, 2009; Carpenter, Sanders, & Gregersen, 2001; Engelen, Kube, Schmidt, & Flatten, 2014), or innovativeness (e.g., Ferreira et al., 2020; Karim, 2009; Mitchell & Skrzypacz, 2015; Teece & Leih, 2016; Tortora, Chierici, Farina Briamonte, & Tiscini, 2021).

The literature distinguishes between two types of capabilities. *Operational capabilities* reflect the ordinary capabilities that are required to maintain the everyday functioning of an organization. *DCs* go beyond maintaining the current operations, representing capabilities that are explicitly related to the initiation and execution of change processes that determine a firm's adaptability (Collis, 1994; Winter, 2003). Thus, firms draw on operational capabilities to exploit existing resources, and turn to DCs to explore new opportunities or modify operational capabilities (Levinthal & March, 1993; March, 1991; Pavlou & El Sawy, 2011; Zollo & Winter, 2002). A DC does not represent a resource in the classical sense (Ahmad, Papert, & Pflaum, 2018), but refers to processes that can influence and reshape resources (Ambrosini & Bowman, 2009) or harness the unused potential of resources (Y. Lin & Wu, 2014). A DC is a higher-

order organizational capability that is embedded in routines firms utilize to exploit and explore resources (Ambrosini & Bowman, 2009). DCs cannot be acquired; they must be internally developed, owing to their path-dependent characteristics (Teece & Pisano, 1994; Zollo & Winter, 2002). Thus, DCs represent higher-order capabilities that are inherently embedded within organizational structures, integral to reaping the benefits of resources, with the ability to reshape operational capabilities (Ahmad et al., 2018; Ambrosini & Bowman, 2009; Eisenhardt & Martin, 2000; Y. Lin & Wu, 2014; Teece & Pisano, 1994).

Figure 2.2 summarizes the preceding arguments by outlining the mechanisms through which DCs develop, and how they affect the evolution of operating routines. Over time, however, changing environmental conditions may make certain DCs unsuitable. If a firm is overly dependent on specific DCs, failing to update them over a prolonged period of time, previously value-promising DCs may become dysfunctional core rigidities for a firm and its innovativeness (Leonard-Barton, 1992).

Figure 2.2 Dynamic capabilities, their origins, and effects



Source: Author's representation, based on Zollo and Winter (2002, p. 340)

The widespread application of the DCV in strategic management literature can be attributed to its particular emphasis on two essential aspects of strategic management. First, a firm must be able to continually align its capabilities with the ever-changing demands of the competitive environment. The DCV highlights *the dynamic nature of competition* and its inherent link to innovation as a vehicle for adaptive responses and renewal (Teece, 2007, 2012a, 2016).

Second, the DCV stresses *the importance of management* in configuring, developing, integrating, and combining internal and external capabilities, competencies, and resources (Dosi, Nelson, & Winter, 2000; Teece & Pisano, 1994; Teece et al., 1997). Accordingly, DCs represent distinct or accumulated higher-order firm-level routines that develop through highly structured and repetitive behaviors and operating procedures (Winter, 2003). Firms with more efficient or effective routines can, consequently, generate competitive advantage (Feldman, 2000; Felin et al., 2012; Nelson & Winter, 1982; Teece, 2012a).

Altogether, the DCV led to the realization that “the competitive advantage of firms stems from DCs rooted in high-performance routines operating inside the firm, embedded in the firm’s processes, and conditioned by its history” (Teece & Pisano, 1994, p. 553). Strong DCs do not naturally lead to competitive advantage, but must be matched with appropriate resources to realize superior organizational strategies (Helfat et al., 2007; Teece, 2007, 2014; Teece, Peteraf, & Leih, 2016).

2.1.5 Dynamic managerial capabilities

2.1.5.1 General concept

According to the DCV, heterogeneities in DCs between firms result from the idiosyncratic development of organizational routines and processes within and across organizational boundaries. Thus, the DCV fundamentally argues that firm-level DCs represents the foundation for sustained competitive advantage by enabling and shaping distinct organizational strategies (Helfat et al., 2007; Nelson & Winter, 1982; Salvato, 2009; Teece & Pisano, 1994).

However, the inherent focus on firm-level capabilities implies that the DCV fails to explicitly consider the role of individual managers and their capabilities for conceptualizing organizational behavior (Salvato, 2003; Salvato & Vassolo, 2018; Zahra et al., 2006). This oversight in the study of organizational behavior has led scholars to increasingly criticize the DCV for its inherent focus on firm-level capabilities (Abell, Felin, & Foss, 2008; Felin & Foss, 2005; Felin et al., 2012; Foss, 2016), despite its widespread application in strategic and innovation management (Schilke et al., 2018).

This major limitation of the DCV led to the microfoundational research stream. According to this individual-level perspective, organizations are composed of heterogeneously skilled managers that determine firm-level strategies through their distinctive capabilities (Argote & Ingram, 2000; Beck & Wiersema, 2013; Nahapiet & Ghoshal, 1998; Salvato & Melin, 2008).

As a result, competitive advantage emerges from the aptitude of individual managers to recognize, initiate, and realize organizational strategies (Aguinis et al., 2022; Felin & Foss, 2005; Felin et al., 2012; Teece, 2012a). Although microfoundational theories are antithetical conceptualizations of strategic decision-making, individual-level theorizing can complement firm-level theories by allowing researchers to “explain the creation, development, reproduction, and management of collective constructs” (N. George et al., 2022, p. 3).

Adner and Helfat’s (2003) DMC theory has garnered the most attention among microfoundational researchers. The authors fundamentally argue that the ability of managers to “build, integrate, and reconfigure organizational resources and competences” (Adner & Helfat, 2003, p. 1012) is contingent on their individual-level DMCs. The fundamental task of managers from the DMC perspective lies in orchestrating a firm’s asset portfolio to ensure organizational adaptability (Beck & Wiersema, 2013; Helfat et al., 2007; J. A. Martin, 2011). Thus, managers are the primary agents of change, contriving, implementing, organizing, and transforming a firm’s operative and strategic activities by drawing on their individual-level DMCs (Castanias & Helfat, 1991; Finkelstein & Hambrick, 1996; Helfat & Martin, 2015b; Kor & Mesko, 2013; Mahoney, 1995; Tripsas & Gavetti, 2000). These capabilities are derived from the interplay between managers’ innate abilities and unique life experiences (Adner & Helfat, 2003; Beck & Wiersema, 2013). Superior DMCs enable managers to fulfill the dual role of being a proficient organizational leader as well as an entrepreneur, exploring new commercial opportunities (Ireland, Hitt, Camp, & Sexton, 2001; Teece, 2007, 2012a, 2016).

Although Adner and Helfat (2003) initially conceptualized DMCs as a discrete concept, their underlying assumptions are closely linked to the DCV (N. George et al., 2022; Helfat & Martin, 2015a; Kor & Mesko, 2013). The present thesis follows the body of research that views DMCs as an identifiable subset of the larger DC construct (e.g., Beck & Wiersema, 2013; Helfat & Martin, 2015a, 2015b; Levine, Bernard, & Nagel, 2017; Tasheva & Nielsen, 2022). Other scholars (e.g., Holzmayer & Schmidt, 2020; Kor & Mesko, 2013) view DMCs as an antecedent to DCs; the two perspectives are complementary, in that they both propose DMCs as related to DCs, but different in terms of their characteristics (N. George et al., 2022). The most important difference between DCs and DMCs can be found in the intentionality of the development and deployment of capabilities. Although both individual- and firm-level DCs are practiced behavioral patterns, DMCs are always associated with managerial intent due to their origins in distinct managerial attributes that need to be formed and practiced. Firm-level DCs, meanwhile, may develop without specific intentions (Beck & Wiersema, 2013; Eisenhardt & Martin, 2000;

J. A. Martin, 2011; Teece et al., 1997). This argumentation leads to the conclusion that DMCs enable firms to have more versatile strategic reactions due to the involvement of managerial intent, leading to greater flexibility in DMC deployment. Additionally, DMCs go beyond simple ad-hoc problem-solving, in the sense that these individual-level managerial capabilities also entail elements of routines that need to be developed, practiced through repetition, and continuously refined to meet the changing demands of the environment (Beck & Wiersema, 2013). It can be concluded that Adner and Helfat's (2003) DMC theory has advanced the DCV by focalizing the role of managers as conscious designers of organizational strategy and agents of organizational change through their unique, individual-level DMCs.

2.1.5.2 Subcomponents of dynamic managerial capabilities

DMCs are composed of three interdependent subcomponents—managerial human capital, social capital, and cognition—that drive the strategic behavior of firms (Adner & Helfat, 2003; J. A. Martin, 2011). High levels of DMCs enable firms to be more efficient and effective in orchestrating, developing, and allocating their resources in order to realize superior corporate and competitive strategies. Thus, organizational strategies, as the prerequisite for sustainable competitive advantage, vary due to differences in individual-level managerial capabilities (Adner & Helfat, 2003; Beck & Wiersema, 2013; Helfat & Martin, 2015b).

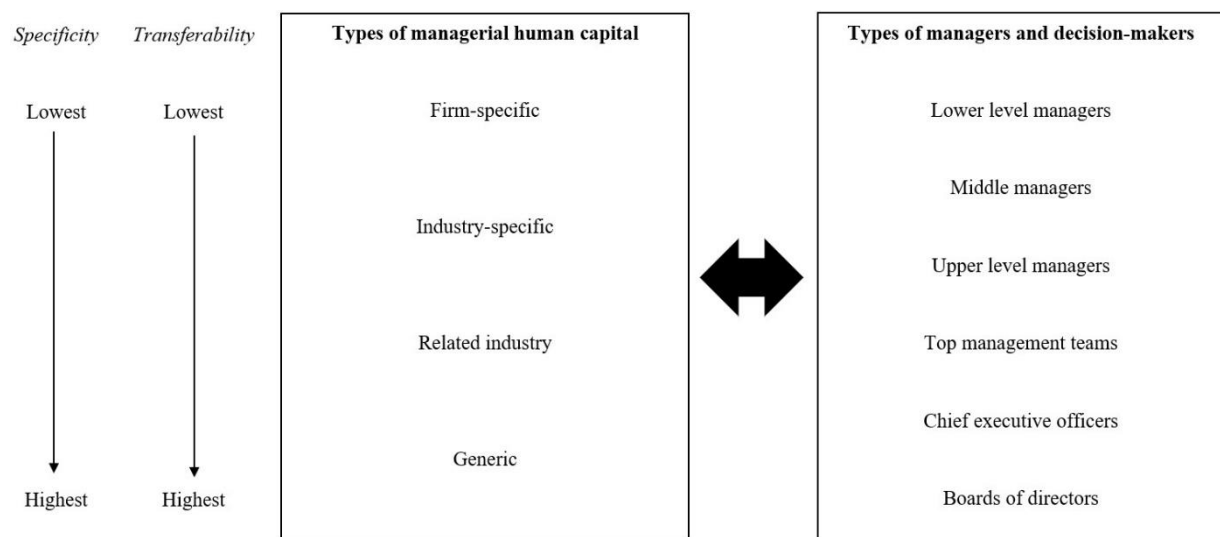
The first DMC subcomponent, *managerial human capital*, refers to the skills, knowledge, and expertise individuals gain through formal training—e.g., education—and informal training—e.g., trial-and-error or work experience (Becker, 1962, 1983; Castanias & Helfat, 2001; Mintzberg, 1973). While all types of human capital—to a varying degree, given specific environmental contingencies—may assist managers in deciding which resources to acquire, develop, or divest, human capital is most closely linked to the managerial resource orchestration ability (Bailey & Helfat, 2003; W. M. Cohen & Levinthal, 1990; Helfat & Martin, 2015a, 2015b).

Building on the original managerial rents model (Castanias & Helfat, 1991), Castanias and Helfat (2001) integrated the work of Bailey and Helfat (2003) and Finkelstein and Hambrick (1996) to develop an expanded framework for examining types of managers and their human capital. The framework depicted in Figure 2.3 distinguishes between four types of human capital available to managers of different hierarchical levels. The various types of human capital are placed within the hierarchy according to their specificity and transferability. *Generic*

human capital is the most widely applicable form of managerial human capital, developed through education or general work experience. Thus, generic human capital is readily transferable between firms, yet low in specificity. Conversely, *firm-specific human capital* is tailored to the organization where it develops, making it less useful for other organizations and more problematic to transfer between firms (Bailey & Helfat, 2003; Becker, 1983; Castanias & Helfat, 2001).

The managerial rents model proposes that skill differentials between managers emerge from “the types of skills that individuals possess and the degree of skillfulness” (Castanias & Helfat, 1991, p. 160). The expanded framework also complements UET by assessing the human capital of lower-level management, which is particularly applicable due to the ongoing shift toward flatter hierarchies and more decentralized decision-making (Patacconi, 2009; Rajan & Wulf, 2006; Wooldridge, Schmid, & Floyd, 2008).

Figure 2.3 Expanded framework of managerial human capital



Source: Author’s representation, based on Bailey and Helfat (2003, p. 353) and Castanias and Helfat (2001, p. 664)

The second DMC subcomponent, *managerial social capital*, reflects the personal relationships managers gradually develop through interactions and shared experiences with other actors, such as individuals, organizations, or communities. The power, control, and influence social capital has on socially-connected actors are contingent on the strength and nature of the network ties (Adler & Kwon, 2000, 2002; Beck & Wiersema, 2013; Bourdieu, 1986; N. Lin,

2001). Social capital differs from human capital in that the former refers to shared experiences, while the latter pertains to individual experiences (Beck & Wiersema, 2013). Compared to other forms of capital, social capital is inherently tied to its owner, making it impossible, or at least challenging, to transfer between individuals (Moran, 2005; Nahapiet & Ghoshal, 1998; G. Walker, 1985). Higher levels of social capital allow managers to improve their resource orchestration abilities because it gives them access to external information, resources, and capabilities (Adler & Kwon, 2002; Adner & Helfat, 2003; Blyler & Coff, 2003; Geletkanycz & Hambrick, 1997). Additionally, social capital may give managers access to other forms of capital embedded within socially-connected actors, such as others' DMCs (Beck & Wiersema, 2013; Blyler & Coff, 2003). The recombination of different knowledge and information, enabled through social capital, ultimately enhances organizational learning processes (Kogut & Zander, 1992, 1993, 1996).

Among the three DMC subcomponents, empirical research has predominantly focused on social capital (N. George et al., 2022). Studies have demonstrated that social capital benefits an organization by increasing the exchange of non-redundant and complementary knowledge, information, and resources between actors (Gant, Ichniowski, & Shaw, 2002; Johnson, Schnatterly, & Hill, 2013; Tsai & Ghoshal, 1998). Furthermore, social capital may influence decision-making by informing managerial judgments with socially-constructed views or norms (Adler & Kwon, 2002; Nahapiet & Ghoshal, 1998). Differences in social capital between managers translate into non-uniform access to external resources and disparate perceptions of strategic choice situations. Individual-level social capital may ultimately lead to differences in firm-level strategies, shaping the managerial decision-making that contributes to the design, implementation, and adaptation of organizational strategies (Adner & Helfat, 2003; Coleman, 1988; Kor & Mesko, 2013; Nahapiet & Ghoshal, 1998).

It can be concluded that social capital may increase strategic adaptability, as it allows firms to "acquire, recombine, and release resources" (Blyler & Coff, 2003, p. 680). Managers do not act within a vacuum; they act within a complex network of social relationships (Granovetter, 2011; Laumann, Galaskiewicz, & Marsden, 1978). Thus, social capital is a micro-level construct that affects other micro-level constructs, such as human capital (Coleman, 1988; Nahapiet & Ghoshal, 1998), as well as macro-level constructs, such as collective learning processes, innovation, competitive advantage, and performance outcomes (Acquaah, 2007; Burt, 1997; Gant et al., 2002; Guo, Xi, Zhang, Zhao, & Tang, 2013; Peng & Luo, 2000).

The third DMC subcomponent is *managerial cognition*, for which the fundamental notion can be traced back to the BTF (Cyert & March, 1963; March & Simon, 1958; Simon, 1947). The Carnegie School was the first to explicitly consider the cognitive processes that underlie organizational and managerial decision-making processes. The general idea of cognition in strategic management draws on psychological and managerial theories, arguing that organizational strategies are derived from managerial decision-making processes that are driven by highly individualized mental processes (Bougon, Weick, & Binkhorst, 1977; Cummings, 1982; S. C. Schneider & Angelmar, 1993).

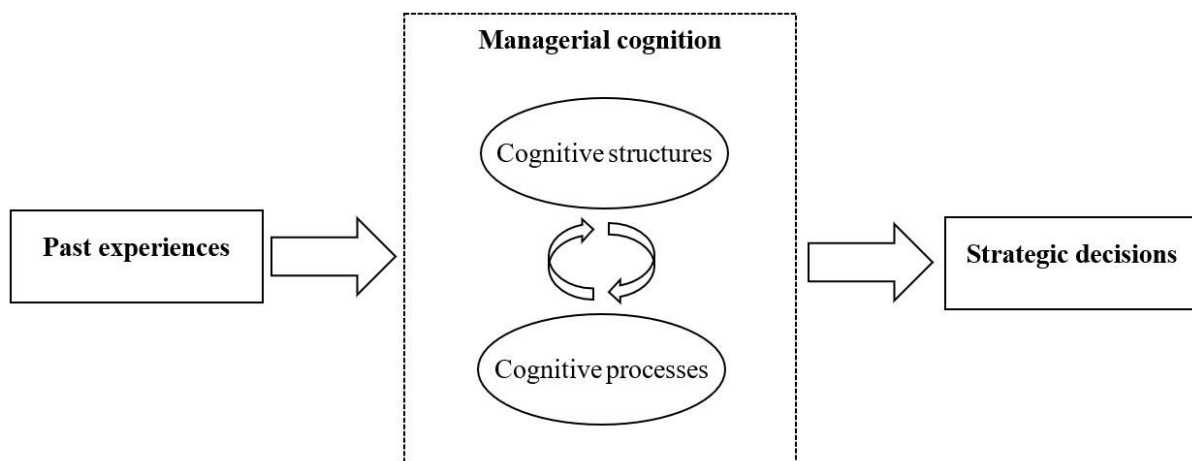
Managers are “information workers” (McCall & Kaplan, 1985), whose main task is to gather, process, assess, and spread information (Daft & Weick, 1984; Walsh, 1995). Information assessment is inherently challenging due to significant amounts of VUCA in the internal and external environment (Huff, Milliken, Hodgkinson, Galavan, & Sund, 2016; R. O. Mason & Mitroff, 1981; Milliken, 1987, 1990; Mintzberg, Lampel, & Quinn, 1997; Schwenk, 1984; Starbuck & Milliken, 1988; Sund, 2013, 2015). Managers cope with these challenges by relying on cognitive processes and structures that enhance and simplify information processing (Helfat & Peteraf, 2015; Walsh, 1995). More specifically, managerial cognition entails *cognitive processes*, which are all of the different ways individuals absorb, interpret, and retain information (American Psychological Association, 2019; Ashcraft, 2006; Colman, 2015; Neisser, 1976), as well as *cognitive structures*, which represent a simplified version of the information environment that infuses meaning and structure (Neisser, 1976; S. C. Schneider & Angelmar, 1993; Walsh, 1995). Cognitive psychology has urged management scholars to integrate senior executive cognitive basis into strategic decision-making models (e.g., Eggert & Kaplan, 2009, 2013; Tripsas & Gavetti, 2000).

