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Achieving Product Ambidexterity in New Product Development: The Role of Middle Managers' Dynamic Managerial Capabilities

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ABSTRACT While the concept of dynamic managerial capabilities was initially developed to understand top managers' strategic decisions, we theorize that it can explain how middle managers successfully contribute to functional outcomes. In this paper, we apply the dynamic managerial capabilities perspective and theorize that middle managers' capabilities to sense, seize, and reconfigure opportunities and assets, enhance product ambidexterity. We test our predictions with survey data obtained in two waves with a three-year time lag and enriched with archival data from a sample of 185 German middle managers. Our results show that middle managers' general human capital (specialized education), structural social capital (managerial ties), and relational social capital (trust) are positively related to product ambidexterity, while their cognitive social capital (solidarity) is negatively related. We contribute by expanding the concept of dynamic managerial capabilities to middle management and provide insights into the underexplored relationship between middle managers' capabilities and functional product ambidexterity.

Keywords: dynamic managerial capabilities, middle management, NPD function, product ambidexterity, SMEs

INTRODUCTION

For decades, research has studied how middle managers (MMs) help or hinder the implementation of the agenda of their companies' top management (Guth and Macmillan, 1986; Wooldridge and Floyd, 1990). MMs' closeness to daily operations enables them to select and champion new initiatives, contributing to changes in

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organizational processes (Heyden et al., 2018). In addition, MMs' skills and abilities empower them to bring the strategic agenda to daily operations at the functional level (Huy, 2011). Prior research identifies capabilities of MMs that can directly influence the operational implementation of firm strategies, such as MMs' ways of interacting with superiors and their sensemaking ability (Rouleau and Balogun, 2011; Smith et al., 2014). However, like top managers, MMs differ among themselves in their resources and capabilities, factors that affect the way they perform their tasks (Glaser et al., 2015).

Given the importance of implementing the strategic agenda, more research is needed that addresses the question of how MMs' individual-level capabilities provide an impetus for functional success. We address this question guided by two research gaps in the current literature on middle managers and ambidexterity within a functional domain. First, earlier studies have shown that dynamic managerial capabilities (DMCs) – skills in sensing, seizing, and reconfiguring opportunities and assets – enable top managers to achieve organizational ambidexterity at the firm level (Adner and Helfat, 2003; Kiss et al., 2020; O'Reilly and Tushman, 2008). Yet, even though research suggests that MMs are responsible for bringing ambidexterity to daily operations at the functional level (Floyd and Lane, 2000; Taylor and Helfat, 2009), prior work is silent on how the DMCs of MMs enable the achievement of a function's product ambidexterity. This is surprising because MMs engage in activities indicative of DMCs, such as 'sensing and reconfiguring related ideas' (Peters et al., 2019, p. 397), which may support product ambidexterity at the function level.

Second, firms often strive for ambidexterity, the ability to combine explorative and exploitative capabilities (O'Reilly and Tushman, 2013). To achieve it, large firms benefit from separating the two capabilities structurally (Csaszar, 2013; Fourné et al., 2019; Lubatkin et al., 2006). In contrast, small- to medium-sized enterprises (SMEs) lack the resources for structural separation and, thus, face the challenge of how to simultaneously explore and exploit product capabilities – including, crucially, within their new product development (NPD) functional area (Voss and Voss, 2013). While prior work suggests that middle managers' capabilities may be key in implementing and operating an ambidextrous strategy at the functional level (Asif, 2017; Lubatkin et al., 2006), there is a lack of conceptual and empirical work examining the relationship between MMs' capabilities and product ambidexterity.

Our study aims to fill these two gaps by investigating MMs' dynamic managerial capabilities in the NPD function of SMEs in the manufacturing industry. We analyse how differences in MMs' dynamic managerial capabilities influence the achievement of product ambidexterity, which, in the context of NPD, means simultaneously exploring new product capabilities and exploiting current product capabilities (Voss and Voss, 2013).

Based on Adner and Helfat (2003) DMCs enable managers to sense, seize, and reconfigure opportunities and assets in organizations. Managers' DMCs are underpinned by three distinct individual-level resources: managerial human capital (a manager's skills and knowledge), managerial social capital (the ability to access resources and information), and managerial cognition (the basis for decision-making) (Adner and Helfat, 2003; Helfat and Martin, 2015; Kor and Mesko, 2013). We argue that product ambidexterity at the level of the NPD function requires MMs to sense and

seize opportunities for new products or adaptations of existing products while configuring and reconfiguring resources (Helfat and Raubitschek, 2000; Holmqvist, 2004; March, 1991; Teece, 2007). Thus, we address the following research question: To what extent do MMs' dynamic managerial capabilities in the NPD function help or hinder product ambidexterity?

The contribution of our study is twofold. First, we expand the theoretical concept of DMC to middle management. Thereby, we integrate the disparate streams of literature on middle management (Glaser et al., 2015; Schubert and Tavassoli, 2020) and DMCs (Adner and Helfat, 2003; Helfat and Martin, 2015). Previous research on DMCs has mainly considered the top management level of firms (Haapanen et al., 2019; Raffaelli et al., 2019), but researchers have called to expand this concept to the middle management level to understand how MMs sense, seize, and reconfigure opportunities and assets (Helfat and Martin, 2015; Helfat and Peteraf, 2015). We import Adner and Helfat's (2003) concept into middle management literature to understand how DMCs enable the MM to achieve ambidexterity at the functional level. Specifically, we transfer the three underpinnings of dynamic managerial capabilities to MMs and describe the impact of each on functional product ambidexterity: human capital (specialized education, firm tenure), social capital (managerial ties, trust, and solidarity), and cognition (alertness). Thereby, we also answer research calls 'to identify unique capabilities needed for success in specific functions' (Anzengruber et al., 2017, p. 145).

Second, we contribute to the literature on ambidexterity at the functional level of SMEs (Lavie et al., 2010; Lubatkin et al., 2006; Raisch and Birkinshaw, 2008). Due to SMEs' inability to structurally separate exploration and exploitation, the success of SMEs in achieving product ambidexterity is dependent on MMs' capabilities to structurally anchor exploration and exploitation within a single functional unit (Cao et al., 2009). Achieving product ambidexterity means establishing patterned and routinized activities that make it possible to identify opportunities for the adaptation or development of products or services (Stettner and Lavie, 2014; Voss and Voss, 2013). We argue that the DMCs of MMs serve to establish these activities and, thus, allow the implementation and operationalization of an ambidextrous strategy at the functional level (Asif, 2017; Voss and Voss, 2013). In particular, we provide nuanced and context-specific insights into how each of the three underpinnings of MMs' dynamic managerial capabilities shapes functional product ambidexterity.

THEORETICAL BACKGROUND

MMs' Dynamic Managerial Capabilities and their Underpinnings

DMCs reflect managers' ability to sense and seize opportunities, and to reconfigure tangible and intangible assets accordingly (Helfat et al., 2007; Helfat and Martin, 2015). A wide variety of research on top managers and boards of directors acknowledges that to understand 'dynamic managerial capabilities and how managers achieve change it is central to look at underlying managerial resources and processes' (Åberg and Torchia, 2020,

p. 661). The underpinnings of DMCs at the top management level can facilitate a firm's innovative output and explain organizational-level heterogeneity (Rothaermel and Hess, 2007).