A third component of managerial cognition has recently attracted research interest: *emotion* (Hodgkinson & Healey, 2011; Huy & Zott, 2019; Sund, Galavan, & Brusoni, 2018; Huy & Zott, 2018). The discussion on the emotional component of cognition is centered around the debate between cold cognition—analytical thought absent of any emotional component—versus hot cognition— affective information processing that is highly infused with emotion (Hodgkinson & Healey, 2011; Hodgkinson, Sund, & Galavan, 2017; Loewenstein, Rick, & Cohen, 2008; Loewenstein & Small, 2007; Sund et al., 2018).

The central problem of managerial cognition, and the reason behind the burgeoning interest of management scholars in psychological processes, is its inherently ambiguous nature (Walsh, 1995). On the one hand, cognition aids strategic decision-making by allowing managers to

increase information processing efficiency and to cope with environmental VUCA. On the other hand, cognition can hamper decision-making speed and quality, eliciting stereotypical thinking, limiting the search for alternative and potentially conflicting information, and suppressing constructive problem-solving (Gioia, 1986; Weick, 1979a). Although cognition does not necessarily lead to inaccurate decisions, and might even be required for swift decision-making, managers in dynamic environments are pressured to constantly adapt their cognitions to transformed circumstances (Beck & Wiersema, 2013; Tripsas & Gavetti, 2000; Walsh, 1995). Otherwise, managers will base their decisions on “impoverished views of the world” (Gioia, 1986, p. 346) that may harm the organization. Figure 2.4 summarizes the preceding arguments into a framework of managerial cognition in the context of strategic decision-making.

Figure 2.4 A framework of managerial cognition



Source: Author’s representation, based on Walsh (1995, p. 282)

Managerial cognition draws from modern psychology by positing that managers process information in two opposing ways. First, the *automatic processing mode*—also called top-down (Abelson & Black, 1986), theory-driven (Nisbett & Ross, 1980), or System 1 processing (Kahneman, 2012; Stanovich & West, 2000)—closely mirrors the previously outlined understanding of managerial cognition. Managers interpret information in the dominant automatic mode by relating it to their learned experiences in similar situations. As a result, managers interpret new information mainly through the lens of past experiences (Fiske & Taylor, 1984; Kahneman, 2012; Schwenk, 1984; Walsh, 1995). Automatic processing reduces cognitive demands and increases information processing speed (Helfat & Peteraf, 2015), but

may significantly bias or restrict decision-making (for a comprehensive review, see, e.g., Kahneman, 2012; Tversky & Kahneman, 1982).

The concept of managerial cognition explicitly considers the boundaries of human rationality that have informed previously outlined theories, such as the BTF (Cyert & March, 1963; March & Simon, 1958; Simon, 1947) or UET (Hambrick & Mason, 1984). In contrast to the automatic processing mode, where managers act as cognitive satisficers (March & Simon, 1958) who seldom question the underlying assumptions of their decision-making (Fiske & Taylor, 1984; Walsh, 1995), the *controlled processing mode* necessitates a significant or the exhaustive expenditure of cognitive capacities. In the controlled mode—also called bottom-up (Abelson & Black, 1986), data-driven (Nisbett & Ross, 1980), or System 2 processing (Kahneman, 2012; Stanovich & West, 2000)—information processing is driven by the specificities of the current information environment. Controlled processing activates a sequential thinking pattern by focusing an individual's limited attention and cognitive capacity on the issue of concern in order to allow in-depth consideration of information (Hambrick & Mason, 1984; Hambrick & Snow, 1977; W. Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977; Ungson, Braunstein, & Hall, 1981, Walsh, 1995).

Past experiences serve as a cognitive lens for noticing, interpreting, and storing information. The nature and content of these individual knowledge structures and cognitive processes may also constrain decision-making (Karhu & Ritala, 2020; Walsh, 1995). Nevertheless, in dynamic environments characterized by VUCA, where cognitions can quickly become outdated, simplicity is not the key to accurate information processing (Kiesler & Sproull, 1982; Tripsas & Gavetti, 2000; Walsh, 1995; Weick, 1979a). Managers must possess substantial cognitive abilities to continuously realign their mental processes and structures to altered circumstances. Thus, cognition should function as “useful simplicity” (Walsh, 1995, p. 306), serving as an accurate abstraction of the information environment instead of blinding managers with tunnel vision (Ashby, 2015; Bartunek, Gordon, & Weathersby, 1983; Kiesler & Sproull, 1982; D. Miller, 1993; Weick, 1979a). Nevertheless, due to inherent constraints on attention (Posner, 1982) and cognitive capacity (Corner, Kinicki, & Keats, 1994; Kiesler & Sproull, 1982; G. A. Miller, 1956), managers persist in defaulting to the automatic mode, except in fundamentally unknown or discrepant situations (Louis & Sutton, 1991), for which they do not have readily available or applicable cognitive processes or structures (Kahneman, 1973, 2012; Walsh, 1995). Research corroborates the notion that managerial cognition is critical to a firm's capacity for strategic change, and that managers face significant difficulties adjusting their

cognitions (e.g., Acha, 2002; Dutton & Duncan, 1987; Gavetti, 2012; Gioia & Chittipeddi, 1991; Holbrook, Cohen, Hounshell, & Klepper, 2000; Kaplan, Murray, & Henderson, 2003; D. Miller & Friesen, 1980; Tripsas & Gavetti, 2000; Virany, Tushman, & Romanelli, 1992). The digital economy further increases the pressure for managers to make quick decisions while managing a great deal of VUCA (Finkelstein et al., 2009; van Knippenberg, Dahlander, Haas, & George, 2015). Therefore, controlled and deliberate information processing might be too slow or demanding, considering the accelerated pace and information overload that is present in the current hypercompetitive environment.

In summary, cognition predisposes managers to make decisions that mirror their historically-developed beliefs and reference frames (Adner & Helfat, 2003; Walsh, 1995). This dominant logic (Bettis & Prahalad, 1995; Prahalad, 2004; Prahalad & Bettis, 1986) may restrict information processing by limiting information search, leading to selective perceptions, as well as infusing the interpretation of information with personal beliefs (Huff, 1990; Schwenk, 1984). Despite its centrality to decision-making, managerial cognition remains the least studied DMC microfoundation (N. George et al., 2022), due to the complexities of measuring this multifaceted psychological construct (Walsh, 1995). This research gap is particularly alarming, since managerial cognition is crucial for managers to sense and seize opportunities, as well as to reconfigure a firm's asset portfolio (Adner & Helfat, 2003; Helfat & Martin, 2015a; Helfat & Peteraf, 2003).

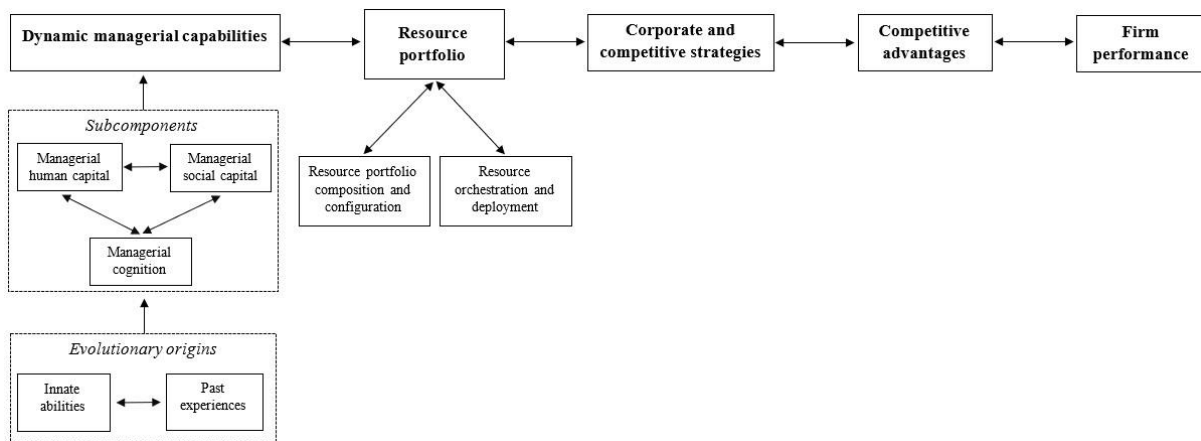
2.1.5.3 Interactions between the subcomponents of dynamic managerial capabilities

The interactions between human capital, social capital, and cognition represent another source of heterogeneity between managers, causing differences in the managerial ability to promote innovation and creativity, as well as to design and implement efficient and effective organizational strategies (Adner & Helfat, 2003; Helfat & Martin, 2015a). Even though all three DMC subcomponents are derived from the interplay between the innate abilities and past experiences of managers, they represent distinct managerial capabilities that—beyond their isolated effect on organizational outcomes—shape managers' aptitude to design and realize organizational strategies, recognize the need for change, and transform existing strategies through their interactions (Beck & Wiersema, 2013).

Firm-specific or industry-specific human capital may allow managers to establish social networks within the firm or industry (Beck & Wiersema, 2013). Human capital can also

enhance the cognitive abilities of managers through experiences gained in other fields (Beck & Wiersema, 2013; Melone, 1994). Further, social capital can aid human capital development by giving managers access to external resources and capabilities, further strengthening social capital, as skilled managers are more sought after as relationship partners (Adner & Helfat, 2003; Castanias & Helfat, 2001; Coleman, 1988). Social capital is also related to cognition. Social networks engender specific, socially-constructed world views, norms, and beliefs that may reinforce or contradict the existing cognitive processes and structures of individual managers (Adner & Helfat, 2003). Managerial cognition is also integral to the learning processes involved in developing human capital (Adner & Helfat, 2003; Beck & Wiersema, 2013; Helfat & Martin, 2015b; Ployhart & Moliterno, 2011). Finally, cognition causes differences in how managers perceive the value of social capital. This highly individual perception may also affect the managers' aspirations to form social relationships, determining what kinds of social relationships are formed and with which specific actors (Helfat & Martin, 2015b).

Figure 2.5 summarizes the key findings of this chapter by providing a comprehensive framework for examining the sources and consequences of DMCs. The fundamental notion of DMCs is that three distinct individual-level capabilities—managerial human capital, social capital, and cognition—emerge from the interaction between a manager's innate abilities and past experiences. These capabilities determine the composition and configuration of a firm's resource portfolio, and how those resources are orchestrated and deployed. The firm-specific resource portfolio subsequently serves as the basis for designing and realizing corporate and competitive strategies. The implemented organizational strategies may infer competitive advantage over other firms, eventually resulting in superior firm performance. Thus, DMCs are central microfoundational antecedents to firm-level outcomes, and superior organizational performance can ultimately be traced back to higher DMC levels (Adner & Helfat, 2003; Beck & Wiersema, 2013; Helfat & Martin, 2015b; J. A. Martin, 2011).

Figure 2.5 The sources and effects of dynamic managerial capabilities

Source: Author's representation, based on Adner and Helfat (2003, p. 1022), Beck and Wiersema (2013, p. 411), and Helfat and Martin (2015b, p. 1291)

2.2 Innovation management

2.2.1 Defining innovation

Schumpeter (1934) pioneered the concept of innovation in his seminal book *The theory of economic development*. He advocated for an economic theory where entrepreneurs constantly develop and diffuse innovations, triggered by internal and external factors that lead to the deterioration of old economic structures and the creation of new ones. This constant renewal process has been coined *creative destruction* (Dahms, 1995; Schumpeter, 1994).

Schumpeter's fundamental notion of the entrepreneur as an initiator, creator, and implementer of innovation matches closely with the current globalized economy, in which the diffusion and emergence of new knowledge, technologies, and value offerings constantly pressure firms to innovate (Carayannis & Ziemnowicz, 2007; Schumpeter, 1994; Ziemnowicz, 2013). Schumpeter (1934) propagated a process-oriented view on innovation, delineating the following five distinct types of innovation.

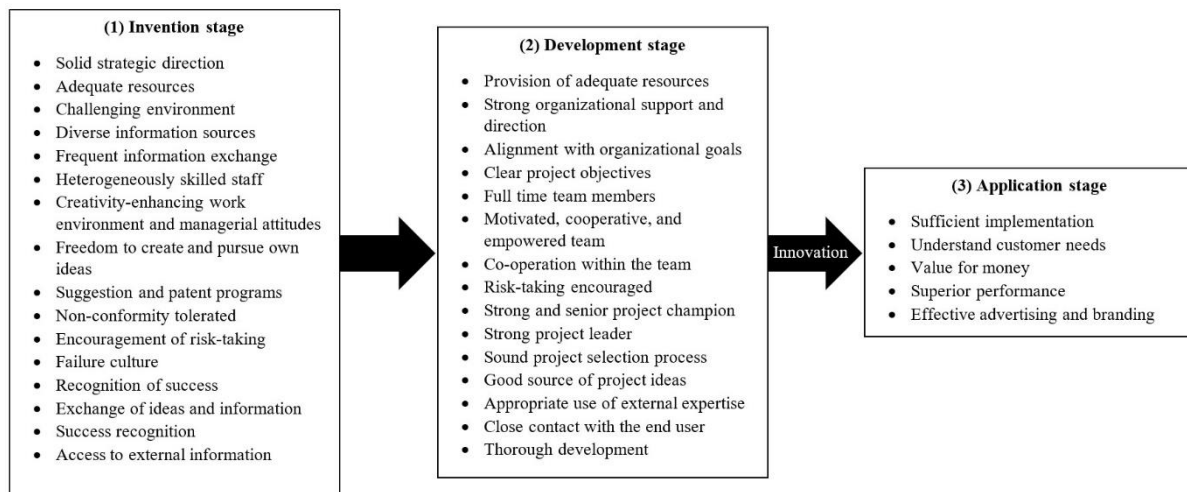
- (1) *Product innovation*: Launching a new or significantly improved product.
- (2) *Process innovation*: Adopting a new production process or commercializing a previously unused resource.
- (3) *Market innovation*: Venturing into a market that is new to the respective firm.

- (4) *Input innovation*: Developing new supply sources for production input factors (e.g., raw materials).
- (5) *Organizational innovation*: Implementing a new organizational structure that creates an advantageous market position.

Schumpeter's (1934, 1939, 1961, 1994) portrayal of innovation as a mechanism for organizational survival and renewal has paved the way for innovation research and has made inroads into various scientific fields, such as psychology, sociology, industrial management, and public administration (Damanpour & Aravind, 2012). The term *innovation* generally relates to the innovation process or innovation outcomes (Drucker, 1985; Kahn, 2018; McAdam & McClelland, 2002), capturing the commercialization of new or transformed products, services, production processes, and other ways of capturing value (Damanpour, 1991; Gupta, Tesluk, & Taylor, 2007; Ortt & van der Duin, 2008). The degree of novelty is related to a firm's perspective—innovations must not be entirely new to the world, but they can also be previously unknown to a specific firm, allowing it to create value (Ojasalo, 2008; Van de Ven, 1986). Rogers (2003) proposes that the consequences of innovation can be desirable or undesirable, direct or indirect, and anticipated or unanticipated.

Two interrelated forces can trigger innovation. First, *market forces* cumulatively produce incremental or significant changes to the commercialization opportunities for specific value offerings. These forces drive change, for example, in an economy's income, price, or demographic structures. Second, *technological forces* provide unknown or unrealized options for developing and offering new products, or allow a firm to offer its current products at a better level of quality or at a lower price. Thus, innovation management must balance market and technological forces in order to develop and sustain competitive advantage (Covin & Miles, 1999; Kline & Rosenberg, 2009; Ortt & van der Duin, 2008).

The innovation process generally includes three stages: (1) *discovery/invention stage*: the creation of new ideas through creativity; (2) *development stage*: the successful translation of an idea into a commercializable value offering; and (3) *delivery/application stage*: the effective and efficient implementation of the new value offering. A firm, its management, and other employees face distinct challenges in each stage; overcoming those challenges may serve as critical success factors for ensuring fulfillment of the respective innovation phase (Cooper, 2008; Cumming, 1998; Kahn, 2018). Figure 2.6 summarizes the success factors of innovation during the three stages identified in the extant literature.

Figure 2.6 Three stages of successful innovation: An overview of success factors

Source: Author's representation, based on Cumming (1998, p. 22)

Although the innovation process is highly risky, complex, dynamic, and interdependent, it is also an integral mechanism for managing and coping with these factors of uncertainty (Kline & Rosenberg, 2009). The problem with innovation investments is that their impact on firm performance and growth can only be evaluated in hindsight (Klein & Sorra, 1996). Managerial decision-making is also often influenced by pro-innovation bias, leading managers to believe that innovation consistently results in desired, direct, and anticipated outcomes (Damanpour & Aravind, 2012; Rogers, 2003; Wischnevsky & Damanpour, 2008). The evaluation of innovation before it is implemented is inherently challenging and may be severely biased. Moreover, it is difficult to quantify the performance implications of innovation due to high interdependency and a process-heavy nature that requires longitudinal performance measurement (Damanpour & Aravind, 2012).

Two degrees of innovation that are directly related to their level of uncertainty can be distinguished. The terms *incremental* or *evolutionary innovation* refer to minor modifications to a product or process, such as changing the color scheme of a car. In contrast, the terms *radical* or *revolutionary innovation* reflect the fundamental renewal of a firm's value offering, such as introducing an entirely new-to-the-world product. The uncertainty between incremental and radical innovations significantly differs. While the former introduces little to no additional uncertainty, the latter may elicit significant uncertainty for various actors (Fagerberg, 2004; Kline & Rosenberg, 2009; Norman & Verganti, 2014; Ritala & Hurmelinna-Laukkanen, 2013). There is a widespread belief among firms and managers that innovations must always be

radically new to create value. However, radical innovations are highly complex and resource-intensive to realize, and their commercial success is often far from certain due to their high degree of novelty for the firm and the market. Decision-makers must broaden their perspective and consider different forms of innovation that fall on a continuum between incremental and radical. Innovation can be understood as a process and an outcome, as well as a mindset that allows creativity and change to thrive (Kahn, 2018).

Successful innovations must provide superior value in terms of cost and performance and be introduced within their “windows of opportunities” (Cumming, 1998, p. 1998). Additionally, an innovation must balance the “requirements of the new product and its manufacturing process, the market needs, and the need to maintain an organization that can continue to support all these activities efficiently” (Kline & Rosenberg, 2009, p. 277). Innovations are based on creative ideas that are new and useful to a firm, in the sense that they have the potential to create value from unused or underutilized resource configurations (Barney, 1991; J. M. George, 2007; Peteraf, 1993; Wernerfelt, 1984). Three factors are essential for an innovation to succeed: cost, performance, and timing (Kline & Rosenberg, 2009).

Firms are advised against focusing on one form of innovation; instead, they are encouraged to introduce combinations of different innovation types (Damanpour & Aravind, 2012; Damanpour, Walker, & Avellaneda, 2009; Roberts & Amit, 2003; Tushman & O’Reilly, 2002). Both incremental and revolutionary innovation can provide a firm with a competitive advantage—incremental innovations are integral to short-term returns, while revolutionary innovations ensure long-term returns (Fagerberg, 2004; Kline & Rosenberg, 2009). At the same time, innovations generally involve a process that is characterized by significant VUCA. Therefore, managers must cope with the interrelated and disorderly nature of the innovation process (Kline & Rosenberg, 2009).