Whereas it is widely acknowledged that top managers' dynamic managerial capabilities drive the strategic renewal of firms (Schilke et al., 2018), the role of MMs' dynamic managerial capabilities is less clear (Heyden et al., 2017). MMs are close to the daily operations (Huy, 2011) and are responsible for playing the 'strategic middle manager role' (Rouleau and Balogun, 2011, p. 976), applying the strategic agenda to daily operations. Nevertheless, literature on DMCs that focuses on MMs is scarce. A few studies (see Online Appendix) consider the skills, characteristics, and capabilities of MMs, crafting the differences between middle managers and top managers. For example, Glaser et al. (2015) find that within a large company, MMs' boundary-spanning activities while working on exploratory innovations appear to differ from those of top management. MMs display sensemaking capabilities in the context of organizational restructuring (Rouleau and Balogun, 2011). Peters et al. (2019) explain that MMs use their specific, function-related knowledge to sense, seize, and reconfigure interactive profit planning systems. These prior studies underscore the crucial role of MMs' capabilities in bringing the strategic agenda to daily operations within organizations (Wooldridge et al., 2008).

According to the theoretical framework of Adner and Helfat (2003), DMCs are underpinned by (1) managerial human capital, (2) managerial social capital, and (3) managerial cognition (Helfat and Martin, 2015; Kor and Mesko, 2013). We argue that these three underpinnings on the level of middle management help explain how ambidexterity is promoted in NPD in SMEs. *Managerial human capital* refers to skills and knowledge that an individual has acquired through education, training, or experience (Becker, 2009). *Managerial social capital* refers to 'the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed' (Nahapiet and Ghoshal, 1998, p. 243). *Managerial cognition* refers to mental representations, mental models, and beliefs, all of which are the basis for decision-making (Helfat and Martin, 2015; Kor and Mesko, 2013); thus, managerial cognition strongly influences what information a manager searches for and interprets (Beck and Wiersema, 2013; Eggers and Kaplan, 2009, 2013).

Previous conceptual and empirical research on DMCs reveals that the three core underpinnings are intertwined and that they impact organizational outcomes (e.g., strategic change, financial performance) both separately and in combination (Adner and Helfat, 2003; Ambrosini and Altintas, 2016; Helfat and Martin, 2015). Since research on MMs' dynamic managerial capabilities is scarce, previous studies on DMCs on the top management level provide relevant insights. For instance, human capital is linked to social capital, since relationships might further develop human capital (Coleman, 1988). Similarly, research by Fiske and Taylor (1984) and Adner and Helfat (2003) reveals that an individual's career experience relates to cognition.

In this paper, utilizing the theoretical framework of DMCs, we make an initial effort to consider MMs' capabilities. In our specific context, we argue that DMCs enable MMs 'to improve their current operations and to expand them by implementing breakthrough new ideas' (de Clercq et al., 2014, p. 191). Since ours is, to the best of our knowledge, the first study of MMs' dynamic managerial capabilities, we focus our theoretical and

empirical analyses on illuminating each underpinning separately with specific consideration for the context of MMs (Anzengruber et al., 2017).

Product Ambidexterity within a Functional Unit and its Dependence on MMs' Dynamic Managerial Capabilities

Existing research proposes several ambidexterity models (i.e., structural, contextual, sequential) to address the need to combine exploitation and exploration (Gibson and Birkinshaw, 2004; O'Reilly and Tushman, 2013). The research considers ambidexterity at the different levels of organization, function, and individual (Foss and Kirkegaard, 2020). SME researchers suggest that contextual ambidexterity – in which managers choose whether to engage in exploration or exploitation based on the particular context they find themselves in – is an effective way to enhance performance outcomes, such as product innovation or marketing efforts (Lubatkin et al., 2006; Voss and Voss, 2013). Reflecting the structural anchoring of exploration and exploitation within a functional unit, contextual ambidexterity has been defined as ‘the behavioral capacity to simultaneously demonstrate alignment and adaptability’ (Gibson and Birkinshaw, 2004, p. 209). As noted above, for SMEs, structural ambidexterity – the structural separation of explorative and exploitative activities – is often impossible due to resource restrictions (Lubatkin et al., 2006). Thus, SMEs typically rely on contextual ambidexterity (Gibson and Birkinshaw, 2004).

We consider SMEs' ambidexterity at the functional level. As defined by Voss and Voss (2013), ambidexterity within the NPD function means simultaneously exploring new product capabilities and exploiting current product capabilities. To capture the NPD function's ambidexterity (here termed ‘product ambidexterity’), we follow the widely accepted conceptualization of ambidexterity as the sum of exploration and exploitation capabilities, following a definition proposed by Lubatkin et al. (2006).

Research discusses how individuals contribute to achieving ambidexterity at the functional or organizational level. For example, Gibson and Birkinshaw (2004) argue that achieving ambidexterity depends on individual capabilities. Lin and McDonough (2014) evaluate strategic business units and reveal that management teams' cognitive frames enable innovation ambidexterity. Kostopoulos et al. (2015), considering business units of US Fortune 500 firms, find that a unit's intellectual capital affects its ambidexterity. Foss and Kirkegaard (2020) focus on blended ambidexterity in two business units in a large medical firm and show that employees' motivation and skills are associated with the units' ambidexterity.

Despite these studies, recent literature reviews on ambidexterity emphasize a need to better understand the capabilities managers need to promote an ambidextrous strategy (Asif, 2017; Simsek, 2009). O'Reilly and Tushman (2008) argue that DMCs are critical for achieving and maintaining ambidexterity and emphasize the capacity of ‘senior managers to ensure learning, integration, and, when required, reconfiguration and transformation – all aimed at sensing and seizing opportunities as markets and technologies evolve’ (O'Reilly and Tushman, 2008, p. 189).

Our study outlines how ambidexterity at the functional level is enabled by middle management (Burgess et al., 2015; Mom et al., 2007; Nosella et al., 2012). We argue

that the achievement of ambidexterity at the functional level in NPD depends on MMs' dynamic managerial capabilities. DMCs enable individuals to sense and seize opportunities and reconfigure resources (Adner and Helfat, 2003). Product exploitation entails refining and extending current products and solutions, whereas product exploration means developing new products or technologies (Voss and Voss, 2013). To do both at the same time requires sensing and seizing opportunities for adapting existing products and creating new products while configuring and reconfiguring NPD resources (Helfat and Raubitschek, 2000; Holmqvist, 2004; March, 1991). Particularly within SMEs, achieving product ambidexterity poses significant challenges for MMs. MMs perform day-to-day operations and are confronted with the task of allocating resources between routines and new opportunities (de Clercq et al., 2014; Voss and Voss, 2013). To explain how MMs achieve product ambidexterity demands an in-depth consideration of MMs' abilities to sense, seize, and reconfigure a function's opportunities and resources (Helfat and Martin, 2015). While prior researchers argued that top managers' DMCs promote ambidexterity at the organizational level (Helfat and Winter, 2011; O'Reilly and Tushman, 2008), we argue that MMs' dynamic managerial capabilities enable them to realize product ambidexterity at the functional level.

DERIVATION OF HYPOTHESES

Managerial Human Capital and Product Ambidexterity

Castanias and Helfat (2001) assert that managerial human capital can be categorized as either general or specific. General human capital reflects knowledge and skills gained through education, whereas firm-specific human capital (knowledge, experience, and skills) relates to capacities gained from tenure within the firm (Castanias and Helfat, 2001).