2.2.2 Digital technologies as enablers of innovation

Digital technologies have fundamentally reshaped the competitive environment since the 1980s (Bouncken, Kraus, & Roig-Tierno, 2021; Damanpour & Schneider, 2006; A. Wallin, Pihlajamaa, & Malmelin, 2022; Weill & Woerner, 2015). New technologies can become the missing link between existing ideas and their realization or augment the commercial potential of existing value offerings (Cumming, 1998). Firms now face pressures to simultaneously exploit existing value offerings and explore new commercial opportunities (Bouncken, Kraus,

& Roig-Tierno, 2021; Damanpour & Schneider, 2006; A. Wallin, Pihlajamaa, & Malmelin, 2022; Weill & Woerner, 2015). Solely focusing on efficiency or effectiveness is no longer sufficient for ensuring long-term organizational performance and survival (Adner & Kapoor, 2010; Hacklin et al., 2018; Porter, 1996).

Digitalization has reshaped society and the world at large, and continues to do so, causing two fundamental trends that are closely related to globalization: (1) the diffusion of information through computers and digital media, and (2) the convergence of societal and economic structures with technological applications (Brennen & Kreiss, 2016). More precisely, *digitalization* is defined as the “adoption or increase in use of digital or computer technology by an organization, industry, country” (Brennen & Kreiss, 2016, p. 1). Digitalization is more encompassing than *digitization*, which refers to the material conversion of formally analog processes or information into digital formats (Brennen & Kreiss, 2016). The broader scope of digitalization necessitates the increased use, integration, and amalgamation of value offerings, as well as all of the underlying input- and output-oriented activities (Björkdahl, 2020; Björkdahl & Holmén, 2019).

Digitalization is recognized as the third industrial revolution, after mechanization and adoption of electricity, due to the widespread implications for top-level managers and policymakers (Kagermann, Wahlster, & Helbig, 2013; Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014). Thus, digitalization is an overarching phenomenon that continues to foster a paradigm shift at the macro-, meso-, and micro-levels (Appio, Frattini, Petruzzelli, & Neirotti, 2021).

First, at the *macro level*, digitalization fundamentally transforms organizational, industrial, economic, political, and societal structures. From these changes, ecosystems have evolved that are enabled by digital technologies, such as the Internet of Things (IoT), big data, cloud computing, and smart products (Adner & Kapoor, 2010; Appio et al., 2021; Weill & Woerner, 2015). Digitalization has reshaped the innovation process from a closed system to an open ecosystem (Carayannis & Campbell, 2009; Rong, Shi, & Yu, 2013), with different products, services, technologies, and capabilities (re)combined to create and capture superior value (Adner, 2012, 2017; Chesbrough, 2017; Holgersson, Granstrand, & Bogers, 2018). Nevertheless, digitalization has also introduced significant uncertainties, increased competitive pressures, and amplified the intensity of competition (Appio et al., 2021; Kraus et al., 2018; Penttilä et al., 2020). Second, at the *meso level*, digitalization reinforces the role of organizational capabilities, processes, and routines in sustaining competitive advantage (Appio et al., 2021; Björkdahl, 2009; Day & Schoemaker, 2016; Teece, 2018). DCs are particularly

integral in the digital economy, as superior DCs allow firms to reap the benefits from a plethora of commercial opportunities enabled by digital technologies; DCs are also essential for coping with inherent threats from digitalization (Björkdahl, 2020; Teece et al., 2016). Finally, at the *micro level*, firms must implement new business models and operating procedures that are leveraged through the DCs of individuals, such as managers or engineers (Appio et al., 2021). These arguments indicate that digitalization accentuates the role of individual-level managerial capabilities in sustaining firm-level competitive advantage.

The use of information technology in manufacturing has reached new heights since its initial flourishing in the 1970s. Manufacturing firms now utilize interconnected cyber-physical systems (CPS) to enable autonomous interaction between smart machines and products (Kagermann et al., 2013). CPS refers to smart machines or production facilities that are capable of making automated algorithm-based decisions, taking appropriate action, and interacting interdependently (Gilchrist, 2016; Kagermann et al., 2013). The application of the IoT to the industrial value chain is recognized as the fourth industrial revolution (Ghobakhloo, 2020; Schwab, 2017; Weyer, Schmitt, Ohmer, & Gorecky, 2015), and continues to have widespread implications from both a technological and organizational viewpoint (Lasi et al., 2014). The German government was pivotal in fostering the extensive implementation of the fourth industrial revolution based on CPS (Kagermann et al., 2013; Lasi et al., 2014). Germany initiated the strategic initiative *Industry 4.0* in 2011 in order to secure a leading role for the country's manufacturing firms in the global economy (Breznitz, 2014; Kagermann et al., 2013). Germany's Industry 4.0 program has since motivated other governments, such as the United States, France, and Italy, to implement similar initiatives (Björkdahl, 2020).

With the advent of the IoT, manufacturing firms have recognized the potential of integrating CPS into their value chains (Gilchrist, 2016; Kagermann et al., 2013). The application of IoT solutions to the industrial context—also known as the Industrial IoT (IIoT)—has culminated in the *smart factory*. In this pinnacle of digitalization, manufacturing firms connect CPS through technologies, such as sensors, actors, identifiers, and micro-controllers, to create holistic, efficient, flexible, and decentralized production systems that autonomously coordinate interdependent production processes (Lasi et al., 2014; Lu, 2017; Wang et al., 2015; Weyer et al., 2015). The vision for Industry 4.0 lies in the convergence of the physical and virtual worlds, necessitating the development of new business models (Kagermann et al., 2013; Weyer et al., 2015) due to the ongoing technological integration of previously disconnected realms, as well as the transformation from product- to service-centric firms (Björkdahl, 2020; Dalenogare,

Benitez, Ayala, & Frank, 2018; Lasi et al., 2014). In summary, smart factories allow firms to simultaneously profit from the benefits of digitalization, as well as to cope with the inherent challenges of their modular and multi-vendor nature (Ghobakhloo, 2020; Weyer et al., 2015).

Two factors have encouraged the pervasive implementation of Industry 4.0 in the manufacturing industry: *application pull* and *technology push*. First, economic, political, and social changes triggered application pull by creating: decentralized organizational structures and value chains; flexibility in all aspects of the organization; a heightened emphasis on resource efficiency and sustainability; increasingly short development processes; and growing demand for individualized products and services (Ghobakhloo, 2020; Kagermann et al., 2013; Lasi et al., 2014; Weyer et al., 2015). Second, the increasing application of automated solutions in all aspects of value creation, the growing implementation of digital technologies and networks to generate data, and the progression toward miniaturized, performance-enhanced technologies triggered the technology push (Lasi et al., 2014). Industry 4.0 ultimately aims to equip manufacturing firms with the technological foundation for the holistically automated production facilities that are required to confront the challenges of digitalization. The smart factory allows firms to simultaneously customize their products and benefit from economies of scale to confront growing pressures for individualized, cost-effective, and timely production (Centobelli, Cerchione, Cricelli, & Strazzullo, 2022; Lasi et al., 2014; Naeem & Di Maria, 2021; Weyer et al., 2015).

The current technology-driven, global economy closely mirrors Schumpeter's (1934, 1939, 1961, 1994) paradigm of dynamic competition based on discontinuous change and disruption. The ideas of Schumpeter are possibly even more applicable to the current age of hypercompetition than ever before (Ziemnowicz, 2013). In the quest for digital transformation, firms need clearly defined objectives that are efficiently realized through managerial capabilities (Björkdahl, 2020). Schumpeter could not, in fact, have envisaged the current hypercompetitive economy more accurately.

2.3 References

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Chapter 3

Research Paper 1: Influences on innovation at the managerial level

Heubeck, T., & Meckl, R. (2021). Antecedents to cognitive business model evaluation: A dynamic managerial capabilities perspective. *Review of Managerial Science*. <https://doi.org/10.1007/s11846-021-00503-7>

Abstract

The increasing misalignment between the technological and economic domains in today's digitalized global economy puts managers under constant pressure to redesign firms' business models. Business model innovation has thus become a critical managerial challenge to develop and sustain competitive advantages. Building on the DMCs perspective, we argue that managers are at the heart of strategic change through business model innovation. We hypothesize that decision-making regarding business model innovation is the outcome of how managers cognitively process information. We further reason that while managerial human capital and social capital reinforce each other, they also promote managers' ability to consciously evaluate options for business model innovation. Our empirical study builds on a sample of firms operating primarily within the Industry 4.0 sector. The results significantly confirm managerial human and social capital as two crucial antecedents to cognitive business model innovation. Contrary to the literature, the data set does not show a significant positive relationship between managerial human and social capital. Our main contributions to the literature are twofold; from a methodological perspective, we are one of the first to construct a multidimensional measurement of DMCs, while from a theoretical and practical perspective, our findings further underline the relevance of DMCs for business model innovation. Finally, we discuss theoretical and practical implications and propose future avenues for research.

Keywords

Business model innovation, dynamic managerial capabilities, human capital, managerial cognition, organizational change, social capital

3.1 Introduction

As a major driver of business model innovation, digital transformation pressures managers to undertake strategic change (Acciarini, Brunetta, & Boccardelli, 2020; Kraus, Palmer, Kailer, Kallinger, & Spitzer, 2018). This 21st-century megatrend causes the “increasing implementation of digital technologies and the transformation of conventional processes into digital ones” (Bouncken, Kraus, & Roig-Tierno, 2021, p. 2). Digitalization, therefore, fundamentally questions current competitive advantages by changing the rules of competition (Acciarini et al., 2020; Penttilä, Ravald, Dahl, & Björk, 2020). In light of these developments, a firm’s long-term success largely depends on its managerial ability to align the existing mechanisms of value proposition, value creation, and value capture—that is, the business model—with the ever-changing demands of the environment (Clauss, Abebe, Tangpong, & Hock, 2019). To survive in the digital economy, firms can no longer solely rely on innovating their products, services, or processes. The business model has become a central avenue for innovation (Clauss, Bouncken, Laudien, & Kraus, 2019; Purkayastha & Sharma, 2016), and business model innovation has consequently turned into one of the most daunting managerial tasks (Eppler, Hoffmann, & Bresciani, 2011).

We adopt the DMCs perspective to analyze the decision-making processes related to business model innovation. DMCs highlight the managerial role within strategic decision-making. Managers possess the capabilities—namely, human capital, social capital, and cognition—that are required to “build, integrate, and reconfigure organizational resources and competences” (Adner & Helfat, 2003, p. 1012). As managerial capabilities shape organizational decision-making, the strength of firm-intrinsic DMCs is a central driver of business model innovation (Teece, 2018).

Despite their centrality to sustained competitive advantage through innovation (Kaplan & Tripsas, 2008) and business model design (Teece, 2018), there is still limited knowledge on how managerial capabilities affect organizational change (Felin, Foss, Heimeriks, & Madsen, 2012). The few existing studies focus on the drivers of DMCs individually (e.g., Åberg & Torchia, 2020) or measure psychological characteristics with observable proxies (e.g., Holzmayr & Schmidt, 2020). Hence, our first research goal relates to the holistic operationalization of DMCs:

How can the concept of DMCs be operationalized from a multidimensional perspective?

Subsequently, we adopt the DMCs perspective to examine the effects of managerial characteristics on strategic decision-making related to business model innovation. Managers possess the capability to orchestrate the firm's asset portfolio (i.e., resources and capabilities). The unique composition of the asset portfolio, in turn, determines the pathways for strategic change and ultimately shapes company performance (Helfat & Martin, 2015b). Efficient management must consequently organize and align all operative and strategic activities of the firm through the business model (Casadesus-Masanell & Ricart, 2010). Due to the high level of dynamism, competition, and uncertainty, the current digital business paradigm causes an increasing discrepancy between company strategy and processes (Al-Debei, El-Haddadeh, & Avison, 2008). As DMCs determine the managerial ability to configure, develop, and deploy the firm's asset portfolio (Adner & Helfat, 2003), they have become a critical success factor for target-oriented business model innovation. This argumentation leads to our second RQ:

How do the three dimensions of DMCs interact in the context of business model innovation?

The rest of the paper is structured as follows. We first outline the general concept of DMCs and its three underlying managerial capabilities in Section 3.2.1. In Section 3.2.2, we describe the business model and adopt a processual view of business model innovation. We then derive the research model, which analyzes the interrelationships between DMCs, in Section 3.3. Section 3.4 outlines our research methodology. We present the empirical results in Section 3.5. In Section 3.6, we discuss theoretical and practical implications. We conclude with an assessment of the limitations and the outlook for future research.

3.2 Theoretical background

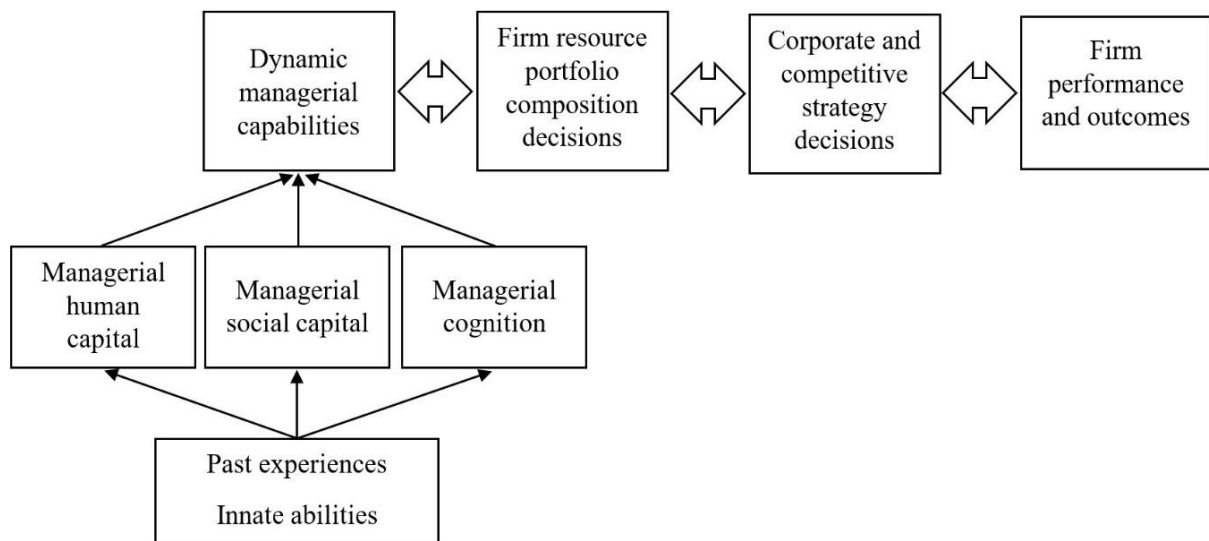
3.2.1 Dynamic managerial capabilities

3.2.1.1 Moving beyond the collective level of analysis

DMCs relate to the specific subset of DCs located within individual managers (Adner & Helfat, 2003). From this perspective, a company's management comprises a heterogeneous group of decision-makers, which decisively shapes outcomes through identifiable strategic choices (Beck & Wiersema, 2013). The driving forces behind both DCs and DMCs are routines (i.e., practiced and patterned behaviors). The former, however, does not necessarily involve managerial intentionality, while the latter posits that intent is the driving force behind firm-specific routines (Martin, 2011). Consequently, DMCs exist if executive action reliably causes the intended outcome (Dosi, Nelson, & Winter, 2000). Additionally, managers must ensure the

reproducibility of capabilities through routinely practicing, repeating, and patterning them. Managerial decisions regarding the firm's asset portfolio limit its scope of strategic action—at least in the short term. Company performance ultimately results from the managerial capability to continuously design effective strategies (Adner & Helfat, 2003; Beck & Wiersema, 2013). We have summarized these interrelationships in Figure 3.1.

Figure 3.1 The causal chain of dynamic managerial capabilities within strategic choice situations



Source: Author's representation, based on Adner and Helfat (2003) and Beck and Wiersema (2013)

This study will expand upon the dominant focus on top managers (e.g., Kor & Mesko, 2013; W. K. Smith & Tushman, 2005) by including middle managers. Middle management decisively influences strategy formulation (B. Wooldridge, Schmid, & Floyd, 2008) and business model implementation (Islam, 2019) by shaping how capabilities are created and deployed. Increasing decentralization, global dispersion, and knowledge intensity have additionally led to an ongoing shift toward flatter hierarchies (Rajan & Wulf, 2006). Middle managers are consequently in an increasingly critical position to ensure the success of business model innovation.

3.2.1.2 Managerial human capital

The three drivers of DMCs originate from managers' innate abilities and past experiences (Beck & Wiersema, 2013). These capabilities individually and jointly determine the managerial ability to configure, develop, and deploy the firm's asset portfolio in dynamic environments (Adner & Helfat, 2003).

Human capital entails the entirety of managerial knowledge, capabilities, and competencies acquired through, for example, education, training, or prior work experience (Adner & Helfat, 2003). Digital technologies have reshaped traditional learning opportunities by facilitating highly individualized training environments (Schneider, 2018).

Two specific types of managerial human capital are tightly linked to firm innovation (Subramaniam & Youndt, 2005). Leadership skills encompass managers' exploitative capabilities, while entrepreneurial skills focus on their explorative capabilities (Ireland, Hitt, Camp, & Sexton, 2001). A high leadership skill level allows managers to effectively organize, allocate, and configure the firm's asset portfolio. These skills consequently help solidify existing competitive advantages (Guo, Xi, Zhang, Zhao, & Tang, 2013; Ireland et al., 2001). Managers with a high level of entrepreneurial skills are conversely more alert toward new business prospects, better at construing ambiguous information, and more prone to design innovative business models (Teece, 2007). Entrepreneurial action is consequently fundamental for exploring new markets, customers, or resources and combining those assets through novel business models (Ireland et al., 2001; K. G. Smith & Gregorio, 2017). Altogether, a holistic assessment of managers' human capital calls for the inclusion of these two types of human capital, as they are both required to design and implement business models that sustain competitive advantages in the long run.

3.2.1.3 Managerial social capital

Managerial social capital constitutes the second driver of DMCs (Adner & Helfat, 2003). We define managerial social capital as goodwill (e.g., trust, sympathy, reciprocity), which originates from informal and formal social ties within the organization (Adler & Kwon, 2002; Nahapiet & Ghoshal, 1998). Managers employ social capital to access tangible (e.g., money, equipment, investments) and intangible resources (e.g., information, knowledge, capabilities, commitment) from their social network (Weiler & Hinz, 2019). Consequently, social capital

facilitates innovation by increasing the interaction within the manager's network (Gant, Ichniowski, & Shaw, 2002).

Following Nahapiet and Ghoshal (1998), we differentiate between three interrelated dimensions of social capital. The structural dimension encompasses general network characteristics, such as the types of actors and their communication forms. The relational dimension describes the nature of personal relationships. Based on past interactions, people develop a unique affiliation with a specific network, which materializes in their behavior (Nahapiet & Ghoshal, 1998). The cognitive dimension refers to shared beliefs, values, norms, and attitudes within the network (Andrews, 2010). Altogether, the structural dimension of social capital makes resources available, while the relational and cognitive dimensions determine the capacity to tap into those resources (Ali-Hassan, Nevo, & Wade, 2015). In addition to the multifaceted nature of social capital, all dimensions promote certain behaviors within specific social boundaries (Nahapiet & Ghoshal, 1998).

3.2.1.4 Managerial cognition

Finally, DMCs are composed of managerial cognition (Adner & Helfat, 2003). This “cognitive capital” (Helfat & Martin, 2015a, p. 427) refers to the method of information processing that originates from cognitive processes and structures (Walsh, 1995). Based on past experiences and learning, managers develop unique cognitive frames through which they process information (Karhu & Ritala, 2020). These mental templates shape the individual perspective in specific choice situations. To make sense of information, managers mentally frame information (Walsh, 1995). This highly individual interpretation of information drives decision-making by determining “how a given problem or decision is perceived” (Karhu & Ritala, 2020, p. 490). Ultimately, managerial cognition serves as the basis for managerial decision-making by governing the extent of consciousness and thus the intentional evaluation of information (Adner & Helfat, 2003; Walsh, 1995).

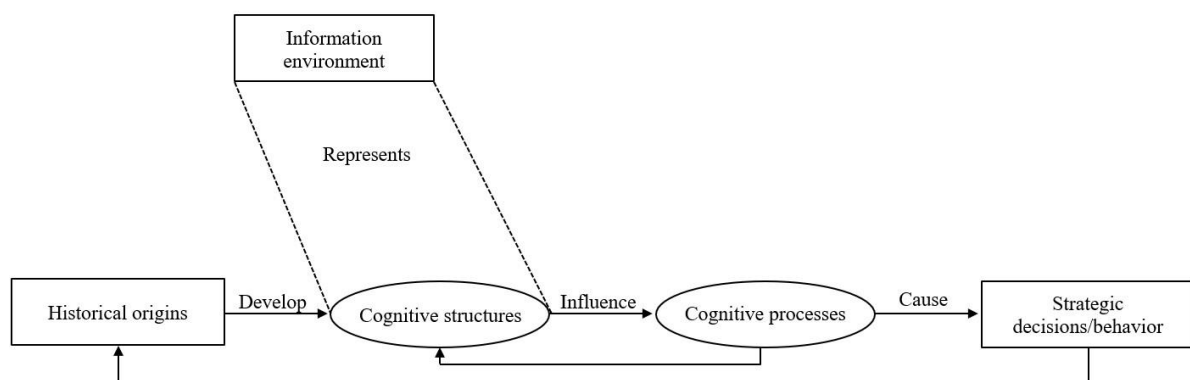
Information processing can fundamentally occur in two ways. Within the automatic processing mode, individuals examine information on a solely superficial level as they resort to past experiences in comparable situations. Automatic processing thus aims to facilitate cognitive efficiency by reducing complexities and uncertainties. The controlled processing mode is, in contrast, shaped by the current informational context. It is most applicable in novel situations,

for which decision-makers do not possess readily available knowledge structures (Kahneman, 2012; Walsh, 1995).

Real-world decision-making is characterized by the necessity to process information efficiently by developing cognitive simplifications. Due to their limited attentional and cognitive capacities, managers cannot notice or interpret the entire scope of information (Walsh, 1995). Consequently, the automatic processing mode is most applicable in relatively stable conditions, in which it enables a higher level of cognitive efficiency. In dynamic environments, however, the existing mental models can quickly become obsolete. Outdated cognitive processes and structures will cause inadequate decisions (Beck & Wiersema, 2013; Tripsas & Gavetti, 2000). Automatic information processing also inhibits creative problem solving, as managers tend to develop incomplete and biased perspectives, ignore discrepant but perhaps important information, and base their decisions on simplified decision rules (Walsh, 1995). Altogether, a high level of cognitive capability equips the manager with the analytical skillset required to cope with environmental change proactively (Helfat & Martin, 2015b).

We view strategic decision-making as an ongoing feedback loop (see Figure 3.2). In this recursive process, managers construe an imperfect mental representation of the internal and external informational environment. Due to limited attentional and cognitive capacities, not all relevant information will enter the decision-making process. Cognitive structures and processes are consequently highly individual and imperfect (Walsh, 1995). Ergo, heterogeneity in managerial cognition shapes company strategy by causing differences in the managerial ability to sense, seize, and reconfigure the firm's asset portfolio (Adner & Helfat, 2003; Helfat & Peteraf, 2015).

Figure 3.2 An organizing framework of managerial cognition



Source: Author's representation, based on Walsh (1995)

3.2.2 *The business model concept*

3.2.2.1 Digital business models

The digital transformation continues to pressure managers to rethink existing business models for two main reasons. First, the widespread use of digital technologies has caused a paradigm shift from physical to intangible value offerings (Iansiti & Lakhani, 2014). Second, the business model itself has turned into a subject of innovation. Companies can create additional value by designing business models that supplement their efforts toward product, process, and service innovation (Clauss, Bouncken, et al., 2019; Purkayastha & Sharma, 2016). Consequently, managers are challenged to design business models that bridge the gap between the technological and economic realms in the face of internal hindrances and external uncertainties (Bouncken et al., 2021; Chesbrough & Rosenbloom, 2002).

We define the business model from two perspectives. The objective view conceptualizes the business model as the holistic and interdependent logic of value proposition, value creation, and value capture (Clauss, Abebe, et al., 2019; Massa, Tucci, & Afuah, 2017; Morris, Schindehutte, & Allen, 2005). The value proposition reflects what kind of value the firm offers to whom and through which channels (Morris et al., 2005). The value creation dimension describes how companies create value along their entire value chain. It hence specifies underlying resources and processes (Clauss, 2017). Value capture maps out how firms commercialize value (Morris et al., 2005) through either revenue streams (Casadesus-Masanell & Zhu, 2013) or revenue models (Baden-Fuller & Haefliger, 2013). By determining and transcending organizational boundaries and allowing firms to be ambidextrous, inimitable business model configurations build the foundation of sustained competitive advantages (Chesbrough & Rosenbloom, 2002; Morris et al., 2005). Second, the cognitive view defines the business model as an implicit managerial mental scheme that shapes decision-making by filtering and simplifying information (Massa et al., 2017). From the managerial perspective, this mental picture of the business model is a subjective view of how the firm proposes, creates, and captures value. Decision-making related to the business model ultimately rests on the manager's subjective perception of its operating principles and not its objective design (Massa et al., 2017; Tikkanen, Lamberg, Parvinen, & Kallunki, 2005).

3.2.2.2 A processual view of business model innovation

Business model innovation generally refers to novel, designed, and nontrivial changes to how the firm proposes, creates, and captures value or how these three domains are linked (Foss & Saebi, 2017). Business model innovation can range from incremental changes within isolated areas to the fundamental renewal of the business model. Additionally, it might even cause the implementation of a secondary business model (Khanagha, Volberda, & Oshri, 2014). Due to their magnitude, business model innovation regularly results in corresponding alterations to the firm's strategy and asset portfolio (Helfat & Martin, 2015a).

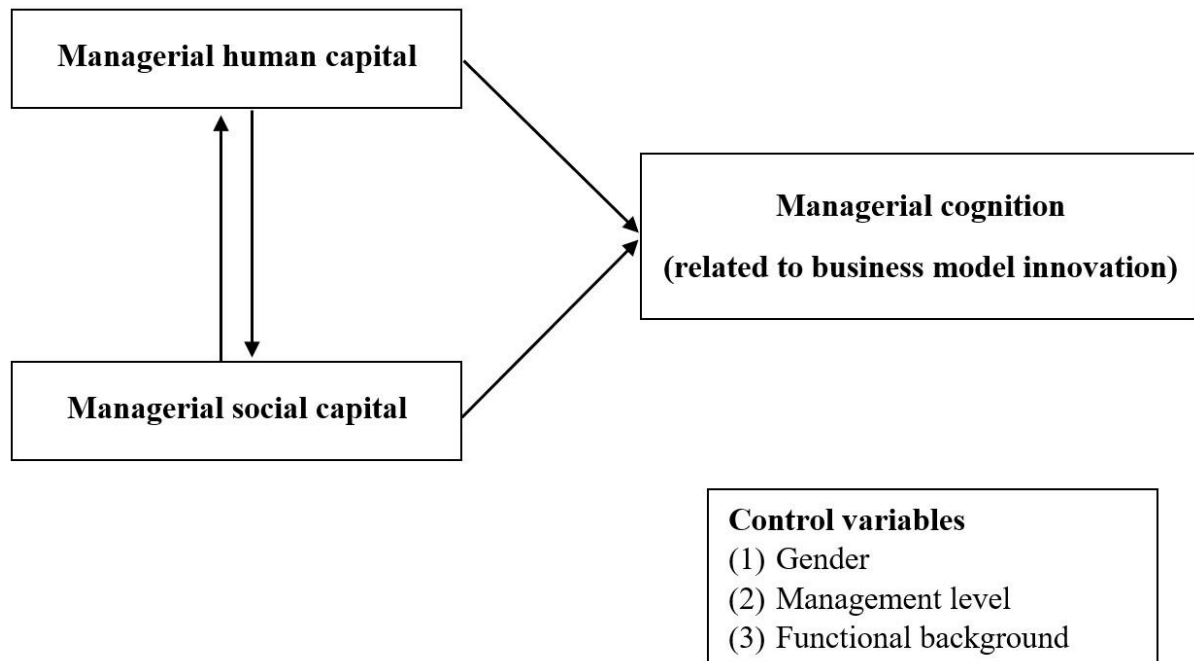
To systematically analyze business model innovation, we adopt the processual 4I-framework of business model innovation (for this and the following, Frankenberger, Weiblen, Csik, & Gassmann, 2013; Gassmann, Frankenberger, & Csik, 2014). This framework proposes an iterative four-phased sequence. During the initiation phase, managers focus on monitoring and interpreting change processes within the competitive and technological environment. In the ideation phase, managers subsequently transform identified change drivers into concrete ideas for business model innovation. Managers must translate those ideas into concrete business model designs in the integration phase. In the final implementation phase, managers must realize business model innovation. Altogether, effective management is essential to ensure the fit between (1) the envisaged business model innovation and the demands of the environment (i.e., the external fit), (2) the newly generated ideas for business model innovation and their transformation into realizable approaches (i.e., the internal fit), and (3) the design and realization phase.

3.3 The effects of dynamic managerial capabilities

We subsequently derive a research model at the individual managerial-level. As depicted in Figure 3.3, managerial human capital, managerial social capital, and managerial cognition shape creativity, innovation, and strategic change through their distinct interactions (Helfat & Martin, 2015a). We choose managerial cognition as the dependent variable to gain more insights into the underlying mechanisms of business model innovation. Managerial cognition ultimately determines how managers subjectively evaluate the current business model and possible options for its redesign. Differences in those cognitive evaluations materialize in the concrete business model configuration by influencing the recognition of change and the disposition to act on those recognitions (Adner & Helfat, 2003; Cavalcante, Kesting, & Ulhøi,

2011). In line with previous research (e.g., Aspara, Lamberg, Laukia, & Tikkanen, 2013; Tikkanen et al., 2005), we infer that managerial cognitive capabilities determine strategic change through business model innovation in dynamic environments.

Figure 3.3 Interactions of dynamic managerial capabilities



Source: Author's representation

We hypothesize that managerial human capital and managerial social capital are positively related to the intentional evaluation of alternatives for redesigning the current business model. Furthermore, we posit that managerial human capital and managerial social capital reinforce each other.

During the four-phased business model innovation process, managerial capabilities play a decisive role in shaping the cognitive evaluation of information. In the initiation phase, managerial human capital supplies the necessary breadth of knowledge and experiences. Consequently, managers are better skilled to proactively identify and realistically evaluate external developments (Bock, Opsahl, George, & Gann, 2012). Especially during the first phase, leadership skills are vital, as managers need to continually adjust the firm's asset portfolio to ensure the constant availability of required resources and capabilities. Managers with a high level of entrepreneurial skills additionally show more tolerance of ambiguities.

Those managers consequently possess the necessary capabilities to monitor technological and competitive change processes, challenge the status quo, and piece together unrelated issues (Tang, Kacmar, & Busenitz, 2012). Furthermore, entrepreneurial managers regard the complex network of social relationships as a potential source of inspiration for new business ideas (Gassmann et al., 2014). The goodwill available through social capital allows managers to integrate viewpoints divergent from their social fabric (Gant et al., 2002). Social capital also supports the development of cohesion, trust, and cooperation within the firm. It thereby facilitates the exchange of heterogeneously distributed resources, information, and knowledge (Alguezaui & Filieri, 2010; Manev, Gyoshev, & Manolova, 2005). Furthering an in-depth understanding of the needs and demands of relevant players and the implications of emerging change drivers is especially crucial in the context of business model innovation (Frankenberger et al., 2013). Altogether, managerial human capital and managerial social capital determine the extent to which decision-makers meet the challenges of the initiation phase.

Generating new ideas for business model innovation is the main challenge during the subsequent ideation phase (Frankenberger et al., 2013). Over time, managers develop a subjective view of how the firm operates through its business model (Prahalad, 2004). Strengthened by the historically grown allocation of assets, adhering to the dominant logic hinders decision-makers from experimenting with new business models (Chesbrough & Rosenbloom, 2002). While this dominant business model logic rests on DMCs (Kor & Mesko, 2013), those capabilities are at the same time needed to overcome entrenched viewpoints. Therefore, effective management in a digital economy requires experimentation by questioning proven recipes for success and acting across industry sectors (Prahalad, 2004). Managerial human capital and managerial social capital both assume a vital role in this process. Leadership skills equip managers with the necessary administrative skills to effectively govern idea creation. Entrepreneurial skills conversely entail the explorative capabilities required to overcome the dominant business model logic by facilitating out-of-the-box thinking. Without sufficient entrepreneurial skills, managers cannot design an innovative business model to commercialize the value of innovation. Hence, entrepreneurial skills function as a leverage mechanism of leadership skills (Guo et al., 2013; K. G. Smith & Gregorio, 2017). Managerial social capital also creates favorable conditions for innovation processes by promoting information exchange through nonhierarchical and informal networks (Gant et al., 2002). Therefore, high levels of social capital guarantee the necessary informal support for business model innovation and complement managers' formal power.

In summary, managerial human capital and managerial social capital are conduits to overcoming the dominant business model logic and establishing the appropriate organizational setting for business model innovation. Decision-makers need to resort to their entrepreneurial skills to design new methods explicitly tailored for idea generation and subsequently ensure their functionality through applying leadership skills. Social capital guarantees the necessary dissemination and support of those new methods and mindsets within the organization. Due to the ambiguous and complex nature of business model innovation, different types of knowledge must be coherently integrated (Eppler et al., 2011). Furthermore, both capability types are also likely to ensure the external fit between the ideation and initiation phases, as they facilitate the situational analysis of the external environment during the initiation phase.

Exploitative managerial capabilities are critical during the integration phase. Management is faced with a twofold challenge to ensure internal fit. First, the effective orchestration of the firm's asset portfolio rests on an in-depth elaboration of its strategic focus. In addition, decision-makers need to ensure the constant alignment between strategic and operative processes (Al-Debei et al., 2008). Leadership skills, in particular, enable effective asset portfolio orchestration. These skills also ensure the consistent alignment of processes by facilitating the goal-directed delegation of firm members (Casadesus-Masanell & Ricart, 2010; Guo et al., 2013). Simultaneously, external fit constitutes a central success factor (Frankenberger et al., 2013; Gassmann et al., 2014). To establish viable partner management within the firm, managers resort to their human capital. Leadership skills are of integral importance during this phase, as effective asset orchestration rests on value-promising partner management. Moreover, strong social structures foster information exchange, whereby the firm benefits from the increased spread of insights through its partner management (Manev et al., 2005). A company's partner management must finally exhibit an adaptive character, as a reinforcement of firmly established practices might result in nonsituational decision outcomes. In this case, managers base their decisions on outdated beliefs about the needs of stakeholders. The availability of managerial human and managerial social capital also ensures the internal fit between the ideation and integration phases. The combined application of entrepreneurial skills and social capital allows managers to explore new ideas for business model innovation. The implementation of those ideas, in contrast, requires their exploitation using leadership skills leveraged through social capital. Therefore, both drivers of DMCs decisively shape the goal-directed business model transformation process. A coherent business model redesign ensures

the fit between the ideas generated for business model innovation, the business model's building blocks, and the building blocks themselves (Frankenberger et al., 2013).

In contrast to the primarily abstract managerial tasks during the first three phases, the implementation phase is concerned with realizing business model innovation (Gassmann et al., 2014). Managers must ultimately convince other company members of the necessity for change and ensure the commitment of key decision-makers. The role of DMCs becomes evident in overcoming the dominant business model logic; managers need to resort to their controlled processing to assess the far-reaching implications of business model change holistically. This assessment, however, is only possible if managers possess the necessary human capital while employing their social capital to disseminate the new mindset. Company members must ultimately come to a shared belief system regarding the importance and execution of the transformation process (Benner & Tripsas, 2012; Nahapiet & Ghoshal, 1998). If managers do not possess a high level of social capital, isolated and diverging thought patterns are likely to result. These factors will impede a uniform definition of objectives and consequently impair the effective execution of business model innovation. Based on those interrelationships, we derive the following effect mechanism. To consciously analyze the options for business model change, managers need to possess a broad pool of knowledge to categorize and evaluate new information. The dissemination of knowledge depends upon sufficient goodwill (i.e., social capital), which is necessary to transcend entrenched mindsets and ensure the commitment of key decision-makers. Therefore, managerial capabilities are a central success factor for realizing business model innovation (Gassmann et al., 2014). Compared to other forms of innovation, business model innovation also causes more fundamental and wide-reaching changes. Management must hence demonstrate an openness to new ideas and an entrepreneurial spirit to continuously question the status quo (Giesen, Riddleberger, Christner, & Bell, 2010). Learnings acquired from previous iteration processes should always inform future decision-making (Sosna, Trevinyo-Rodríguez, & Velamuri, 2010). This type of trial-and-error learning calls for managers who possess entrepreneurial skills and employ their social capital to ensure the spread of knowledge. Additionally, managers need to possess a high level of leadership skills to manage the process of business model innovation effectively.

In sum, the business model innovation process rests on the following logic. Human capital entails the managerial capability to identify, assess, and act on possible pathways for business model innovation. In particular, entrepreneurial skills enable managers to identify options for business model innovation and their subsequent realization (Chesbrough & Rosenbloom,

2002). Managerial social capital also drives business model innovation by facilitating the exchange of resources and ensuring the necessary support within the organization. At the same time, managers' human capital and social capital supplement each other. Highly skilled managers are more attractive as relationship partners, while a high level of social capital eases the access to resources, capabilities, and information required to design, support, and realize business model innovation. Based on those interrelationships, we postulate the following four hypotheses:

Hypothesis 1: Higher levels of managerial human capital will lead to a more conscious evaluation of alternatives for business model innovation.

Hypothesis 2: Higher levels of managerial social capital will lead to a more conscious evaluation of alternatives for business model innovation.

Hypothesis 3a: Managers with higher levels of human capital will possess higher levels of social capital.

Hypothesis 3b: Managers with higher levels of social capital will possess higher levels of human capital.

3.4 Methodology

3.4.1 Data collection and sample

This study draws on a written survey of companies from German-speaking countries conducted during the last months of 2019. Our survey technique follows the key informant approach (Lechner, Dowling, & Welp, 2006). We acquired contact information through exhibitor lists from trade shows covering the entire spectrum of smart and digital automation, referred to as *Industry 4.0*. Firms operating within innovative and knowledge-intensive industries are appropriate subjects for our study. They are faced with disruptive changes in their fast-paced business environments and correspondingly need to possess DMCs to cope with the need for rapid innovation processes (Schneider, 2018). More specifically, we contacted exhibitors from the following international trade shows: *Smart Production Solutions* (focus: smart and digital automation), *Hannover Messe* (focus: industrial transformation), *EuroShop* (focus: retail trade), *Medica* (focus: medical industry), and *Photokina* (focus: photography, video, and imaging).

We distributed the questionnaire to a total of 2,920 companies using the web-based online survey tool *Qualtrics*. The initial response rate was 7.02% ($N = 205$). The questionnaire was structured as follows. After a short introduction to the study, we collected general data about the respondent. In the next block of questions, we individually measured DMCs with a five-point Likert-type scale. We present the operationalization of the constructs in the following chapters. In the fourth and final part of the questionnaire, we gathered general company data.