General human capital. Education is an acknowledged part of general human capital (Castanias and Helfat, 2001). We argue that to achieve product ambidexterity, MMs benefit from a specialized educational background in their general human capital. Specialized education can come from studying a single STEM (science, technology, engineering, mathematics) discipline. In contrast, a general education would include studies in multiple disciplines, such as a combination of STEM and management (Schubert and Tavassoli, 2020).

Enabling product ambidexterity requires MMs to have an educational background that supports their skills at sensing and seizing opportunities and reconfiguring assets, particularly in their functional domain (Helfat and Martin, 2015). A specialized education helps MMs to mobilize their function's explorative and exploitative activities for two reasons. First, MMs in SMEs' NPD functions that strive for ambidexterity must improve, experiment, develop, and evaluate new products, technologies, and services (Fourné et al., 2019). Such activities require a thorough understanding of existing processes, skills, and knowledge (Taylor and Helfat, 2009). More specialized

education for MMs supports ambidextrous mechanisms since it enhances their specific knowledge base and information-processing abilities related to their functional tasks (Glaser, 1984; Johnson et al., 2018). Consequently, MMs with a specialized educational background can recognize potential for both exploitation and exploration in their functional area.

Second, managers responsible for a particular functional domain continuously sense and seize opportunities based on specific knowledge (Mom et al., 2007; Tippmann et al., 2014). Moreover, and in contrast to top managers, who benefit more from more general and broad education, MMs' focus on domain-related functional tasks benefits from more specialized education (Krausert, 2014). Prior research reveals that MMs with less specialized educational backgrounds tend to be risk-averse and follow rather conventional approaches (Andreu and Puetz, 2017). This risk aversion can prevent effective search and opportunity recognition and hinder the development of pronounced product ambidexterity (Helfat and Martin, 2015; Voss and Voss, 2013). Hence, we argue that specialized education helps MMs to focus on sensing and seizing opportunities and reconfiguring assets in their functional domain of NPD. Thus, we expect a more specialized education to relate positively to product ambidexterity. We hypothesize:

Hypothesis 1: MMs' specialized education will have a positive association with product ambidexterity.

Firm-specific human capital. Following Castanias and Helfat (2001), firm-specific human capital is comprised of knowledge, experience, and skills that are accumulated as an individual's tenure within a particular firm increases. Firm-specific human capital is different from general work experience and may shape individual-level abilities supporting ambidexterity in the NPD function (Helfat and Martin, 2015; Voss and Voss, 2013). However, prior work suggests there may be limits to the benefits of firm-specific human capital (Rodan and Galunic, 2004). Thus, the relationship between firm tenure and product ambidexterity might turn negative at high levels of firm tenure, suggesting a curvilinear relationship.

At low levels of firm tenure, MMs suffer from a lack of knowledge about firm-specific processes and interpersonal norms (Mom et al., 2015). They need a lot of time and effort to learn about organizational structures, assets, and abilities in their functional domain. Because the simultaneous achievement of product exploration and exploitation requires managers to sense and seize opportunities for new products while also configuring and reconfiguring NPD resources (Voss and Voss, 2013), MMs with short tenure may be less able to support their function's product ambidexterity. As MMs' firm tenure increases to moderate levels, firm-specific knowledge and assertiveness increase (Guo et al., 2016; Mom et al., 2015), enabling them to promote asset orchestration and change in their functional domain. MMs' moderate levels of tenure allows them to bring in novel perspectives on established business practices from their previous external perspective (Ng and Feldman, 2010), increasing their ability to sense and seize opportunities for new products (Behrens et al., 2014). At the same time, middle managers can deal with increased work challenges without

negatively affecting their job performance (van de Brake et al., 2019). Thus, they can concentrate on the refinement and extension of their functional domain, as reflected in exploitative activities. MMs with moderate levels of tenure may therefore tend to feel comfortable with the firm-specific conditions, and their ability to promote ambidexterity in their functional domain increases.

At high levels of firm tenure, however, MMs may exhibit a decreased focus on asset orchestration, resulting in detrimental effects related to product ambidexterity. Prior work has shown that long-tenured managers become inflexible and succumb to counterproductive habits of thought such as the not-invented-here syndrome (Allen et al., 1988). Specifically, prior work has shown a negative relationship between firm tenure and innovation (Rodan and Galunic, 2004). While there are also some positive aspects to being long-tenured, such as higher commitment to one's organization (Katz and Allen, 1982; Kim et al., 1999), the tendency of long-tenured managers to neglect innovation will likely lead to a reduced proclivity to sense and seize opportunities and reconfigure complex resources and processes in NPD, which will impede product ambidexterity. In sum, we expect that a function's product ambidexterity is highest when the MM has been with the firm for a medium length of time. Hence, we hypothesize:

Hypothesis 2: MMs' firm tenure will have an inverted U-shaped association with product ambidexterity.

Managerial Social Capital and Product Ambidexterity

According to Nahapiet and Ghoshal (1998), social capital consists of a structural, a relational, and a cognitive dimension. The *structural dimension* describes how individuals are connected within their network outside the organization. It captures an individual's connectedness, network density, and hierarchical position within that network (Kemper et al., 2013; Nahapiet and Ghoshal, 1998). The *relational dimension* focuses on the quality of interpersonal relationships within that network (Moran, 2005). The *cognitive dimension* 'facilitates a common understanding of collective goals and proper ways of acting in social systems' (Tsai and Ghoshal, 1998, p. 465) and hence provides 'shared representations, interpretations, and systems of meaning among parties' (Nahapiet and Ghoshal, 1998, p. 244). Managers of all organizational levels can utilize their social capital to gain information through their networks, access resources through their social ties, and leverage their social status to facilitate favorable asset orchestrations (Adner and Helfat, 2003; Helfat and Martin, 2015), which may foster exploiting and exploring resources and opportunities (Adler and Kwon, 2002; Payne et al., 2011). Because they are different, the three dimensions of social capital can be expected to affect MMs' ability to mobilize their function's product ambidexterity in different ways.

Structural social capital (managerial ties). The structural dimension of social capital reflects the closeness of ties between firms' MMs and outside managers or government officials (Peng and Luo, 2000). Research suggests that these ties positively contribute to MMs' ability to sense and seize opportunities and reconfigure assets in their functional domain

(Helfat et al., 2007; Helfat and Martin, 2015). Consequently, using their social relations may help MMs to fulfill the dual purposes of product ambidexterity.

Heterogeneous knowledge from personal contacts and connections outside the organization is a valuable resource for MMs' capabilities. Indeed, Rodan and Galunic (2004) found that MMs' access to external, heterogeneous knowledge positively relates to the 'joint presence of creativity and implementation skills for innovation' (p. 550). MMs with enhanced heterogeneous knowledge have more creativity (Rodan and Galunic, 2004), which is important for sensing product opportunities (Helfat and Martin, 2015; Voss and Voss, 2013). Also, the closeness of different ties enhances MMs' access to diverse information that contributes to their ability to recognize opportunities regarding product adaptations or new products (Rodan and Galunic, 2004), which will support their ability to seize those opportunities. Close ties to customers and suppliers make it possible to quickly gather information on such things as technology and changing customer preferences (Fischer et al., 2021; Gao et al., 2008; Kemper et al., 2013). MMs can integrate such information into the process of sensing and seizing opportunities in NPD. Simultaneously, such information enhances their ability to evaluate the decisions involved in exploitative and explorative activities. Consequently, we hypothesize:

Hypothesis 3: MMs' managerial ties will have a positive association with product ambidexterity.