3.4.2 Measures

3.4.2.1 Dependent variable

We conceptualize *managerial cognition* concerning the business model (see Table 3.7 in Appendix). In this sense, managers develop a unique cognitive representation of the firm's business model. This highly individual interpretation entails the managerial perception of the business model's three core building blocks. Therefore, we define managerial cognition as the conscious evaluation of alternatives for business model innovation (Schrauder, Kock, Baccarella, & Voigt, 2018). Based on this cognitive perspective, Schrauder et al. (2018) generate a total of eleven items. We translated those items into German. Additionally, we modified the initial items to measure the extent to which managers resort to the automatic processing mode while evaluating the options for partial or complete business model innovation. Managerial cognition was inversely coded. Small values indicated automatic processing, while high values inferred that managers resort to the controlled mode of processing (i.e., they entirely focus their cognitive resources on evaluating the current business model). Consequently, we argued that managers can only modify established business model schemes by consciously and intentionally evaluating the existing business model and possible options for its redesign.

3.4.2.2 Independent variables

We measured *managerial human capital* by resorting to the duality of leadership skills and entrepreneurial skills (see Table 3.7 in Appendix). Based on the work of Chandler and Hanks (1998), Guo et al. (2013) developed a five-item measurement of those two dimensions. We translated those items into German.

Our operationalization of *managerial social capital* builds on Carr, Cole, Ring, & Blettner (2011) (see Table 3.7 in Appendix). We modified the original items to measure social capital at the individual managerial-level. We maintained the division of social capital into structural, relational, and cognitive dimensions. We translated those items into German.

3.4.2.3 Control variables

We controlled for three variables at the managerial-level: (1) *gender*, which was coded as a binary variable (male = 0; female = 1); (2) *management level*, which was divided into middle management, top management, and owner/shareholder; and (3) *functional background*, which was classified as output functions (i.e., marketing, sales, research and development), throughput functions (i.e., production, accounting, process engineering), and peripheral functions (i.e., law, finance) (Herrmann & Datta, 2005). We included these variables to account for their possible effects on managers' cognitive processes. First, prior research has shown that gender impacts strategic decision-making by causing differences in the propensity for risk-taking (Croson & Gneezy, 2009). Second, the hierarchical position influences the exchange and flow of information within the firm (Ethiraj & Levinthal, 2004). Last, functional background shapes decision-making by being the source of highly personal perceptions (Herrmann & Datta, 2005).

3.4.3 Statistical procedure

Using *IBM SPSS Statistics Version 26*, we first constructed the variables for DMCs using principal axis confirmatory factor analysis (CFA). We determined the optimal allocation of items by applying varimax rotation. We excluded missing values listwise. We asserted the basic eligibility of factor analysis by the Bartlett test of sphericity, the measure of sample adequacy (MSA) criterion, and the Kaiser-Meyer-Olkin (KMO) criterion (Hair, Black, Babin, & Anderson, 2014). We used the Kaiser-Guttman (KG) criterion to determine the appropriate number of factors and then conducted a scree test to assess the factors' robustness (Thompson, 2004). In general, we only constructed a factor if it consisted of at least three variables and factor loadings exceeded 0.30 (Hair et al., 2014).

We assessed the quality criteria as follows. First, we classified factors with Cronbach's alpha coefficients greater than 0.70 as reliable (Hair et al., 2014). Second, we determined validity using convergent and discriminant validity. While the former calls for an average variance

extracted (AVE) over 0.50, the latter requires a minimum factor loading of 0.50 and the fulfillment of the Fornell-Larcker (FL) criterion (Fornell & Larcker, 1981). Last, objectivity demands include the objectivity of application (i.e., standardized test situation), the objectivity of analysis (i.e., unbiased analysis), and the objectivity of interpretation (i.e., independent interpretation) (Payne & Payne, 2004; Resnik, 2001).

We tested our hypotheses using multiple regression analysis. We additionally assessed those results by constructing a structural equation model using *R* and its *lavaan* extension (Rosseel, 2012). We defined significance levels as extremely significant ($p \leq 0.001$), highly significant ($p \leq 0.01$), and significant ($p \leq 0.05$) (J. M. Wooldridge 2019). We classified effect sizes as strong ($\beta > 0.35$), moderate ($\beta > 0.15$), and weak ($\beta > 0.02$) (Cohen, 1988).

3.5 Results

3.5.1 Measurement model

We conducted a CFA of all drivers of DMCs and their respective dimensions. We only included data sets if the respondent indicated a current management affiliation within the firm. The Bartlett test of sphericity generally confirmed the basic data eligibility as extremely significant for each factor ($p < 0.001$; for this and the following, see Table 3.1). The MSA criterion and the KMO criterion confirmed these findings. The CFA of managerial human capital indicated a two-factor solution for its leadership skills dimension, while entrepreneurial skills loaded onto a single factor. Even though the KG criterion and the scree test validated those results, the item composition of leadership skills had to be modified. We excluded item 3 because its factor loading fell short of 0.50. We also removed item 1 because it showcased a loading onto a second factor while not loading sufficiently onto the same factor as the remaining items. Leadership skills were therefore comprised of items 2, 4, and 5. The variable composition of entrepreneurial skills was not modified.

Subsequently, we assessed the item composition of managerial social capital. In the first step, we confirmed the theoretical tripartite structure of social capital. We excluded three items due to a factor loading smaller than 0.50. The modified item composition yielded a two-factorial solution, in which we removed item 1 of the structural dimension (factor loading < 0.50). Both the KG criterion and the scree test attest to those results. In the third and last step, we extracted two factors for managerial social capital. All the remaining item loadings exceeded 0.50.

The CFA of managerial cognition confirms the proposed structure of value offering, value architecture, and value capture. We precluded items 1 and 5 of the architectural dimension from further analyses, as their factor loadings were below the cutoff value. The KG criterion and scree test confirmed those findings.

Hereafter, we evaluate the quality of our data (see Table 3.1). All factors are reliable ($\alpha > 0.70$). Managerial cognition is convergent valid ($AVE > 0.50$). Managerial human and social capital are also convergent valid, as their respective AVE is between 0.40 and 0.50, while their Cronbach's alpha coefficients exceed 0.60 (Fornell & Larcker, 1981). All factors are discriminantly valid and meet the defined quality criteria. The test situation was fully standardized throughout this study, and the data were objectively analyzed and interpreted. Our study hence complies with all objectivity demands.

Table 3.1 Results of the confirmatory factor analysis

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

Source: Author's representation

Notes: α = Cronbach's alpha; AVE = Average variance extracted; FL = Fornell-Larcker; KMO = Kaiser-Meyer-Olkin; N = Sample size; Std. FL = Standardized factor loadings

3.5.2 Descriptive statistics and bivariate results

In the next step, we calculated the descriptive statistics and correlations (see Table 3.2). The managers within the sample are, on average, 45.55 years old, primarily male (83.72%), identify as owners/shareholders or top managers (74.42%), and perform an output function (91.86%). We assessed their qualification as key informants by calculating the average years of firm affiliation. On average, the respondents have worked at their current firm for 13.42 years. This long tenure serves as a suitable indication of their qualification as key informants. The firms within the sample are primarily based in Germany (93.91%). They operate within five industries, which we classified according to the following Standard Industrial Classification (SIC) codes: service providers (SIC 8; 28.30%), producers of capital goods (SIC 4; 25.47%), producers of consumer goods (SIC 3; 23.58%), retail and wholesale (SIC 6; 20.75%), and transport and logistics (SIC 5; 1.89%).

Table 3.2 Descriptive statistics: Means, standard deviations, and correlations

Variable	Mean	SD	1	2	3	4	5	6
1 Managerial human capital	0.116	0.591	1					
2 Managerial social capital	0.039	0.673	0.130	1				
3 Managerial cognition	0.049	0.517	0.375***	0.405***	1			
4 Gender	0.163	0.371	-0.212	0.015	-0.087	1		
5 Management level	1.953	0.750	-0.131	-0.125	-0.071	0.112	1	
6 Functional background	1.116	0.418	0.031	-0.181	0.045	-0.123	0.280**	1

Source: Author's representation

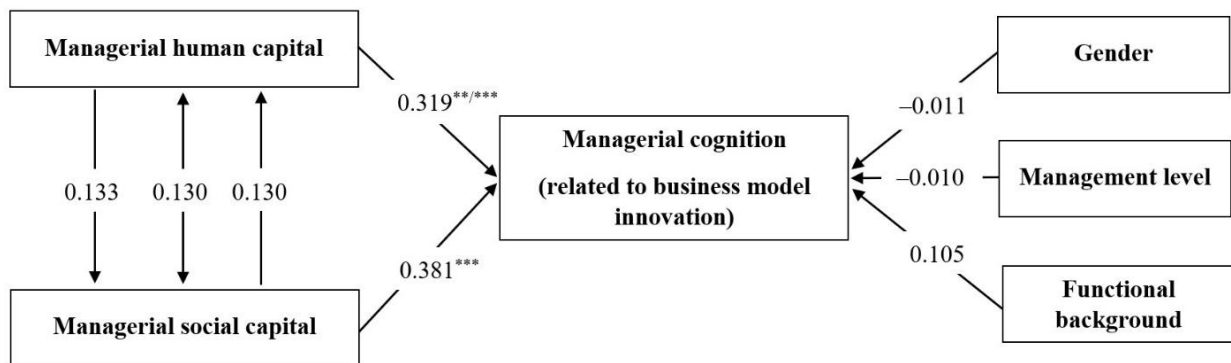
Notes: $N = 86$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; $SD =$ Standard deviation

3.5.3 Regression results

We list the regression results in Table 3.3. Hypotheses 1 and 2 predicted a positive effect of managerial human and managerial social capital on managerial cognition related to business model innovation, respectively (see Table 3.6). Hypothesis 1 is confirmed, as managerial human capital is found to exert a highly significant, moderate to strong effect on managerial cognition related to business model innovation ($b = 0.278$, $se = 0.086$, $p = 0.002$). The data also supports Hypothesis 2. Managerial social capital shows an extremely significant, strong effect on managerial cognition related to business model innovation ($b = 0.293$, $se = 0.075$, $p < 0.001$).

We subsumed a reciprocal positive effect between managerial human and managerial social capital in Hypotheses 3a and 3b. While the data show this proposed positive relationship between both variables, the coefficients are statistically insignificant (Hypothesis 3a: $b = .151$, $se = 0.127$, $p > 0.237$; Hypothesis 3b: $b = 0.114$, $se = 0.096$, $p = 0.237$). Thus, we consequently reject Hypotheses 3a and 3b.

Figure 3.4 The statistical model of dynamic managerial capabilities



Source: Author’s representation

Notes: Parameters are standardized estimates; $N = 86$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

The structural equation model confirms these results (see Tables 3.4 and 3.5). Managerial human capital ($b = 0.278$, $se = 0.083$, $p < 0.001$) and managerial social capital ($b = 0.293$, $se = 0.072$, $p < 0.001$) both exert an extremely significant effect on managerial cognition related to business model innovation. Conversely, there is no significant covariance between managerial human capital and managerial social capital ($b = 0.051$, $se = 0.043$, $p = 0.233$). As summarized in Table 3.6, the data set significantly supports Hypotheses 1 and 2 but not Hypotheses 3a and 3b. Figure 3.4 shows the respective path coefficients within our research model.

Table 3.3 Regression results

Dependent variable	Independent variable	<i>b</i>	<i>se</i>	β
<i>Managerial cognition</i>				
$(R^2 = 0.280^{***}; \text{Corrected } R^2 = 0.235^{***}; F (df = 5; 80) = 6.225)$				
	Constant	-0.124	0.175	
	Managerial human capital	0.278**	0.086	0.319**
	Managerial social capital	0.293***	0.075	0.381***
	Gender	-0.015	0.137	-0.011
	Management level	-0.007	0.070	-0.010
	Functional background	0.130	0.126	0.105
<i>Managerial social capital</i>				
$(R^2 = 0.055; \text{Corrected } R^2 = 0.009; F (df = 4; 81) = 1.183)$				
	Constant	0.420	0.255	
	Managerial human capital	0.151	0.127	0.133
	Gender	0.055	0.203	0.030
	Management level	-0.058	0.103	-0.065
	Functional background	-0.262	0.184	-0.163
<i>Managerial human capital</i>				
$(R^2 = 0.074; \text{Corrected } R^2 = 0.029; F (df = 4; 81) = 1.626)$				
	Constant	0.234	0.224	
	Managerial social capital	0.114	0.096	0.130
	Gender	-0.309	0.174	-0.194
	Management level	-0.087	0.089	-0.110
	Functional background	0.088	0.162	0.062

Source: Author's representation

Notes: $N = 86$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; b = Unstandardized coefficient; β = Standardized coefficient; df = Degrees of freedom; F = F value; N = Sample size; R^2 = Coefficient of determination; se = Standard error

Table 3.4 Results of the structural equation model

Dependent variable	Independent variables	<i>b</i>	<i>se</i>	β
<i>Managerial cognition</i>	Managerial human capital	0.278***	0.083	0.319***
	Managerial social capital	0.293***	0.072	0.381***
	Gender	-0.015	0.132	-0.011
	Management level	-0.007	0.067	-0.010
	Functional background	0.130	0.121	0.105

Source: Author's representation

Notes: $N = 86$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; b = Unstandardized coefficient; β = Standardized coefficient; N = Sample size; se = Standard error

Table 3.5 Structural equation model—covariance structure

Variable 1	Variable 2	<i>b</i>	<i>se</i>	β
Managerial human capital	Managerial social capital	0.051	0.043	0.130
	Gender	-0.046	0.024	-0.212
	Management level	-0.057	0.048	-0.131
	Functional background	0.008	0.026	0.031
Managerial social capital	Gender	0.004	0.027	0.015
	Management level	-0.062	0.054	-0.125
	Functional background	-0.050	0.030	-0.181
Gender	Management level	0.031	0.030	0.112
	Functional background	-0.019	0.017	-0.123
Management level	Functional background	0.087*	0.035	0.280*

Source: Author's representation

Notes: $N = 86$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; b = Unstandardized coefficient; β = Standardized coefficient; se = Standard error

Table 3.6 Empirical results of hypotheses

Hypotheses		Results
<i>Hypothesis 1:</i>	Higher levels of managerial human capital will lead to a more conscious evaluation of business model innovation.	Supported
<i>Hypothesis 2:</i>	Higher levels of managerial social capital will lead to a more conscious evaluation of business model innovation.	Supported
<i>Hypothesis 3a:</i>	Managers with higher levels of human capital will possess higher levels of social capital.	Not supported
<i>Hypothesis 3b:</i>	Managers with higher levels of social capital will possess higher levels of human capital.	Not supported

Source: Author's representation

3.6 Discussion

3.6.1 Theoretical contributions

Our first research goal was to operationalize the three drivers of DMCs from a multidimensional perspective. Based on this methodology, our second objective was to analyze the unique interactions of DMCs in the context of business model innovation.

Our findings confirm Adner and Helfat's (2003) basic notion of DMCs, as heterogeneity in DMCs stems not only from differences within the three underpinnings but also from their unique interactions. The results indicate that human capital and social capital decisively shape how managers cognitively evaluate options for business model innovation.

First, our findings underline the importance of managerial human capital as the basis of knowledge and experience for strategic decision-making. The data show that managers with higher levels of human capital will evaluate the opportunities and risks of business model innovation more consciously than those with lower levels of human capital. Therefore, managers with higher levels of human capital are more prone to resort to the controlled mode of information processing than their counterparts. Future research could examine whether the mode of information processing materializes in the design and ultimate success of business model innovation. Scholars could also test whether managerial cognition increases managerial human capital through conscious and in-depth information processing.

Additionally, our data set shows that managerial social capital is a significant antecedent to managerial cognition. These results validate the prevailing view of social capital as a facilitator of information exchange and decision-making quality (Alguezaui & Filieri, 2010; Manev et

al., 2005). Through increased trust, collaboration, cooperation within the organization, managerial social capital provides access to a greater breadth and depth of information. This wealth of information allows for a more conscious evaluation of business model innovation by providing the necessary information to question existing mental models. Hence, managers with higher levels of social capital are more likely to resort to the controlled mode of information processing. Future research could examine a potential recursive effect between managerial social capital and managerial cognition. Conscious information processing allows decision-makers to analyze the challenges associated with business model innovation more comprehensively and develop a more profound understanding of the needs and demands of key players.

Contrary to our expectations, we find an insignificant albeit positive effect of managerial human capital on social capital and vice versa. These findings contrast the existing studies on the relationship between both forms of capital, which confirm human and social capital as substitutes or complements (e.g., Santarelli & Tran, 2013). One possible explanation might be the unique context of business model innovation. This form of innovation takes place in an ambiguous environment characterized by enormous pressure for success. It seems plausible that highly skilled managers might be more reluctant to form new relationships due to the fear of knowledge drain. It is also possible that highly connected managers are more averse toward external knowledge, as they are inclined to primarily base their decisions on what they know for sure. Our findings might also point to more complex mechanisms. The relationship between managerial human and social capital is potentially mediated by omitted interpersonal factors, such as expectations and obligations or norms and sanctions (e.g., Nahapiet & Ghoshal, 1998). Last, culture might influence the relationship between managers' human and social capital. The previously mentioned study by Santarelli and Tran (2013) analyzed human and social capital in Vietnamese firms. Hofstede's cultural dimensions study has shown that Vietnamese culture is driven by collectivistic tendencies, whereas German culture is highly individualistic (Hofstede Insights, 2022). These cultural differences might ultimately cause differences in how important social capital is in the context of a specific country. Hence, previous studies in collectivistic cultures have confirmed a reinforcing relationship between human and social capital (e.g., Santarelli and Tran 2013), while we could not demonstrate this linkage in an individualistic culture.

In summary, our contributions to the literature are fourfold. First, we derived precise definitions for all relevant constructs. Second, to the best of our knowledge, we are the first to employ a

survey-based multidimensional operationalization of DMCs. Third, we move beyond partially analyzing DMCs by examining the interrelationships between all underlying dimensions. Finally, fourth, we have further strengthened the importance of DMCs in the context of business model innovation.

3.6.2 Managerial implications

Beyond its theoretical contributions, this study has substantial implications for managerial practice. On the one hand, we advise firms to invest substantial resources in managerial training and education. Our research has demonstrated that higher levels of managerial human capital will lead to a more conscious evaluation of business model innovation. Promoting an in-depth analysis of business model innovation will enhance the managerial ability to continuously align all interrelated elements of the business model with the demands of today's dynamic environment. As previous research has shown, ensuring the constant adaptability of the business model is a central driver of long-term company success (Clauss, Abebe, et al., 2019). On the other hand, organizational design should foster social relationships. Due to the interdisciplinary nature and its wide-reaching implications, successful business model innovation rests on the frequent interdivisional exchange of information between highly skilled managers. In particular, principal-agent theorists have long called for less hierarchical and more informal organizational structures to facilitate knowledge transfer and conflict resolution within organizations (Adler, 2001). To promote the value and growth of managerial social capital by supporting resource exchange and managerial autonomy, we advise business practitioners to design "decentralized, informal and specialized organizational structures" (Andrews, 2010, p. 588).

3.6.3 Limitations and recommendations for future research

In addition to its contribution to research and practice, our paper faces several limitations. First, the predominance of German firms within the sample impairs the generalizability of the findings. Further research could include cultural variables and test whether culture-specific management styles influence our findings. Second, our study focuses on business model innovation within digitally driven industries. Additional research needs to examine whether managerial activities toward business model innovation differ between increasingly digitalized industries. Third, we do not address how individual-level capabilities aggregate at the

collective level. Scholars can build on our theoretical and empirical insights to build models at the management team level. Fourth, our statistical analyses indicate that other explanatory variables might exist. Therefore, future research should take other potential variables at the individual and organizational levels into account. Fifth, our study relies on cross-sectional data. As the development and sharing of knowledge are not static processes, a fruitful avenue for subsequent studies might be longitudinal data analysis. From a statistical perspective, we note additional possible limitations due to our relatively small sample size.

3.7 References

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3.8 Appendix

Table 3.7 Operationalization of items translated from German

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.
			Relational dimension	When exchanging information, I draw on my internal company relationships.
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.		

Source: Author's representation

Table 3.7 Operationalization of items translated from German (continued)

Construct	Dimension	Item
	Cognitive dimension	<p>I feel committed to the goals of the company.</p> <p>I share a common purpose with other company members.</p> <p>I see myself as a discussion partner in determining the company's direction.</p> <p>My vision for the future of the company is in line with that of other company members.</p>
Managerial cognition	Value offering evaluation	<p>When redesigning the business model in part or in whole, I consciously evaluate alternatives to a very high extent alternatives with regard to</p> <p>... customer problems and needs.</p> <p>... value propositions.</p> <p>... relationships between value propositions and customer problems/needs.</p>
	Value architecture evaluation	<p>... sales and distribution channels.</p> <p>... business transactions and the ways of collaborating with partners.</p> <p>... linking business participants together in novel ways.</p> <p>... taking over new value propositions or substituting existing parts of the value chain.</p> <p>... applying new revenue streams.</p>
	Value capture evaluation	<p>... resource requirements for all business aspects.</p> <p>... the financial benefits for our company.</p> <p>... all the business-related costs of the project.</p>

Source: Author's representation

Chapter 4

Research Paper 2: Influences on innovation at the managerial and firm levels

Heubeck, T., & Meckl, R. (2022). More capable, more innovative? An empirical inquiry into the effects of dynamic managerial capabilities on digital firms' innovativeness. *European Journal of Innovation Management*, 25(6), 892–915. <https://doi.org/10.1108/EJIM-02-2022-0099>

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 DMCs theory to close this research gap. The paper proposes managers' DCs 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' DCs as facilitators of innovation. In contrast to previous research on non-digital industries, the findings demonstrate that only the complete portfolio of managers' DCs promotes innovativeness in digital firms. The study provides evidence for the importance of DMCs in the digital economy yet contradicts previous research on non-digital industries related to the advantageousness of managers' human capital, social capital, and cognition for innovation.

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

Keywords

Digital transformation, dynamic managerial capabilities, human capital, innovation, managerial cognition, social capital

4.1 Introduction

The digital transformation of the economy continues to cause fundamental shifts in organizations' strategies due to the continuous emergence of new technologies (Bouncken, Kraus, & Roig-Tierno, 2021; Wallin, Pihlajamaa, & Malmelin, 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, Lerner, & Stern, 2013; Matt, Hess, & Benlian, 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 & Teece, 2009; Felin & 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, 2007b).

Building on DMCs theory (Adner & Helfat, 2003), the research model posits that heterogeneity at the individual managerial-level matters for organizational outcomes (Foss & Foss, 2000). Managers' DCs comprise their human capital, social capital, and cognition and determine the managerial ability to "build, integrate, and reconfigure organizational resources and competences" (Adner & Helfat, 2003, p. 1012). Accordingly, individual managers drive innovation by exploring new ideas themselves or managing creativity in the organization. DMCs consequently constitute the individual-level capabilities required to sustain innovative activities, and different levels of firm innovativeness may hence originate from heterogeneity in the DCs of particular managers (Adner & Helfat, 2003; Helfat & 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 & Dauth, 2020; Wrede, Velamuri, & 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., W. K. Smith & Tushman, 2005; Tripsas & Gavetti, 2000). Second, previous studies primarily analyze top managers or top management teams (e.g., Barker & Mueller, 2002; Manev & Elenkov, 2005). Due to an ongoing shift toward flatter hierarchies (Rajan & 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 & 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 DMCs and their three underpinnings influence firms' innovativeness in digital industries. From an academic perspective, this micro-level 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 RQs:

RQ 1. What role do DMCs occupy in digital firms?

RQ 2. How do the three underpinnings of DMCs (i.e., managerial human capital, social capital, and cognition) affect digital firms' innovativeness individually?

RQ 3. How do DMCs jointly affect digital firms' innovativeness?

The paper is structured into six sections. Section 4.2 presents the theoretical background by defining innovation in the research context and outlining the concept of DMCs and its three underpinnings. The research model and hypotheses are subsequently derived in Section 4.3. Next, Section 4.4 describes the research methodology employed, and Section 4.5 presents the empirical results. Section 4.6 discusses the findings and their theoretical and practical implications. The article concludes with an assessment of limitations and possible pathways for future researchers.

4.2 Theoretical background

4.2.1 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 & Schneider, 2006; Weill & Woerner, 2015). Therefore, focusing solely on improving efficiency and effectivity is no longer sufficient to ensure organization survival in the long run (Adner & Kapoor, 2010; Hacklin, Björkdahl, & Wallin, 2018).

Innovations generally refer to innovation processes or outcomes (Drucker, 1985; McAdam & 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, 2007; Ortt & 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 & Miles, 1999; Ortt & 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, Landry, Becheikh, & Ouimet, 2008; Damanpour, 1991).

The study examines the relationship between DMCs 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, Fettke, Kemper, Feld, & Hoffmann, 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, Törngren, & Onori, 2015; Weyer, Schmitt, Ohmer, & Gorecky, 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, Cerchione, Cricelli, & Strazzullo, 2022; Naeem & 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, Wahlster, & Helbig, 2013). For these reasons, the German Industry 4.0 sector serves as an appropriate setting in light of the proposed RQ.

4.2.2 Dynamic managerial capabilities

The concept of DMCs offers a fruitful perspective on innovation by explicitly relating managerial capabilities to organizational behavior in dynamic environments (Adner & Helfat, 2003). DCs originate from the interplay between managers' innate abilities and past experiences (Beck & 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 & 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 & Wiersema, 2013; Helfat & Martin, 2015b). Therefore, DMCs are the foundation of sustained competitive advantages and cause performance differences between firms (Helfat & Martin, 2015b).

4.2.2.1 Managerial human capital

The first component of DMCs, 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 & Helfat, 2003).

The present study distinguishes between two dimensions of managerial human capital explicitly related to innovation (Subramaniam & 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, Hitt, Camp, & Sexton, 2001; Hornsby, Naffziger, Kuratko, & Montagno, 1993; K. G. Smith & 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 (K. G. Smith & 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, Ireland, & Hoskisson, 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.

4.2.2.2 Managerial social capital

The second component of DMCs, 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 & Kwon, 2000, 2002; Tsai & Ghoshal, 1998). Research has repeatedly demonstrated that social capital promotes innovation by improving the exchange of information, knowledge, and resources between actors (Gant, Ichniowski, & Shaw, 2002; Johnson, Schnatterly, & Hill, 2013; Tsai & Ghoshal, 1998).

Following the most recent research on DMCs (Heubeck & 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 & Martin, 2015b; Kor & 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 & Ghoshal, 1998).

4.2.2.3 Managerial cognition

Managerial cognition is the third and final dimension of DMCs. This "cognitive capital" (Helfat & 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 & 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, Kinicki, & Keats, 1994, p. 298) who expend their limited cognitive resources only in the most novel or challenging situations (March & 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).

4.3 Linking dynamic managerial capabilities to digital firms' innovativeness

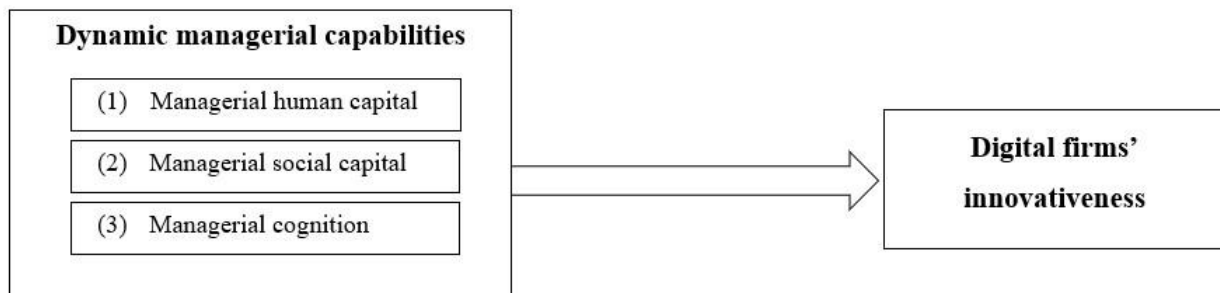
The hypothesis model is deduced using the economic network approach (Håkansson, 2014, 2015; Håkansson & Snehota, 1995). This model proposes that innovation occurs in a network composed of three key elements: actors, activities, and resources (Oerlemans, Meeus, & Boekema, 1998). The model hence provides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

Taking a DMCs 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 & 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 & Helfat, 2003), ultimately determine the decision for or against investments in innovation (Tripsas & Gavetti, 2000).

Figure 4.1 Research model: Dynamic managerial capabilities and digital firms' innovativeness



Source: Author's representation

The following section derives three research hypotheses for the respective drivers of DMCs. Subsequently, the argumentation is combined by proposing DMCs as a direct antecedent to digital firms' innovativeness. Figure 4.1 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 & 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, Opsahl, George, & Gann, 2012). In scanning and interpreting the environment, managers are prone to identify and comprehend information related to their existing knowledge (Cohen & Levinthal, 1989; Helfat & Martin, 2015a). Entrepreneurial skills shape decision-making by promoting the managerial ability to make sense of ambiguous information (Tang, Kacmar, & Busenitz, 2012; Tasheva & Nielsen, 2022). Second, managers draw on their human capital to seize identified opportunities through their investment decisions (Helfat & 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, Xi, Zhang, Zhao, & Tang, 2013; Helfat & 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:

Hypothesis 1: Managers with more human capital promote digital firms' innovativeness.

As the second driver of DMCs, 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 & Filieri, 2010; Manev & 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 & 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 & Martin, 2015a). Social capital gives managers power over other actors' tangible and intangible assets in reconfiguring assets (Helfat & Martin, 2015a). Innovation is altogether an inherently social process based on interactions between interdependent actors (Landry, Amara, & Lamari, 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 & Ghoshal, 1998), provides access to resources and capabilities (Beck & Wiersema, 2013; Blyler & 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 & 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:

Hypothesis 2: Managers with more social capital promote digital firms' innovativeness.

The third component of DMCs, 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 & 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 & 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 & 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 & Gavetti, 2000), heterogeneity in managerial cognition is likely to cause differences in innovativeness between firms. More formally, the following is hypothesized:

Hypothesis 3: Managers with stronger cognitive abilities promote digital firms' innovativeness.

The three underpinnings of DMCs are also likely to affect firms' innovativeness individually and through their interactions (Helfat & Martin, 2015a). Consequently, these interactions are an additional source of heterogeneities between managers (Adner & 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 & 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 & Martin, 2015a). Additionally, managerial cognition shapes learning processes by making past experiences salient (Tversky & 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 & Martin, 2015b). Last, higher levels of human capital may also reinforce managers' social capital by making them more attractive as relationship partners (Adner & Helfat, 2003). DMCs are also likely to determine the managerial capacity to seize and reconfigure, as managers draw on these capabilities to develop and implement innovations (Helfat & Martin, 2015a). Based on this argumentation, DMCs are proposed as a crucial antecedent to firms' innovativeness. More formally, the following is hypothesized:

Hypothesis 4: Managers with more DMCs promote digital firms' innovativeness.

4.4 Methodology

4.4.1 Data collection and sample

Following the key informant approach (Lechner, Dowling, & Welpel, 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).

4.4.2 Dependent variable

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

4.4.3 Independent variables

Heubeck and Meckl (2021) developed a multidimensional operationalization based on established measurement scales for the three dimensions underlying DMCs, which were used to operationalize *DMCs* (see Table 4.5 in Appendix). 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, Kock, Baccarella, & Voigt, 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, Tucci, & Afuah, 2017; Morris, Schindehutte, & Allen, 2005). The commercial success of innovations depends on a business model's ability to derive value from innovation (Chesbrough & 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).

4.4.4 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 & 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 & Levinthal, 2004). Third, the model controls for *functional background*, which comprises output, throughput, and peripheral functions (Hambrick & Mason, 1984). The functional background shapes managerial decision-making by being the source of highly personal experiences and perceptions (Boone & Hendriks, 2008; Waller, Huber, & Glick, 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 & 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 & 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, Devinney, Yip, & Johnson, 2009).

4.4.5 Statistical procedure

Principal axis CFA using varimax rotation was performed to conduct factor analysis. The Bartlett test of sphericity, MSA criterion, and KMO criterion were used to assess the eligibility of the data for factor analysis (Hair, Black, Babin, & Anderson, 2014). The 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 AVE of factors exceeds 0.50, factor loadings surpass 0.50, and the FL criterion is met (Fornell & Larcker, 1981). In the third step, test objectivity was ensured through an unbiased application, analysis, and interpretation of data (Payne & Payne, 2004; Resnik, 2001). Two regression analyses were performed in the final step. Model 1 analyzed the three drivers of DMCs individually, and Model 2 tested their combined effect on digital firms' innovativeness.

4.5 Results

4.5.1 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 Table 4.6 in Appendix). 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 & Larcker, 1981).

4.5.2 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 4.1 summarizes the demographic characteristics of the respondents. Table 4.2 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 DMCs on innovation. Table 4.3 compiles the regression results.

The results of the hypothesis tests are summarized in Table 4.4. 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 DMCs on

digital firms' innovativeness. The data support this positive relationship, thereby confirming Hypothesis 4 ($b = 6.803$, $\beta = 0.364$, $se = 2.202$, $p = 0.003$).

Table 4.1 Demographic characteristics of the study participants

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

Source: Author's representation

Table 4.2 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

Source: Author's representation

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$; *SD* = Standard deviation; *N* = 68

Table 4.3 Regression results

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

Source: Author's representation

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

Table 4.4 Summary of hypothesis tests

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

Source: Author's representation

4.6 Discussion and contributions

4.6.1 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 DMCs perspective and the economic network model to close this research gap by hypothesizing that managers facilitate innovation through their individual-level DCs. Accordingly, managers are firms' key decision-makers and thus directly influence their innovativeness (Adner & 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' DCs. Consequently, Hypotheses 1–3 postulated that the three underlying drivers of DMCs—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 DMCs.

The study provides novel empirical evidence that DMCs are significant drivers of digital firms' innovativeness. Hence, differences in innovation between 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 DMCs. Managers and the DCs 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 DMCs 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., W. K. Smith & Tushman, 2005; Tripsas & 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 DMCs 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 DMCs to digital firms. Differences in innovation between digital firms hence originate from heterogeneities in the individual-level DCs 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 DMCs perspective, the data provide evidence that managers' human capital, social capital, and cognition alone are insufficient to drive innovation in digital industries. In truth, DMCs only promote innovativeness if they are applied in their entirety. Thus, the present study advances understanding of DMCs by providing novel empirical evidence for more complex interrelationships between DMCs than previously presumed within the literature. Although this study did not explicitly address the relationships between the underlying drivers of DMCs, 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 DMCs 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 & Moliterno, 2011; Santarelli & Tran, 2013). Consequently, future research can build on these

insights to elucidate how managerial human capital, social capital, and cognition interact in shaping DMCs in digital firms.

4.6.2 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 DMCs 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 DMCs directly promote digital firms' innovativeness. Thus, in the digital economy, DMCs 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 DMCs on strategic change, thereby advancing the microfoundational literature on innovation.

Furthermore, the study extends the empirical literature on DMCs 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 DMCs perspective (e.g., Adner and Helfat, 2003; Helfat and Martin, 2015a, 2015b) and is inconsistent with previous research on non-digital industries (e.g., Bock et al., 2012; Tasheva & Nielsen, 2022; Tripsas & Gavetti, 2000). Hence, this study provides a more nuanced account of how the DCs of individual managers affect innovation at the firm level by holistically testing the effect of DMCs on digital firms' innovativeness. Nevertheless, the findings show that DMCs 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 DMCs 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 DMCs also contribute to shaping digital firms' innovativeness. In

line with the theoretical arguments, the results demonstrate that the DCs of middle and top managers directly facilitate higher levels of innovation in their firms. Second, the findings contradict the previous literature by showing that DMCs only promote digital firms' innovativeness compositely and not through their three underlying components. These results stand in contrast to the theoretical assumptions proposed by DMCs scholars (e.g., Adner & Helfat, 2003; Helfat & Martin, 2015a, 2015b) and to the empirical evidence provided by studies that focus on the individual underpinnings of DMCs (e.g., Bock et al., 2012; Tasheva & Nielsen, 2022; Tripsas & Gavetti, 2000).

4.6.3 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 DCs to promote innovation. Thus, decision-makers are advised to facilitate the holistic development of DCs 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 DCs. 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 DMCs, 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 DMCs. Managers should conduct appraisals not only to assess employee performance and derive a basis for payment decisions (Cleveland, Murphy, & Williams, 1989) but also to improve organizational outcomes, such as innovation and performance (DeNisi & Sonesh, 2011). Accordingly, management appraisal tools should ideally be constructed to reinforce the development of DCs 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 DMCs. At the same time, organizations should offer

beneficial training opportunities to managers and give them appropriate leeway to express their DCs.

4.6.4 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 DMCs on innovation varies over time. Second, the study's conceptualization of DMCs 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 DMCs 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 DMCs 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 & 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 DMCs in the context of innovation. In conclusion, the present study may put research on the right track to better understand the micro-level antecedents to organizational behavior.

4.7 References

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4.8 Appendix

Table 4.5 Questionnaire items translated from German

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.
			Relational dimension	When exchanging information, I draw on my internal company relationships.
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.		

Source: Heubeck and Meckl (2021)

Table 4.5 Questionnaire items translated from German (continued)

Construct	Dimension	Item
	Cognitive dimension	<p>I feel committed to the goals of the company.</p> <p>I share a common purpose with other company members.</p> <p>I see myself as a discussion partner in determining the company’s direction.</p> <p>My vision for the future of the company is in line with that of other company members.</p>
Managerial cognition		<p>When redesigning the business model in part or in whole, I consciously evaluate alternatives to a very high extent alternatives with regard to</p>
	Value offering evaluation	<p>... customer problems and needs.</p> <p>... value propositions.</p> <p>... relationships between value propositions and customer problems/needs.</p>
	Value architecture evaluation	<p>... sales and distribution channels.</p> <p>... business transactions and the ways of collaborating with partners.</p> <p>... linking business participants together in novel ways.</p> <p>... taking over new value propositions or substituting existing parts of the value chain.</p> <p>... applying new revenue streams.</p>
	Value capture evaluation	<p>... resource requirements for all business aspects.</p> <p>... the financial benefits for our company.</p> <p>... all the business-related costs of the project.</p>

Source: Heubeck and Meckl (2021)

Table 4.6 Results of the confirmatory factor analysis

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

Source: Author's representation

Notes: α = Cronbach's alpha; AVE = average variance extracted; FL = Fornell-Larcker; KMO = Kaiser-Meyer-Olkin; N = sample size; Std. FL = standardized factor loadings

Chapter 5

Research Paper 3: Influences on innovation at the governance and firm levels

Heubeck, T., & Meckl, R. (2022). Does board composition matter for innovation? A longitudinal study of the organizational slack–innovation relationship in NASDAQ 100 companies. *Currently in the review process at a scientific journal.*

Abstract

Particularly high-tech firms accumulate increasing amounts of excess resources. The existing research paints an ambiguous picture of these slack resources for innovation: while some slack is essential as fuel for experimentation, too much slack inhibits innovation by causing inefficiencies. However, firms in high-tech industries cannot develop and sustain competitive advantage in the long run without sufficient and steady investment in innovation. Increasing complexities within these highly dynamic industries also make it easier for managers to pursue their interests—often to the organization’s detriment. Against this backdrop, the role of the board of directors is particularly crucial in high-tech industries, as it determines the efficacy of the board’s governance and resource provisioning functions. Based on this argument, this study proposes several board characteristics as moderators of the slack–innovation relationship. The dataset builds on a longitudinal sample of high-tech firms from the NASDAQ 100 Index between 2010 and 2020. The study advances the literature by extending the notion of slack resources as a double-edged sword for high-tech industries. The findings show that this relationship is contingent on specific board characteristics: larger and more independent boards dampen this relationship, while longer board tenure, more board affiliations, and a larger number of women directors amplify it. Additionally, the findings caution managers to strike a balance between the necessity of slack resources for promoting innovation and the drag of those resources on efficiency. Similarly, the results can guide practitioners on optimal board composition in the face of mounting competitive pressure for sustained innovation.