Relational social capital (trust). An essential piece of the relational dimension of social capital is trust (Nahapiet and Ghoshal, 1998). In the context of social capital, trust 'can be viewed as the basic active ingredient of social capital, the condition that allows an actor to reliably expect to obtain and use [...] information and resources' (Kemper et al., 2013, p. 591). Given that organizational ambidexterity literature indicates that trust is a necessary element to simultaneously focus on exploration and exploitation (Gibson and Birkinshaw, 2004; Patel et al., 2013), MM's trust in an information source might support product ambidexterity (Levin and Cross, 2004).

The trustworthiness of an information source improves the usefulness 'of both tacit and explicit knowledge exchange' (Levin and Cross, 2004, p. 1486). In NPD, we argue that the MM – by using highly trusted information sources – contributes to the function's product ambidexterity in three ways. First, increased trust in internal contacts as an information source enhances MMs' openness to receive and transmit creative ideas. They feel confident and believe that their colleagues and supervisors will be receptive to their suggestions (Anderson et al., 2014; George and Zhou, 2007). Following Kostopoulos et al. (2015), such trust enhances knowledge absorption, refinement, and improvement of existing products, all of which is needed for exploitative activities within functional units.

Second, because MMs have trusted sources within their firm, they can also foster creativity, enhanced learning, and knowledge exchange within their functional domain of NPD (Tsai and Ghoshal, 1998). Integrating reliable information from other functions, be they output-oriented (e.g., marketing) or input-oriented (e.g., finance), helps professionals in the NPD function to evaluate and perform explorative and

exploitative activities in the best way possible (Martin, 2011). Due to the exchange of resources and cooperative behavior among trusted contacts (Jones and George, 1998; Tsai and Ghoshal, 1998), MMs in NPD can make better sense of improvements or new offerings.

Third, MMs who have trusted, firm-external relationships can gather scarce but reliable information about trends and new technologies (Cook and Schilke, 2010) that is useful for exploitative and explorative activities. This information received from trusted business contacts is likely to be integrated with existing knowledge, further promoting explorative activities (Voss and Voss, 2013). In sum, we hypothesize:

Hypothesis 4: MMs' trust in an information source will have a positive association with product ambidexterity.

Cognitive social capital (solidarity). Solidarity, the cognitive dimension of social capital, facilitates teamwork and business-related relationships, as it emphasizes common goal attainment and cooperation (Atuahene-Gima and Murray, 2007). Following Nahapiet and Ghoshal (1998), we consider MMs' solidarity with others in business networks, including managers of any level, other employees, suppliers, and customers. We argue that the consequences of MMs' solidarity might turn negative at high levels, leading to a curvilinear relationship.

At low levels of solidarity, MMs responsible for NPD do not cooperate well with the business network inside and outside the firm and tend not to share the same goals. Consequently, the level of shared knowledge is low, and access to resources to evaluate potential exploitative and explorative activities is minimal. Given the evidence that low levels of solidarity provide the MM with less cross-functional communication and sharing of ideas (Nahapiet and Ghoshal, 1998), particularly in SMEs (Lubatkin et al., 2006), it is less possible to refine and extend current knowledge. Simultaneously, with reduced levels of solidarity, explorative activities are less possible, too, since they require higher levels of new skills, knowledge, and resources drawn from outside the firm (Lavie et al., 2010).

As solidarity increases, informal knowledge exchange in MMs' business networks increases (Adler and Kwon, 2002), allowing access to more knowledge and resources inside and outside the firm. This access supports MMs' capacity to scan and search for information that fosters the opportunity recognition and creativity (Adner and Helfat, 2003; Helfat and Martin, 2015) that are needed to explore new products (Lubatkin et al., 2006; Voss and Voss, 2013). Research on network effects inside and outside firms reveals that solidarity facilitates knowledge transfer and knowledge sharing (Markham and Lee, 2014; Reagans and McEvily, 2003). High levels of knowledge transfer help MMs to evaluate exploitative and explorative opportunities for their functional domain across a broader range of alternatives. In addition, solidarity in firm-internal business networks enhances cooperative resource-sharing across functions within a firm, which promotes exploration (Shaner et al., 2016). Given that firm-internal solidarity improves problem-solving and the ability of functional teams to reach a strategic consensus (Atuahene-Gima and Murray, 2007), output-oriented

functions can refine and adapt current resources efficiently, which improves and extends exploitative activities.

At high levels, though, solidarity may result in forces that decrease functional product ambidexterity. High solidarity can create intense intimacy and group thinking that ‘may hinder the development of new assumptions and expansive understanding of problems’ (Atuahene-Gima and Murray, 2007, p. 8). High solidarity may, therefore, hinder activities such as problem-solving, discovering, and experimentation, which are the basis of new product developments and product refinements (Holmqvist, 2004; March, 1991). Moreover, very high solidarity ‘restricts the free-flow of new ideas and in the case of firms, new innovations that are generated outside the network’ (Edelman et al., 2004, p. 62). In sum, we hypothesize:

Hypothesis 5: MMs’ solidarity will have an inverted U-shaped association with product ambidexterity.

Managerial Cognition and Product Ambidexterity

Mental representations, mental models, and beliefs all serve as the foundation for decision-making, and are referred to as managerial cognition (Helfat and Martin, 2015; Kor and Mesko, 2013). Mobilizing product ambidexterity requires the manager’s cognition to establish patterned and routinized activities to identify opportunities for the adaptation and development of products or services (Lavie et al., 2010; Voss and Voss, 2013). We argue that MMs’ managerial cognition may support their capacity to sense and seize opportunities for new products while also configuring and reconfiguring NPD resources (Voss and Voss, 2013).

We conceptualize MMs’ cognition as their degree of alertness for the following reasons. Social cognitive theory and research on awareness suggest that individuals’ cognition has various features that allow individuals to discover and create opportunities (Fiske and Taylor, 1984; Kirzner, 1980). The concept of alertness incorporates this theoretical lens and includes three underlying dimensions – search, association, and evaluation – that support individuals’ ability to recognize and develop new opportunities (Tang et al., 2012; Tang et al., 2021). The concept of alertness explains why and how individuals recognize and develop opportunities (Tang et al., 2012). Given that opportunities are the key to product ambidexterity (O’Reilly and Tushman, 2008, 2013), we argue that MMs with these cognitive characteristics should be able to promote product ambidexterity in their functional domain.

The characteristics of alertness assist MMs in identifying domain-relevant information, enabling them to adapt their thinking to the new information instead of adapting the new information to their thinking (Tang et al., 2012; Tang et al., 2021). Since the cognitive characteristic of search leads to the enhancement of domain-relevant information (Tang et al., 2012), MMs who do it well are able to sense and seize opportunities within their function (Helfat and Martin, 2015). The dimension of association ‘allows an individual to consider multiple options and possibilities and to make unique connections’ (Tang et al., 2012, p. 80), which enables MMs to ‘sense cognitively distant yet superior market opportunities’ (Helfat and Martin, 2015, p. 1286). Lastly, the dimension of evaluation supports MMs’ reflection on opportunities and their explorative and exploitative potential for NPD (Allen et al., 1988; McMullen and

Shepherd, 2006; Tang et al., 2012). Consequently, alertness enhances individual-level mechanisms that support MMs' out-of-the-box thinking (Baron and Ward, 2004), fostering the simultaneous pursuit of their function's explorative and exploitative activities (Voss and Voss, 2013). Thus, we hypothesize:

Hypothesis 6: MMs' alertness will have a positive association with product ambidexterity.

METHODOLOGY

Sampling and Data Collection

We collected primary survey data in two waves with a three-year time lag and added archival data for further robustness. Initially, a random sample of 3,313 German manufacturing SMEs was drawn from the Bisnode business database (Schilke, 2014). For our study, we qualified SMEs with 50 to 500 employees and with a yearly revenue less than 500 million euros (Brettel et al., 2012; de Clercq et al., 2014). Bisnode contains a comprehensive list of German firms with information on firm size, firm age, annual revenue, and industry codes for each one. Following Taylor and Helfat (2009), we targeted MMs working in NPD and complementary functions, such as R&D, innovation management, and product management within manufacturing firms. To identify our respondents, we searched the German equivalent of LinkedIn, XING (Brettel et al., 2011). If we were able to identify a potential respondent, we emailed the survey directly to that person; if not, we sent an email to the headquarters with a request to forward it to the appropriate party. To increase the participation rate in our study, we randomly selected a subsample of the contacts and asked them via phone to participate in our study.

The data collection for the first wave was conducted between April and October 2017. We received 294 responses. From this survey, we extracted all perceptual variables except for our dependent variable, which we gathered after a three-year time lag (Schilke, 2014). We did this to reduce potential common method bias (Podsakoff et al., 2012) and to account for the temporal order of our exogenous variables and our endogenous perceptual measure (Zahra et al., 2006). For our second survey, in April 2020, we again contacted the respondents who had participated in the first survey. We identified and contacted an alternative MM within the same firm if the previous respondent was no longer with the firm or did not respond. Using this procedure, we received 214 responses. We excluded responses with more than 10 per cent missing items (Newman, 2003). Our final sample resulted in matched survey data across the first and second waves of 185 firms. We show our sample composition in Table I. To ensure the study's content validity, we excluded respondents from firms that did not undertake in-house NPD activities. Finally, we added accounting data from the German Federal Gazette to our dataset, as well as secondary data on patents using patent application records obtained from the Orbit database, which contains all the patents issued to German manufacturing firms.

Table I. Sample composition

	<i>Sample in $t = 1$ ($n = 221$)</i>		<i>Sample in $t = 2$ ($n = 185$)</i>	
	<i>N</i>	<i>Percentage</i>	<i>N</i>	<i>Percentage</i>
Manufacturing industry				
Machinery and equipment	86	38.91	75	40.54
Textiles	7	3.17	6	3.24
Chemicals	14	6.33	12	6.49
Pharmaceutical products	6	2.71	4	2.16
Metal products	19	8.60	15	8.11
Computers, electronics, & optical products	33	14.93	28	15.14
Electrical equipment	25	11.31	21	11.35
Motor vehicles	17	7.69	12	6.49
Transport equipment	6	2.71	5	2.70
Furniture	8	3.62	7	3.78
Firm age (years since incorporation)				
0–9	12	5.43	10	5.41
10–19	35	15.84	31	16.76
20–49	75	33.94	62	33.51
50–99	65	29.41	54	29.19
100–199	33	14.93	27	14.59
≥ 200	1	0.45	1	0.54
Firm size (number of employees)				
50–99	63	28.51	54	29.19
100–249	111	50.23	94	50.81
250–499	47	21.27	37	20
Position of respondents				
Member of executive board	46	20.81	50	27.03
Head of NPD function	134	60.63	73	39.46
Project leader in NPD function	15	6.79	14	7.57
Employee in NPD function	3	1.36	5	2.70
Head of other function	17	7.69	26	14.05
Project leader in other function	4	1.81	10	5.41
Employee in other function	2	0.91	7	3.78
Number of supervised employees				
0–9	91	41.18	92	49.73
10–19	48	21.72	25	13.51
20–49	35	15.84	30	16.22
50–99	26	11.76	12	6.49
≥ 100	21	9.50	26	24.05

Table I. (Continued)

	<i>Sample in t = 1 (n = 221)</i>		<i>Sample in t = 2 (n = 185)</i>	
	<i>N</i>	<i>Percentage</i>	<i>N</i>	<i>Percentage</i>
Age of respondents				
20–29	8	3.62	5	2.70
30–39	61	27.6	29	15.68
40–49	75	33.94	48	25.95
50–59	69	31.22	65	35.14
60–69	8	3.62	14	7.57
Not specified	-	-	24	12.97
University degree				
Bachelor	12	5.43	10	5.41
Master	142	64.25	123	66.49
PhD/MBA	67	30.32	38	20.54
Not specified	-	-	14	7.56
Field(s) of study				
STEM	212	95.93	171	92.43
Business and Economics	109	49.32	80	43.24
Other field of study	40	18.10	33	17.84

Note: STEM is an abbreviation for Science, Technology, Engineering, Mathematics.

Measures

For all latent constructs, we used established, multi-item measures in our survey (7-point Likert scale; 1 = strongly disagree, 7 = strongly agree). All first-order constructs besides managerial tie utilization were measured reflectively (Jarvis et al., 2003). We made only minor adaptations to the scales to ensure that they matched the context of this study and were understandable to the respondents. Following Heggstad et al. (2019), we pre-tested the questionnaire with four academics and three practitioners to assure clarity and parsimony (Podsakoff et al., 2003). The scales and items of the latent constructs are listed in Table II.

Dependent variable. We operationalized *product ambidexterity* as a higher-order construct through the latent constructs of exploration and exploitation (Lubatkin et al., 2006). The items were slightly adapted to better reflect the patterns and routinized behaviors necessary for product ambidexterity at the functional level (O'Reilly and Tushman, 2013; Voss and Voss, 2013). Following Homburg et al. (2012), we triangulated our dependent variable with the data on this perceptual measure obtained from the first wave and with archival patent data information. To account for the time frame of our study, we used the number of patents with application dates following the first survey (November 2017–20). Since *patent applications* are recognized as an

Table II. Measurement scales

<i>Construct</i>	<i>Items</i>	α	<i>CR</i>	<i>AVE</i>
Product ambidexterity based on Lubatkin et al. (2006). Adaptions of items appear in italics.		.79	.74	.61
Exploration	Please indicate your new product development capabilities relative to your competition for each of the following: (much weaker/much stronger)			
	We look for novel technological ideas by <i>regularly</i> thinking ‘out-side the box’.			
	We base our success on our ability to <i>repeatedly</i> explore new technologies.			
	We <i>often</i> create products or services that are innovative to the firm.			
	We <i>continuously</i> look for creative ways to satisfy our customers’ needs.			
	We <i>dynamically</i> risk entering new market segments in a <i>recurring manner</i> .			
	We actively target new customer groups <i>on an ongoing basis</i> .			
Exploitation	Please indicate your new product development capabilities relative to your competition for each of the following: (much weaker/much stronger)			
	We <i>continuously</i> commit to improve quality and lower cost.			
	We <i>continuously</i> improve the reliability of our products and services.			
	We <i>repeatedly</i> increase the level of automation in our operations.			
	We <i>constantly</i> survey existing customers’ satisfaction.			
	We fine-tune what we offer to keep our current customers satisfied <i>on an ongoing basis</i> .*			
	We <i>continuously</i> penetrate more deeply into our existing customer base.*			
Social capital based on Nahapiet and Ghoshal (1998), Peng and Luo (2000), Kemper et al. (2013), and Levin and Cross (2004).				
Managerial tie utilization				
Business tie strength	During the past three years, you have personally utilized personal ties, networks, and connections with...	—	—	—
	... managers at buyer firms.	VIF = 1.39		
	... managers at supplier firms.	VIF = 1.12		
	... managers at competitor firms.	VIF = 1.42		
Political tie strength	During the past three years, you have personally utilized personal ties, networks, and connections with...	—	—	—
	... political leaders in various levels of the government.	VIF = 1.80		
	...officials in industrial bureaus.	VIF = 1.76		