Keywords

Agency theory, board composition, corporate governance theories, corporate innovation, resource dependence theory

Chapter 6

Research Paper 4: Influences on innovation at the managerial, governance, and firm levels

Heubeck, T., & Meckl, R. (2022). Microfoundations of innovation: A dynamic CEO capabilities perspective. *Currently in the review process at a scientific journal.*

Abstract

Developing and sustaining a competitive advantage in today's hypercompetitive economy requires managers to make far-reaching innovation investment decisions. Nevertheless, management literature lacks a holistic, empirical understanding of the specific DCs CEOs possess that may benefit firm innovativeness. To address this research gap, the paper derives the DCC concept by linking UET and DMC theory. Additionally, a contingency perspective is adopted to propose that the nature of the innovation-enhancing DCC effects depends on a CEO's firm-internal power. A longitudinal sample of S&P 900 manufacturing firms is used to test the hypotheses, as the increased competitive dynamism particularly pertains to these firms. The paper contributes to microfoundational management literature by showing that DCCs, individually and compositely, are direct antecedents to innovation and that the extent to which DCCs promote is contingent on a CEO's structural, yet not expert, power.

Keywords

Agency theory, dynamic capability view, innovation and R&D, power and politics, upper echelons theory

Chapter 7

Research Paper 5: Influences on innovation at the managerial and firm levels

Heubeck, T., & Meckl, R. (2022). Multi-level antecedents of innovation: Dynamic CEO capabilities and the mediation role of slack resources. *Finished manuscript*.

Abstract

Although management literature has long recognized innovation as the foundation for developing and sustaining competitive advantage, stressing its importance in today's hypercompetitive environment more strongly than ever before, empirical research has tended to neglect the microfoundational origins of organizational adaptation. This lack of empirical understanding is alarming in the current competitive landscape, where firms compete based on innovation initiated by their top management. In an effort to fill this void in the literature, the present study builds a comprehensive model to hypothesize how the DMCs of CEOs—the so-called *DCCs*—may indirectly enhance innovation by determining the orchestration of a firm's resource portfolio. More specifically, the multidimensional model draws on the resource orchestration framework to propose that DCCs, compositely and individually through their subcomponents—managerial human capital, social capital, and cognition—influence the orchestration of firm-internal slack resources. Conversely, it is argued that DCCs neither individually nor compositely affect the level of firm-external slack. The hypotheses are tested on a longitudinal sample of 332 manufacturing firms. The findings support the significance of DCCs in determining a CEO's ability to orchestrate internal slack for innovation. The results reveal that DCCs and two subcomponents—managerial human capital and cognition—are the most critical capabilities for the innovation-enhancing orchestration of available slack. In contrast to expectations, managers' social capital does not affect the orchestration of any slack type, and only managerial cognition is found to impact the level of recoverable slack, although adversely. As theoretically derived, DCCs and their subcomponents are unrelated to firm-external slack. This paper significantly advances microfoundational strategic management literature by providing the first holistic empirical account of the resource orchestration mechanisms DCCs use to enhance firm innovativeness. The study also extends the literature on resource orchestration by taking an individual-level perspective on innovation. Altogether, this study shows that neither the superordinate construct of DCCs nor organizational slack

should be regarded as equal individual- and firm-level antecedents to innovation. Instead, scholars and practitioners are advised to treat both concepts for what they are: multidimensional. The study's findings provide long called for evidence on the resource orchestration function of top managers as the cornerstone of DMC theory.

Keywords

Dynamic managerial capabilities, innovation, managerial cognition, managerial human capital, managerial social capital, organizational slack, resource orchestration

Chapter 8

Research Paper 6: Influences on innovation at the managerial and firm levels

Heubeck, T., & Meckl, R. (2022). Dynamic managerial capabilities and R&D spending: The role of CEO founder status. *Currently in the review process at a scientific journal.*

Abstract

The hypercompetitive landscape challenges CEOs to make astute investment decisions on inherently long-term, complex, and uncertain R&D projects that mold a firm's long-term innovative capacity. Although differences in R&D intensity between firms have been widely discussed within academia due to their effect on competitive advantage, research neglects how the individual-level capabilities of CEOs may influence these critical investment decisions. The present study builds on DMC theory to argue that superior individual-level DMCs lead to increased R&D spending by improving the abilities of CEOs to sense opportunities and threats, seize identified commercial potentials, and reconfigure organizational resources. Further, CEO founder status is proposed as a moderator of the DMC–R&D spending relationship, as founder CEOs differ from professional CEOs in their investment behavior. The results provide novel evidence on the effect of DMC on R&D spending in the context of a digitalized, global economy. Regarding the direct DMC effects, the analysis reveals that DMCs only compositely contribute to R&D investments, while the subcomponents—except for managerial social capital—exert no significant, isolated effect. Further, the results demonstrate that founder CEOs can deploy their DMCs more efficiently in facilitating R&D investments than their professional counterparts. In summary, this study provides novel evidence on the significance of individual-level DMCs for R&D investments in a hypercompetitive economy, as individual-level DMCs facilitate firm-level R&D spending and founder CEO status enhances this effect, yet not all DMC subcomponents affect these critical investment decisions.

Keywords

Dynamic managerial capabilities, founder CEO, innovation, leadership and individual differences, research and development

Chapter 9 Conclusion

9.1 Summary of findings and research contributions

The present thesis aimed to answer calls from a large number of researchers for an exploration of the microfoundations of innovation (e.g., Aguinis et al., 2022; Felin & Foss, 2005; Felin, Foss, Heimeriks, & Madsen, 2012; Helfat & Martin, 2015b; Pavlou & El Sawy, 2011). Over the course of six research papers, empirical studies of three fundamental levels of strategic and innovation management—the managerial, governance, and firm levels—were conducted to fill this void in the literature. By answering the four RQs derived in Chapter 1, the main findings of the research papers are presented in the following.

RQ 1. How do DMCs interact at the managerial level?

The first RQ focused on individual-level interactions between DMCs. Research Paper 1, “Antecedents to cognitive business model evaluation: A dynamic managerial capabilities perspective,” drew on a two-stage procedure to address this research gap. In the first stage, the paper theoretically deduced how DMCs are related to the business model innovation process in digitalization-driven Industry 4.0 firms. In the second stage, the paper conceived a multidimensional, survey-based DMC operationalization. The paper ultimately developed a comprehensive model of individual-level DMC interactions in the specific context of business model innovation in digitalized industries.

The findings from a sample of Industry 4.0 firms supported some, but not all, theoretically deduced hypotheses. The results demonstrated that higher human and social capital levels promote the intentional evaluation of business model innovation. In contrast to the widely-held belief in management research, the findings revealed that managers’ human and social capital do not reinforce each other. In summary, Research Paper 1 offers four main contributions to the literature. First, this paper combined the often separated, but complementary, research fields of strategic and innovation management with psychology to develop precise definitions for DMCs and their subcomponents. Second, these definitions were the basis for developing a novel, survey-based DMC operationalization. Third, the paper’s findings provide new evidence on the interactions between the three DMC subcomponents in the context of business model innovation. Finally, the results confirmed the significance of DMCs for business model innovation in digitalization-driven industries. Altogether, Research Paper 1 significantly advanced strategic and innovation management literature by providing much-needed evidence

for the value of superior DMCs in the current hypercompetitive environment, where firms compete based on continual business model innovation as the foundation for sustained competitive advantage (Clauss, Abebe, Tangpong, & Hock, 2019; Clauss, Bouncken, Laudien, & Kraus, 2019).

RQ 2. Are managers drivers of innovation at the firm level through their DMCs/DCCs?

The second RQ was addressed in Research Papers 2, 4, and 5. Research Paper 2, titled “More capable, more innovative? An empirical inquiry into the effects of dynamic managerial capabilities on digital firms’ innovativeness,” built on the theoretical and methodological groundwork of the first study. The second research paper aimed to gain an empirical understanding of the specific managerial capabilities required to drive innovation in digital industries. For this purpose, an extended theoretical model of the individual-level interactions between middle and top managers’ DMCs was developed. Building on the economic network model (Håkansson, 2014, 2015; Håkansson & Snehota, 1995), the research model argued that DMCs facilitate digital firms’ innovativeness through their subcomponents—managerial human capital, social capital, and cognition—and their combined effects. Thus, the research goal of Research Paper 2 was to empirically assess whether, and to what extent, DMCs matter for innovation in digital industries.

The findings from a sample of digital firms from the German Industry 4.0 sector confirmed the basic tenet that DMCs are direct antecedents to innovation in digital industries. The results offered several fruitful starting points for theoretical discussions, as they did not provide evidence for the isolated effects of managerial human capital, social capital, or cognition on innovation. Instead, the data demonstrated that only the joint DMC portfolio promotes digital firms’ innovativeness. This study consequently revealed more complex interrelationships between DMCs and innovation in digital firms than presumed within the extant literature in non-digital research settings. Therefore, the study provided novel evidence on the integrality of DMCs for innovation in digital firms. The findings significantly advance DMC theory by providing a more nuanced account of the mechanisms and extent to which individual-level DMCs influence firm-level innovation in today’s hypercompetitive economy.

Research Paper 4, presented in Chapter 6, contributed to the overall research goal of developing a more in-depth understanding of the micro-level antecedents of innovation. The paper “Microfoundations of innovation: A dynamic CEO capabilities perspective” extended the

current literature by developing the DCC concept. By complementing UET with DMC theory, the specific DMCs of CEOs were proposed as critical determinants of firm-level innovation, due to the role of the CEO as a firm's primary strategic architect (Quigley & Hambrick, 2015). The findings from a longitudinal sample of S&P 900 manufacturing firms provided strong evidence that DCCs are particularly crucial in the highly complex and failure-prone environment of innovation. The results empirically demonstrated that higher DCC levels facilitate innovation. The study also highlighted that DCCs positively contribute to innovation in manufacturing firms through the three subcomponents. Therefore, Research Paper 4 reconfirmed the significance of DCCs for facilitating innovation in the current globalized digital economy. The findings significantly advanced strategic and innovation management literature by demonstrating that the fundamental propositions of UET and DMC theory are still valid in today's radically transformed decision-making context. Beyond its theoretical contributions, the study paved the way for future empirical research by developing a holistic, proxy-based DMC operationalization.

Finally, Research Paper 6, included in Chapter 8, tested the DMC–R&D spending relationship in a sample of high-tech firms. The paper “Dynamic managerial capabilities and R&D spending: The role of CEO founder status” proposed that superior DMCs lead to increased R&D spending, as more skilled CEOs are more proficient at sensing opportunities and threats, seizing the commercial potential of identified opportunities, and reconfiguring a firm's resource portfolio (Teece, 2007; Wach, Maciejewski, & Głodowska, 2022).

In line with the results of Research Papers 2 and 4, the findings from a sample of NASDAQ 100 firms further underscore the integrality of DMCs for facilitating innovation strategies. In line with Research Paper 3, the findings demonstrate that only the entire DMC portfolio contributes to higher levels of R&D investment. At the same time, the underlying DMC subcomponents—except for managerial social capital—do not enable CEOs to allocate more resources toward R&D. Research Paper 6 altogether provides novel evidence on the significance of DMCs and their subcomponents for innovation in the specific context of high-tech firms. Additionally, the findings highlight the role of social capital in an era of hypercompetition, where the inherently social process of innovation additionally occurs within open rather than closed networks (Chesbrough, 2017; Leão & da Silva, 2021). Altogether, this study opens the black box of innovation-related strategic decision-making, highlighting the importance of individual-level DMCs as facilitating antecedents to high levels of R&D spending.

RQ 3. Which governance-level contingencies shape the relationships between different firm-level phenomena?

The third RQ shifted the level of analysis from the manager to the firm. This change in perspective was motivated by the overarching goal of gaining multi-level insights into the organizational processes that underlie innovation investments.

Research Paper 3, titled “Does board composition matter for innovation? A longitudinal study of the organizational slack–innovation relationship in NASDAQ 100 companies,” aimed to answer the third RQ by reexamining the organizational slack–innovation relationship in the specific setting of high-tech industries. This research proposition was grounded in the observation that high-tech firms accumulate increasing amounts of excess resources (Chireka & Fakoya, 2017). Although these slack resources have already been widely studied in the context of uncertainty-inducing strategic behaviors (e.g., Geiger & Cashen, 2002; Geiger & Makri, 2006; Kim, Kim, & Lee, 2008; Nohria & Gulati, 1996, 1997), the literature still lacks a holistic understanding of how slack resources may affect innovation in high-tech industries. Faced with significant VUCA, slack may be essential for high-tech firms to cope with the demanding managerial task of assessing the commercial potential of new and recombined digital technologies (Chiesa & Frattini, 2011; Hacklin, Björkdahl, & Wallin, 2018). At the same time, excessive slack levels in high-tech industries may also give managers more opportunities to engage in opportunistic behavior. Based on this argument, Research Paper 3 additionally considered several board characteristics as governance-level moderators of the slack–innovation relationship.

A total of six research hypotheses were tested on a longitudinal sample of NASDAQ 100 firms. The results confirmed the theoretical argument that slack resources have an inverted U-shaped effect on innovation. Therefore, the study extended the notion of organizational slack as a double-edged sword for innovation to the transformed decision-making context of high-tech industries. Contrary to existing research on high-tech industries that only found weak correlations (e.g., S. Lee, 2015), or reported a positive, linear relationship between slack and innovation (e.g., Shaikh, O’Brien, & Peters, 2018), the results provided evidence for the ambiguous nature of slack resources that has previously been acknowledged in non-digital settings (e.g., Chiu & Liaw, 2009; G. George, 2005; Nohria & Gulati, 1996, 1997). This trade-off is rooted in two counteracting forces: lower slack levels are beneficial for innovation because they facilitate experimentation and creativity; beyond the optimal point, slack becomes detrimental to innovation, causing self-opportunism, laxity, and reduced aspiration levels in

managers (G. George, 2005; Nohria & Gulati, 1996, 1997). In summary, Paper 3 confirmed that organizational slack is a dual-edged resource for high-tech firms, with the capacity to both facilitate and harm innovation depending on the extent of slack endowment.

Furthermore, Research Paper 3 showed that the board of directors is a central governance-level moderator of the inverted U-shaped slack–innovation relationship in high-tech industries. The results demonstrated that corporate governance efficacy influences the effect of slack on innovation. Although the findings confirmed all theoretically deduced board characteristics as moderators of the slack–innovation relationship in high-tech industries, they demonstrated that some board characteristics differ in the direction of their effect from previous findings in non-high-tech industries. In line with the theoretical arguments, the findings established that expanding board size and improving board independence by increasing the number of outside directors enhances corporate governance efficacy. Thus, larger and more independent boards possess superior monitoring and resource provisioning capabilities that attenuate the inverted U-shaped relationship between slack and innovation in high-tech firms. The analysis also reinforced that longer average board tenure and more directorial affiliations amplify the inverted U-shaped slack–innovation relationship. These boards give managers more leeway to make choices about deploying slack resources for innovation, thereby decreasing corporate governance efficacy. In contrast to the theoretical expectations, the results revealed that increasing board gender diversity amplifies the inverted U-shaped effect of slack on innovation. This finding supports research demonstrating that gender heterogeneity may threaten efficient group functioning (e.g., Ryan & Haslam, 2005, 2007).

Research Paper 3 contributed to the literature in the following ways. First, the study confirmed a robust relationship between organizational slack and innovation in high-tech industries. Second, the findings demonstrated that this relationship is neither weakly correlative nor monolithically positive in high-tech industries, as demonstrated by previous research (e.g., S. Lee, 2015; Shaikh et al., 2018). The data instead pointed out that the slack–innovation relationship follows an inverted U-shaped progression: some slack is beneficial for innovation, fueling experimentation and reducing short-term success pressure; excessive slack, however, becomes increasingly detrimental, as it causes inefficiencies. Third, the study considered governance-level moderators of the slack–innovation relationship. The findings demonstrated that structural board characteristics (i.e., board size and board independence) and demographic board characteristics (i.e., board tenure, board affiliations, and board gender diversity) moderate the inverted U-shaped slack–innovation relationship in high-tech firms. The findings

related to the role of board gender diversity conflict with existing research that views gender diversity as unequivocally beneficial for corporate governance efficacy, as a driver of innovation, and, ultimately, as a source of competitive advantage (e.g., R. B. Adams & Ferreira, 2004, 2009; Carter, D'Souza, Simkins, & Simpson, 2010; Erhardt, Werbel, & Shrader, 2003; Galia & Zenou, 2012; Hillman, Shropshire, & Cannella, 2007), by showing that increasing female representation on the board enhances the inverted U-shaped slack–innovation relationship. In short, Research Paper 3 reaffirms that the relationship between organizational slack and innovation follows an inverted U-shaped progression in high-tech industries, as found in non-high-tech industries. This paper additionally demonstrated that governance-level factors moderate this relationship.

RQ 4. Do managerial-, governance- and firm-level contingencies transform the relationship between DMCs/DCCs and innovation?

Research Papers 4, 5, and 6, presented in Chapters 6, 7, and 8, respectively, brought all three levels of analysis together. As previously outlined, Research Paper 4, “Microfoundations of innovation: A dynamic CEO capabilities perspective,” tested the direct effects of DCCs on innovation to gain insights into the micro-level origins of innovation. Due to the inherent VUCA of innovation, decision-making related to innovation strategies is particularly susceptible to the influence of managerial power (Finkelstein, 1992; Mintzberg, 1983). The study therefore proposed CEO power as a governance-level moderator of the DCC–innovation relationship. The theoretical argument was grounded in a contingency perspective, drawing from the seemingly conflicting perspectives of agency and organizational theories to hypothesize that powerful CEOs can exert a more significant influence over organizational outcomes than their less powerful counterparts. In other words, CEO power was expected to amplify the positive effect of DCCs on innovation.

The findings provided evidence for the moderating role of structural CEO power. In line with expectations, the results showed that CEO discretion strengthens the positive DCC–innovation relationship, while board independence weakens it. In contrast to the theoretical argument, CEO duality weakened this relationship. The findings showed that CEO duality might not benefit organizations in the ambiguous context of innovation, as it may instill destructive, self-opportunistic behaviors in top-level executives. The paper also advanced strategic management literature by including expert power, which gradually develops during a CEO's tenure.