Table II. (Continued)

<i>Construct</i>	<i>Items</i>	α	<i>CR</i>	<i>AVE</i>
Trust	...officials in regulatory and supporting organizations such as tax bureaus, state banks, commercial administration bureaus, and the like.	VIF = 1.83		
	Prior to seeking information/advice from a key contact in my business network...	.84	.88	.65
	... I assumed that he or she would always look out for my interests.			
	... I assumed that he or she would go out of her or his way to make sure that I was not adversely affected.			
	... I felt like he or she cared what happened to me.			
Solidarity	... I believed that this person approached her or his job with professionalism and dedication.			
	To what extent do you agree with the following statements?	.70	.72	.47
	Members of my business network believe that the needs of the whole network should take priority over personal needs.			
	Members of this business network accept decisions taken within the network even when they have different opinions.			
	Problem solving by many members of a business network gives better results than those by individuals.			
Alertness based on	Tang et al. (2012).	.88	.89	.73
Search	To what extent do you agree with the following statements?			
	I have frequent interactions with others to acquire new information.*			
	I always keep an eye out for new business ideas when looking for information.			
	I read news, magazines, or trade publications regularly to acquire new information.			
	I browse the Internet every day.*			
Association	I am an avid information seeker.			
	I am always actively looking for new information.			
	To what extent do you agree with the following statements?			
	I see links between seemingly unrelated pieces of information.			
	I am good at 'connecting dots'.			
Evaluation	I often see connections between previously unconnected domains of information.			
	To what extent do you agree with the following statements?			
	I have a gut feeling for potential opportunities.			
	I can distinguish between profitable opportunities and not-so-profitable opportunities.			
	I have a knack for telling high-value opportunities apart from low-value opportunities.			

(Continues)

Table II. (Continued)

Construct	Items	α	CR	AVE
Organizational slack based on Atuahene-Gima and Murray (2007).	When facing multiple opportunities, I am able to select the good ones.*			
	To what extent do you agree with the following statements?	.90	.90	.70
	We have uncommitted resources that can be used to fund strategic initiatives at short notice.			
	We have a large amount of resources available in the short run to fund our initiatives.			
	We will have no problems obtaining resources at short notice to support new strategic initiatives.			
	We have a large amount of resources at the discretion of management to fund new strategic initiatives.			

*Item excluded from further analysis due to low item reliability.

outcome of NPD (Rothaermel and Hess, 2007), we obtained data for 64 firms where patents were applied for. We then triangulated this archival measure with product ambidexterity (i.e., the average of the items) captured from the first wave of our data collection (Homburg et al., 2012). We found a positive and significant correlation with MMs' perception of product ambidexterity ($r = 0.272$; $p = 0.030$). Also, the perceptual measures of our dependent variable from the first and second waves were positively correlated ($r = 0.432$; $p = 0.000$).

Independent variables. Our survey asked respondents to provide information on all of the three underpinnings of DMCs (Adner and Helfat, 2003). To measure general human capital, we followed research on specialized education in management teams (Schubert and Tavassoli, 2020; Shin and Zhou, 2007). To reflect MMs' *specialized education* in the functional domain of NPD, we used a binary variable. We excluded those respondents from analysis who had not attained a university degree to ensure comparability. Respondents who claimed to possess a university degree were asked to state whether they had studied each of the following three areas: (1) STEM (science, technology, engineering, mathematics), (2) business and/or economics, and (3) other fields. Studies of only one discipline were coded '1' for specialized education, whereas study durations for at least two fields of study were coded '0'. We operationalized firm-specific human capital through *firm tenure*, measured as the number of years that the respondent had worked for her or his current employer (Geletkanycz and Hambrick, 1997). The structural dimension of social capital was measured through *managerial ties*. This formative, two-dimensional construct considers the intensity of MMs' use of their business and political ties with external entities covering the last three years (Peng and Luo, 2000). We averaged the items of each dimension to obtain two-factor scores and used them as reflective items for the utilization of managerial ties (Kemper et al., 2013). The other two dimensions, trust and solidarity, are based

on constructs used by Kemper et al. (2013) and Levin and Cross (2004). *Trust* reflects the managers' perceptions of the reliability of information obtained from their business networks (Nahapiet and Ghoshal, 1998). *Solidarity* describes how individuals subordinate their needs to the goals and achievements of their group (Adler and Kwon, 2002; Nahapiet and Ghoshal, 1998). Finally, MMs' managerial cognition was captured through *alertness*, which was measured as a second-order factor with three dimensions (scanning and search, association, evaluation), according to the scale developed by Tang et al. (2012).

Control variables. We control for MMs' *position tenure* and *age* in years, since research has shown that these individual-level factors determine functional product ambidexterity and new product performance (Ahearne et al., 2014; Huy, 2011). Also, using archival data, we controlled for *firm age* (in years) and *firm size* (number of employees), as these two variables have been shown to influence explorative and exploitative activities (Danneels, 2008; Kemper et al., 2013). To achieve normal distribution, we employed the natural logarithm of both control variables (Hair et al., 2009). We further controlled for the potential effects of *organizational slack* since organizational and financial resources enhance the potential to explore and exploit external and internal opportunities (Atuahene-Gima and Murray, 2007). Following Atuahene-Gima and Murray (2007), we used a four-item scale to measure organizational slack rated by the respondents from the second-wave survey.

Bias Testing

We tested for nonresponse bias in three ways. First, for both surveys, we followed Armstrong and Overton (1977) and checked whether the means for each of the theoretical constructs differed between early (first three quarters) and late respondents (last quarter). Second, we tested for bias in the first wave of our survey that might originate in our having contacted a subset of respondents via telephone before emailing them (Forsman, 2011). Third, we compared our sample of participating firms with a sample of non-responding firms ($n = 70$) for which we gathered archival data on debt-to-equity ratio and profit margin for the last consistently available financial years, 2017 and 2018. The t-tests for each analysis showed no significant difference ($p > 0.05$).

We followed Podsakoff et al. (2012) recommendations to prevent and control for common method bias. We pretested the survey extensively to ensure that its wording was clear and concise, decreasing the difficulty for respondents. Moreover, we assured respondents of their anonymity and declared that there were no right or wrong answers. To increase the respondents' motivation to respond accurately, we promised individualized evaluation reports. Finally, to reduce respondents' tendency to respond in ways that were inaccurate but socially desirable we separated the independent from the dependent variables through two time-lagged waves of data collection. We tested for common method bias by including in the confirmatory factor analysis a common latent factor on which all items were loaded (Bagozzi, 1984). Comparing the model that included the common latent factor to the model without the common latent factor revealed that neither relationships nor factor loadings were significantly impacted

($p > 0.05$). Thus, we observe no indicators that common method bias may affect our results.