Although considering expert CEO power might be particularly fruitful for promoting an in-depth understanding of managers' individual-level DCs in the context of innovation, the data provided no evidence that expert CEO power moderates the DCC–innovation relationship. This finding points to more ambiguous effects of CEO tenure than presumed by agency or organizational theories. Altogether, the study contributed to the literature by showing that the extent to which CEOs can promote innovation through their DCCs is contingent upon their structural, not their expert, power within the firm.

Research Paper 5, “Multi-level antecedents of innovation: Dynamic CEO capabilities and the mediating role of slack resources,” adopted a holistic perspective on the resource orchestration function of CEOs. The research model postulated that DCCs promote innovation by allowing CEOs to allocate firm-internal slack resources—available and recoverable slack. In contrast, it was hypothesized that a firm's endowment of external slack resources—potential slack—is unaffected by DCCs. Therefore, the level of firm-external slack and its effect on innovation is argued to be beyond the scope of CEOs.

The results supported the significance of DCCs in shaping a CEO's ability to orchestrate slack resources for innovation. In line with the theoretical expectations, DCCs and two subcomponents—managerial human capital and cognition—enhanced firms' innovativeness by enabling CEOs to orchestrate higher levels of available slack. At the same time, the results revealed that DCCs were only associated with the orchestration of recoverable slack—the second internal type of organizational slack—through managerial cognition. More importantly, managerial cognition was found to adversely affect potential slack, even though those resources are beneficial for innovation. Finally, and as theoretically presumed, neither DCCs nor any of the subcomponents were directly related to firm-external potential slack.

Research Paper 5 significantly advanced strategic and innovation management literature by being the first study to analyze top managers' resource orchestration function empirically. Building on DMC theory and UET, the paper developed a multi-level model of how DCCs shape firm-level innovation by determining the orchestration of firm-internal slack resources. Additionally, the research model considered the role of the board of directors by including governance-level variables in the analysis. In summary, the findings demonstrated that DCCs and their subcomponents—managerial human capital, social capital, and cognition—as well as organizational slack in its various forms—available, recoverable, and potential—are multifaceted constructs with disparate effects on firm-level innovation.

Finally, Research Paper 6 completed the multi-level innovation management model by proposing CEO founder status as a managerial-level moderator of the DMC–innovation relationship. This expansion of the research model was grounded in the argument that although CEOs represent a firm’s primary strategic architect (Wasserman, 2003), they differ in their investment behavior due to variances in their background characteristics (Hambrick, 2015; Hambrick & Mason, 1984; J. M. Lee, Kim, Bae, 2020). By definition, founder CEOs are entrepreneurs, intrinsically motivated as well as financially and psychologically committed to ensuring their firm’s long-term success (Arthurs & Busenitz, 2003; Deb & Wiklund, 2017; Fahlenbrach, 2009). Based on these arguments, the paper proposed that the DMCs of founder CEOs contribute to even higher levels of R&D investment than the DMCs of professional CEOs (R. B. Adams, Almeida, & Ferreira, 2005; Fahlenbrach, 2009).

The study provided novel evidence that founder CEO status enhances the DMC–R&D spending relationship. The findings revealed that founder CEOs are a critical source of competitive advantage in an era of hypercompetition, as their long-term investment horizon and risk-taking attitude align with the characteristics of innovation investments. Therefore, the study reaffirms the research stream that proposes CEO founder status as a facilitator of organizational adaptation in highly dynamic and complex competitive environments (e.g., J. M. Lee et al., 2020; Tang, Li, & Liu, 2016) instead of evidencing that professional CEOs should eventually replace founder CEOs due to their lack of managerial capabilities (e.g., Haveman & Khaire, 2004; Wasserman, 2003). These findings concur with the prescriptions of agency theory and entrepreneurship theories, adding much-needed evidence to these severely understudied relationships (Hsu, Chen, & Ho, 2020; Souder, Simsek, & Johnson, 2012). Especially in the agency cost-prone context of R&D investments, CEO founder status may thus represent a coping mechanism that ensures the alignment of goals between principals and agents (Hsu et al., 2020; Schuster, Nicolai, & Covin, 2020).

In demonstrating that superior DMCs of CEOs—particularly high social capital levels—are integral to sustaining competitive advantage through continuous innovation in today’s era of hypercompetition, and showing that founder CEOs contribute to even higher innovation investments through their DMCs than nonfounder CEOs, Research Paper 6 has significantly advanced management literature. In this regard, the paper provides empirical support for the fertile ground DMC theory offer for theoretical expansion, like complementing its theoretical proposition with UET as requested by microfoundational researchers (e.g., Bendig, Strese, Flatten, da Costa, & Brettel, 2018; Felin, Foss, & Ployhart, 2015).

In summary, five key contributions to strategic and innovation management literature emerge from the cumulative findings of the six research papers. First, the present thesis showed that DMCs have distinct, individual-level interactions in digital industries, which ultimately lead to a highly personalized cognitive evaluation of business model innovation. Second, within the transformed decision-making context of digital firms, the findings demonstrated that only the joint portfolio of middle and top managers' DMCs is a direct antecedent to innovation. Thus, contrary to studies in non-digital contexts, Research Paper 2 provided strong evidence that the DMC subcomponents do individually not facilitate digital firms' innovativeness. These findings are largely supported by Research Paper 6, which concurs that a superior DMC portfolio facilitates innovation, while two of its underlying subcomponents—managerial human capital and cognition—do not lead to higher innovation investments. Third, the thesis introduced the DCC concept based on a synthesis of DMC theory and UET. The results provided first evidence that CEOs directly promote innovation through their entire DCC portfolio. In contrast to Research Paper 2, which examined the DMCs of middle and top managers in digital firms, the results of Research Paper 4 demonstrated that the DCC subcomponents also individually instill higher innovativeness in manufacturing firms. In high-tech firms, however, Research Paper 6 showed that, except for managers' social capital, none of the DMC subcomponents facilitates firm-level R&D spending individually. Thus, industry-specific factors, managers' hierarchical positions, and personal differences between managers potentially affect the relationships between DMCs and innovation. Fourth, the results provided strong evidence that managerial-, governance-, and firm-level factors affect the relationship between individual-level DCCs and firm-level innovation. In this vein, Research Paper 5 shed light on the importance of structural CEO power for deploying DCCs, offering comprehensive insights into the significance of DCCs in orchestrating different slack types for innovation. Relatedly, Research Paper 6 highlighted that founder CEOs are particularly beneficial for innovation strategies in high-tech firms through their DMCs. Finally, this thesis developed holistic operationalizations of DMCs for primary and secondary data, paving the way for further microfoundational research.

The six research papers have cumulatively shown that managers' individual-level DCs across different hierarchical levels are integral to the pursuit of innovation. The present thesis has thereby broadened the empirical understanding of the micro-level antecedents to innovation in and across multiple levels of analysis.

9.2 Practical implications

Beyond its theoretical merits, this thesis also has substantial implications for managerial practice. First, at the managerial level, the findings highlight the importance of managers' human and social capital for improving their cognitive abilities, which contributes to an in-depth evaluation of business model innovation. Thus, the findings encourage firms to create an organizational context that is conducive to the development and refinement of DMCs, in order to protect their competitive advantage through an appropriate business model redesign.

Research Paper 2 further shows that digital firms' innovativeness benefits from the holistic development of all three underlying managerial resources. Therefore, focusing on isolated measures to promote DMCs, such as developing only managerial human capital through on-the-job learning or additional formal education, does not seem to benefit innovation in the face of significant VUCA in digital industries.

Research Paper 4 supports these findings in a sample of manufacturing firms, yet shows that DMCs also individually promote innovation. Research Paper 6 further demonstrated that high DMC levels are integral for pursuing innovation strategies in high-tech firms. In contrast to the findings of Research Paper 4 from a sample of manufacturing firms, the sixth paper revealed that the DMC subcomponents are not equivocal in driving R&D spending. In the specific context of high-tech firms, CEOs' social capital is the only direct facilitator of innovation investments. Firms should consequently foster the development of social capital by implementing organizational structures and procedures conducive to social interactions within and beyond their boundaries, as well as position themselves in cross-industry innovation networks.

Finally, in high-tech industries, in which sustainable competitive advantage is premised on continued efforts toward innovation, founder-led firms have a significant advantage over agent-led firms. Research Paper 6 evinces that founder CEOs have a greater propensity to deploy their DMCs to a firm's long-term benefit due to their entrepreneurial mindset, which leads to greater risk-taking and motivation while instilling the necessary long-term orientation and commitment in managers (Arthurs & Busenitz, 2003; Deb & Wiklund, 2017; Fahlenbrach, 2009). Thus, founder-led firms profit even more from high DMC levels than agent-led firms, prompting the former to focus on developing their CEO's DMCs.

These nuanced results at the managerial level lead to the conclusion that practitioners should consider the internal and external characteristics of their organization, as well as the

hierarchical level and personal characteristics of the specific manager. Nevertheless, although the results differ between digital and non-digital industries, they highlight the significance of DMCs for innovation across different hierarchical levels. By the same token, the findings from digitalization-driven industries do not imply that the DMC subcomponents are irrelevant for innovation. Instead, as they represent the foundation of the DMC portfolio, managers' human capital, social capital, and cognition should be continually developed and refined to ensure competitive advantage in a globalized, digital economy.

Second, at the governance level, the results demonstrate that corporate governance efficacy under specific slack levels is contingent on board composition. At low levels of slack, firms can promote innovation by staffing their boards with more women, fostering external directorial affiliations, and retaining board directors for longer periods of time. Conversely, firms can reduce the detrimental effect of slack on innovation by increasing board size or ensuring board independence with a higher number of outside directors.

Research Paper 4 shows that CEOs vary in their capacity to influence strategic decision-making. The findings advise practitioners that structural CEO power shapes the extent to which CEOs can deploy their DCCs to promote innovation. More specifically, giving CEOs more discretion over readily-available resources empowers them to utilize their DCCs to a firm's benefit. Conversely, the results show that firms should split decision-making from decision control by structurally separating the CEO from the board chair. The findings further reveal that larger numbers of inside, rather than outside, directors provide a supportive structural environment for CEOs to nurture innovation through their DCCs. In contrast to the prescriptions of agency theory and widely held beliefs in the popular press, the results advise manufacturing firms to appoint more inside directors in order to ensure adaptability. Inside directors are more capable and motivated to monitor CEOs effectively due to their informational benefits, long-term interest in the firm, and reliance on behavioral, rather than financial, controls compared to outside directors.

The findings, however, provide no clear implications for expert CEO power. Expert power developed during a CEO's tenure may neither be consistently beneficial nor detrimental for the organization. CEOs may differ in how a longer tenure manifests in their strategy-related decision-making, possibly due to influences that were omitted from the research model, such as compensation policies or incentive structures.

Third, at the firm level, Research Paper 4 reveals that slack resources are neither unequivocally beneficial nor unequivocally detrimental for innovation in high-tech firms. The findings advise these firms to retain low levels of slack resources, while not losing sight of potential countermeasures that might need to be pursued if slack resources become too abundant. This paradoxical nature of organizational slack mirrors the dual capacities that are rooted in the simultaneous exploitation of existing resources, and the exploration of novel commercial potential that is needed for organizational survival in high-tech industries.

Conversely, Research Paper 5 demonstrates that readily deployable and highly discretionary slack resources facilitate innovation in manufacturing firms. The findings urge firms to appoint highly skilled CEOs to ensure sustained competitive advantage: DCCs lead to higher levels of innovation due to their direct effects and advantageousness for the appropriate orchestration and deployment of available slack. Hence, DCCs shape the organizational ability to retain high levels of available slack and purposefully utilize these readily deployable resources to foster innovation investment. Furthermore, the study reveals that managerial cognition is the most significant antecedent of innovation that underlies DMCs. Firms should therefore prioritize training that fosters higher cognitive abilities in their CEOs.

When all of these levels of analysis are brought together, the findings of the present thesis clearly demonstrate that managers across different hierarchical levels strongly contribute to innovation through their DMCs. The results provide strong evidence that the appropriate staffing of management positions represents a central source of competitive advantage. The research papers demonstrate that individual-level differences between DMCs across different hierarchical levels significantly affect firms' innovativeness. Moreover, the findings guide firms in making astute CEO appointment decisions and implementing appropriate structural contexts at the governance and firm levels to support their long-term pursuit of innovation.

9.3 Research limitations and recommendations

Beyond its contributions to the literature, this thesis faces some theoretical and empirical limitations. These limitations may, however, provide fruitful avenues for future research. This section will outline the limitations of the individual research papers, from which promising avenues for research are derived.

Research Papers 1 and 2 examined DMCs in the specific context of digital industries. Therefore, the findings may not be applicable to non-digital firms. Future research could

investigate the extent to which DMCs interact with and shape innovation, and whether the DMC–innovation relationship differs between digital and non-digital industries. Further, the sample of these papers consisted of German firms, which might impair the generalizability of the findings across different cultures. Future research should include cultural variables to test whether, for example, cultural differences in management styles influence the individual- and firm-level effects of DMCs. Additionally, both studies offered no aggregated perspective on DMCs. Future studies could use the findings to develop a theoretical model of the group-level interactions between individual managers' capabilities in TMTs. Research Papers 1 and 2 did not consider any time-varying effects, as they analyzed cross-sectional data. Future research is needed to examine the dynamic learning processes that potentially underlie DMCs and their longevity in today's hypercompetitive environment. From a conceptual perspective, these studies relied on self-reported questionnaires to collect the data, which might have led to biased results. Future research could use objective data from databases to corroborate the results. Last, these research papers were based on a relatively small sample size due to their research design. Further research can build on the questionnaire design and the underlying operationalizations that were developed in the two papers to collect data on a larger scale.

Research Papers 3, 4, 5, and 6 already addressed some of these limitations. Research Paper 3 was based on a longitudinal sample of NASDAQ 100 firms between 2010 and 2020. Research Papers 4 and 5 drew on data from S&P 900 manufacturing firms between 2016 and 2020. These papers consequently considered time effects, a limitation of Research Papers 1 and 2. Further, these studies relied on objective data from annual reports. Research Paper 4 complemented previous research by developing an objective, proxy-based DMC operationalization. The results substantiated the first and second papers by providing further evidence for the innovation-enhancing role of DMCs. Research Paper 4, 5, and 6 also included cultural variables to account for possible cultural differences in managers' long-term orientation and uncertainty avoidance. Finally, all four research papers considered governance-level effects that were omitted in the first two studies as possible influences on firms' innovativeness.

Nevertheless, Research Papers 3, 4, 5, and 6 also face limitations. First, the studies drew on samples of shareholder-oriented US-based companies with one-tier board structures. Future research should assess the reproducibility of the results in stakeholder-oriented governance models, such as the German two-tier board. Second, the studies were limited to a specific examination period. Although the time frames were more extensive than in many previous studies, the dynamics of the digitalized marketplace continue to change the rules of

competition. Third, the papers examined the role of DMCs in specific industries. Research Papers 3 and 6 focused on high-tech firms; Research Papers 4 and 5 analyzed data from a sample of publicly listed manufacturing firms. Future studies could test whether the findings differ, for example, between more and less digitalized industries, or between manufacturing and service industries. Last, the research papers focused on publicly listed medium- and large-cap firms. Although organizational characteristics were included as control variables in the analyses, future research could explicitly examine if the findings also transfer to smaller or family-owned businesses.

Innovation measurement was input-oriented across all research papers, which is consistent with the theoretical foundation of the thesis. Because R&D spending is directly controlled by a firm's top-level manager (Daellenbach, McCarthy, & Schoenecker, 1999), the amount of resources spent on R&D reflects a manager's intention to pursue innovation (Hill & Snell, 1988; Kor, 2006), as well as commitment to the innovation process (Ahuja, Lampert, & Tandon, 2008; Lim, 2015). Additionally, continuous R&D investments contribute to developing new knowledge (Sciascia, Nordqvist, Mazzola, & De Massis, 2015) and enhance the organizational ability to absorb, retain, and utilize external knowledge (Cohen & Levinthal, 1989, 1990). Therefore, R&D intensity captures the level of strategic importance managers attribute to innovation, and is integral to the knowledge-based innovation process (Barker & Mueller, 2002; Hill & Snell, 1988; Kor, 2006). Although R&D intensity is a widely accepted proxy for innovation in management and innovation literature (R. Adams, Bessant, & Phelps, 2006), future research can complement input-oriented measures of innovation with outcome-oriented measures, such as number of patents, patent citations, or new product developments (Ashwin, Krishnan, & George 2016), to consider the management's ability to realize innovation.

9.4 Concluding remarks

Discussing the sources of sustainable competitive advantage is a long-standing tradition in strategic and innovation management research. In light of the complexity of organizations and the broader competitive and societal environment in which they are embedded, a plethora of explanatory approaches—often based on conflicting assumptions, resulting in divergent implications—have evolved over the years.

The present thesis set out the overarching goal of advancing management literature by providing an in-depth analysis of the managerial-, governance-, and firm-level influences on innovation, grounded in rigorous theories and tested through empirical research. Over the course of six research papers, this thesis examined the sources for innovation in and across the three aforementioned analysis levels in the context of today's globalized, digital economy. Research Paper 1 provided the first evidence for how DMCs interact at the level of individual managers to shape the cognitive evaluation of business model innovation in digital industries. Research Paper 2 built on these insights to propose that DMCs directly promote innovation in digital firms. Research Paper 3 departed from the managerial level, empirically linking the governance level to the firm level in the specific context of high-tech firms. Research Paper 4 merged these three different levels of analysis into a multi-level model that illustrates innovation-related decision-making. The paper developed the DCC concept as a synthesis of DMC theory and UET, subsequently connecting these individual-level capabilities of CEOs directly to firm-level innovation. Based on the link between the managerial and firm levels, the paper proposed CEO power as a moderator of the DCC–innovation relationship. The research model thus bridged the gap between the managerial level and the firm level—the DCC–innovation relationship—and then complemented the model by introducing governance-level contingencies—CEO power as a moderator of the DCC–innovation relationship. Research Paper 5 built on the DCC concept to develop and test a holistic model of the mechanisms through which DCCs shape a CEO's ability to orchestrate different types of slack resources for innovation. This study contributed to the emerging stream of holistic empirical studies on the individual-level antecedents of innovation, expanding DMC literature by examining the underlying multi-level linkages. Thus, Research Paper 5 provided long called for evidence for one of the cornerstones of DMC theory: the resource orchestration function of managers. Finally, Research Paper 6 examined the DMC–R&D spending relationship in the unique context of high-tech firms, and how a CEO's status as founder or nonfounder influences this relationship. This paper provided novel evidence on the significance of DMCs for innovation strategies in digitalization-driven industries by showing that a superior DMC portfolio leads to higher R&D investments. In contrast, the underlying DMC subcomponents—except for managerial social capital—do not directly affect these investment decisions. Therefore, the study reiterated the integrality of DMCs for competitive advantage, while stressing the importance of social capital in facilitating innovation. Research Paper 6 additionally demonstrated that high-tech firms benefit from retaining their founder in the CEO position, as founder CEOs encourage innovation investments through their DMCs even more strongly than

their professional counterparts. This study has altogether substantiated the significance of individual-level DMCs for competitive advantage through their benefits for innovation investments, and highlighted the disposition of founder CEOs in driving long-term innovation strategies through superior DMCs.

By expounding on the links between three fundamental strategic and innovation management levels, the present thesis offers a holistic perspective on innovation within and across the managerial, governance, and firm levels. The six research papers presented in Chapters 3 to 8 added significant evidence to microfoundational research by empirically examining the role of micro-level antecedents to innovation in the current globalized, digital business environment. Overall, the evidence corroborated the pivotal role of individual-level DMCs in driving firm-level innovation, clarifying how the nature of this relationship is affected by managerial-, governance-, and firm-level contingency factors.

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