RESULTS

We followed previous research on ambidexterity and applied covariance-based structural equation modeling (Kemper et al., 2013). We used AMOS 23 software and employed a two-stage data analysis approach in assessing the measurement model and, subsequently, the structural model (Anderson and Gerbing, 1988; Hair et al., 2009).

Validity and Reliability of Measures

We conducted a confirmatory factor analysis to examine the validity of our measurement model (Anderson and Gerbing, 1988). Following Lubatkin et al. (2006), we compared two different models. Model 1 used the dependent variable as a second-order construct and Model 2 used a single latent factor of ambidexterity. Comparing both Models show that Model 1 provided the highest reliability (Model 2: $\chi^2/\text{d.f.} = 1.751$, CFI = 0.794, TLI = 0.771, RMSEA = 0.031, SRMR = 0.072). The overall measurement model of Model 1 fit the criteria satisfactorily ($\chi^2/\text{d.f.} = 1.465$, CFI = 0.870, TLI = 0.855, RMSEA = 0.050, SRMR = 0.065). We further assessed the measures' validity and reliability. We followed Hair et al. (2009) to establish the unidimensionality of the constructs and found that each factor for a latent variable had no significant loadings on another factor. Table II displays the convergent validity and reliability of all constructs. The common thresholds for all indices as recommended by Hair et al. (2009) are exceeded in all but one case. Table III provides descriptive statistics and shows that discriminant validity is established (Fornell and Larcker, 1981).

Structural Model and Hypothesis Testing

In the next step, we established the structural model with all variables used in our study. Since the exogenous variables in our model may covary, we estimated the covariances between them. For establishing the nonlinear predictors, we mean-centred the indicators of the latent variables (Marsh et al., 2004; Moosbrugger et al., 2009). Table IV presents results for the structural relationships, including the unstandardized path coefficients and p-values estimated via generalized least squares estimation. The goodness-of-fit measures showed that the model fits the data well ($\chi^2/\text{df} = 1.633$, CFI = 0.787, TLI = 0.763, SRMR = 0.079, RMSEA = 0.059).

Hypothesis 1 suggests that MMs' specialized education has a positive association with product ambidexterity. This hypothesis is supported, as the path coefficient is positive and significant ($\beta = 0.195$, $p = 0.045$). Hypothesis 2 proposes that managerial firm tenure has an inverted U-shaped association with product ambidexterity. The path coefficient of firm tenure in the structural model exhibits no significant effect ($\beta = -0.011$, $p = 0.599$). To test whether an inverted U-shaped relationship exist, Haans et al. (2016) suggest that three conditions must be cumulatively satisfied: The squared term of the independent variable needs to be significant with a negative sign, the slope needs to be steep enough at both ends of the variable, and the turning point

Table III. Means, standard deviations, and Pearson correlations

Variable	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Product ambidexterity	9.123	1.461	779											
(2) Specialized education	.580	.501	.090	n.a.										
	.221													
(3) Firm tenure	9.520	8.091	.004	.158	n.a.									
	.959		.032											
(4) Managerial ties	3.346	1.048	.089	-.031	-.138	n.a.								
	.227		.677	.061										
(5) Trust	4.566	1.023	.077	.016	-.181	.157	.809							
	.299		.833	.014	.032									
(6) Solidarity	4.350	1.067	-.165	-.161	-.010	.136	.281	.684						
	.025		.029	.064	.000	.064								
(7) Alertness	4.965	.738	.161	-.009	.003	.283	.284	.132	.856					
	.028		.908	.000	.000	.073								
(8) Organizational slack	3.323	1.090	.375	.043	-.048	.005	.069	.092	.092	.837				
	.000		.558	.517	.348	.945	.213	.211						
(9) Firm age	56.546	46.070	-.102	.021	-.010	-.059	.069	-.009	.057	.018	n.a.			
	.168		.774	.890	.424	.348	.906	.437	.803					
(10) Firm size	889.773	2999.399	-.012	.090	.133	-.018	.004	-.066	-.018	-.076	.026	n.a.		
	.876		.222	.072	.806	.371	.811	.307	.725					
(11) Age	44.828	8.710	.059	.128	.434	-.032	-.062	-.092	.140	-.021	-.019	.064	n.a.	
	.426		.083	.000	.667	.400	.214	.058	.780	.795	.387			
(12) Position tenure	5.349	5.773	.092	.127	.690	-.107	-.200	-.031	.186	.170	-.033	-.072	.405	n.a.
	.212		.085	.000	.149	.006	.671	.011	.020	.652	.328	.000		

Note: n = 185; p-values appear in italics; square root of AVE for reflective constructs on the diagonal appears in bold. Table displays the pairwise correlation coefficients; Descriptive analyses use unstandardized values.

Table IV. Structural path coefficient for the direct effects of dynamic managerial capabilities on product ambidexterity

<i>Hypothesis</i>	<i>Structural relationship</i>	<i>Path coefficient (Unstandardized)</i>	<i>Probability</i>
Independent variables			
H1	Specialized education → Product ambidexterity	$\beta = 0.195$	$p = 0.045$
H2	Firm tenure → Product ambidexterity	$\beta = -0.011$	$p = 0.599$
H3	Managerial ties → Product ambidexterity	$\beta = 0.110$	$p = 0.034$
H4	Trust → Product ambidexterity	$\beta = 0.115$	$p = 0.043$
H5	Solidarity → Product ambidexterity	$\beta = -0.227$	$p = 0.006$
H6	Alertness → Product ambidexterity	$\beta = 0.091$	$p = 0.435$
Control variables			
	Organizational slack → Product ambidexterity	$\beta = 0.191$	$p = 0.007$
	Firm size → Product ambidexterity	$\beta = -0.159$	$p = 0.072$
	Firm age → Product ambidexterity	$\beta = -0.070$	$p = 0.168$
	Age of middle manager → Product ambidexterity	$\beta = 0.005$	$p = 0.425$
	Position tenure → Product ambidexterity	$\beta = -0.006$	$p = 0.797$

Note: $n = 185$. Model fit: $\chi^2/df = 1.633$, CFI = 0.787, TLI = 0.763, SRMR = 0.079, RMSEA = 0.059. Adding the squared terms of firm tenure and solidarity, respectively, revealed no significant U-shaped associations (firm tenure squared: $\beta = 0.001$, $p = 0.587$; Solidarity: $\beta = 0.106$, $p = 0.165$); the results of the linear associations remained stable.

needs to be situated within the range of the data. We added the squared term of firm tenure to our model and found no significant association. Thus, not all conditions are met, and Hypothesis 2 is not supported.

Hypothesis 3, 4, and 5 address the associations between three facets of social capital and product ambidexterity. The path coefficient of structural social capital (managerial ties) is positive and significant ($\beta = 0.110$, $p = 0.034$). Hence, Hypothesis 3 is supported. However, one could argue that managerial ties might have an (inverted) U-shaped relationship with product ambidexterity. Thus, we tested for such potential effects and again followed the conditions by Haans et al. (2016). We included the squared term of managerial ties, and the results revealed no significant relationship. Next, to support Hypothesis 4, the path coefficient of trust must be positive and significant, which is fulfilled ($\beta = 0.115$, $p = 0.043$). Again, we checked for a potential U-shaped relationship following Haans et al. (2016). Including the squared term of trust revealed no significant result. In Hypothesis 5, we propose that solidarity has an inverted U-shaped association with product ambidexterity. Since the path coefficient is negative and significant ($\beta = -0.227$, $p = 0.006$), we re-estimated our structural equation modelling. We again followed Haans et al. (2016) by adding the squared term of solidarity to the model. In this model, the variable of solidarity is significant, whereas its squared term is not ($\beta = 0.106$, $p = 0.165$). Thus, the condition that the squared term needs to be significant is not fulfilled and the indication of an inverted U-shaped association proposed by Hypothesis 5 is rejected (Haans et al., 2016).

Finally, Hypothesis 6 suggests that alertness, as a proxy for managerial cognition, is positively related to product ambidexterity. The path coefficient is positive but insignificant ($\beta = 0.091$, $p = 0.435$). In sum, Hypothesis 1, 3, and 4 are supported, whereas Hypothesis 2, 5, and 6 have to be rejected. Surprisingly, solidarity negatively and significantly relates to product ambidexterity. Our structural model also included the control variables described earlier.

Robustness and Post Hoc Analyses

We conducted multiple robustness checks and post hoc analyses. First, we used the extracted accounting data for a subsample analysis to examine the potential effects of recoverable slack. Following Peng et al. (2019), recoverable slack (i.e., resources embedded in the organization) provides firms with the ability to establish new routines and to invest in explorative capabilities. In particular, recoverable slack negatively affects the operational level and managerial decisions (Bradley et al., 2011). Thus, it could be argued that recoverable slack may be counterproductive to product ambidexterity. Therefore, we conducted an additional analysis to check if recoverable slack may affect product ambidexterity beyond the control variables used (George, 2005). We gathered archival data and captured the debt-to-equity ratio to measure recoverable slack, following Kiss et al. (2018) for the firms that published their balance sheet ($n = 154$). To address reverse causality (Henley et al., 2006), we used the last consistently available financial years (2017 and 2018) to capture recoverable slack. We employed the measurements as exogenous variables and reran our estimated model. The results remain stable regarding direction and p-values.

Second, we confirmed the observed association of Hypothesis 1 by using the maximum likelihood estimator. We analysed our structural model using a generalized least squares estimation in which intercepts and means are not estimated. Since we considered the association between middle managers' specialized education and product ambidexterity (H1) with a binary variable, we further validated our results to verify that using structural equation modeling without intercepts does not bias the results of this hypothesis. We estimated a separate model containing the binary variable specialized education and the control variables by using maximum likelihood and employing the estimation of means and intercepts in AMOS. The results are consistent with our main analysis ($\beta = 0.073$, $p = 0.039$).

Third, since previous research on DMCs acknowledges potential interaction effects, we tested the following relationships. Cognitive attributes such as alertness 'can be learned and improved' (Tang et al., 2012, p. 78), and individuals' prior experience may affect MM's cognitive characteristics (Helfat and Martin, 2015). To assert the robustness of our results, we examined a model in which alertness mediates the relationships between specialized education and firm tenure and product ambidexterity. Both the path from specialized education to alertness ($\beta = 0.034$, $p = 0.262$) and the path from firm tenure to alertness ($\beta = -0.005$, $p = 0.295$) are insignificant. These results support the robustness of our findings and suggest that the direction of the relationships among our variables is consistent with our theoretical arguments.

Fourth, following Coleman (1988) and Kor and Mesko (2013), human and social capital may interact since the knowledge gained through social capital contributes

to human capital. Also, MMs' specialized education and firm tenure may interact with the dimensions of social capital (Adner and Helfat, 2003). Thus, we analyzed the interaction of specialized education and the respective dimensions of social capital (i.e., managerial ties, trust, solidarity). Likewise, we considered the interaction of firm tenure and the social capital dimensions. Since regression techniques have been proven superior to structural equation modeling when considering interaction effects of continuous and manifest variables (Jaccard and Wan, 1995), we employed ordinary least square regression to estimate potential interaction effects. We did not find any significant relationships.

DISCUSSION

This study aims to examine how differences in MMs' dynamic managerial capabilities help or hinder the achievement of product ambidexterity in the context of NPD. We focus on the DMC literature and argue that product ambidexterity depends on MMs' capabilities to sense, seize, and reconfigure opportunities and assets. Relying on a sample of MMs, we find that MMs' *general human capital* (MMs' specialized education) is positively associated with product ambidexterity, whereas we do not find support for an effect of *firm-specific human capital* (firm tenure). In addition, we find that both MMs' *structural social capital* (managerial ties) and *relational social capital* (trust) are positively related to product ambidexterity. Against expectations, we find that *cognitive social capital* (solidarity) is negatively related with product ambidexterity. Finally, we do not find support for the hypothesis that MMs' *managerial cognition* (alertness) has a positive association with product ambidexterity. Our study offers contributions to theory by expanding the concept of DMCs to middle management and by adding to the literature on ambidexterity at the functional level of SMEs.

Theoretical Implications

Dynamic managerial capabilities. We expand the concept of DMCs by Adner and Helfat (2003) to the realm of the MM. While the concept of DMCs was initially developed to understand how top managers make strategic decisions (Adner and Helfat, 2003), we suggest that it can enhance scholarly understanding of how MMs successfully contribute to functional outcomes (de Clercq et al., 2014; Foss and Kirkegaard, 2020). Although prior literature has provided important theoretical work on DMCs at different management levels of organizations (Anzengruber et al., 2017; Helfat and Martin, 2015; Helfat and Peteraf, 2015), we are the first, to the best of our knowledge, to provide empirical results on how MMs' dynamic managerial capabilities relate to functional outcomes. Further, the middle management literature aims to understand which characteristics and skills of MMs enable functional success or impact functional outcomes (i.e., Adna and Sukoco, 2020; Schubert and Tavassoli, 2020). We contribute to this research by extending the concept of DMCs to MMs and providing evidence that MMs' capabilities to sense, seize, and reconfigure opportunities and resources lead to functional success (Adner and Helfat, 2003). Thus,

our study responds to the call by Helfat and Peteraf (2015) to improve the theoretical understanding and to empirically investigate the consequences of function-specific DMCs among MMs.

Considering the *social capital* of MMs, our results show that the individual-level resources of structural social capital (managerial ties) relate to product ambidexterity. Prior work on social capital has found mixed evidence on the influence of social capital on functional success. Glaser et al. (2015) found no relationship between MMs' boundary-spanning activities and exploratory innovations, whereas Ahearne et al. (2014) did find that district sales managers' informational social capital is associated with the implementation of sales strategies. Our results show that managerial tie utilization enables MMs to mobilize product ambidexterity through the closeness (i.e., intensity) of personal contacts and connections to managers of other firms (Peng and Luo, 2000). Even close ties with governmental officials might help MMs adjust resources and assets by enhancing their knowledge of state authority plans (e.g., changes in regulatory guidelines for services and products) relevant to their functional domain (Kemper et al., 2011). Thus, we argue that it may be the closeness of function-related ties, rather than the degree of ties outside their function (Glaser et al., 2015), which is associated with NPD success among MMs.

Also, we add to social capital research by examining the distinct influence of trustworthiness in addition to the structural and cognitive components of social capital (Levin and Cross, 2004; Nahapiet and Ghoshal, 1998). Adding to the study by Levin and Cross (2004), our findings advance knowledge on the benevolence-based component of trust (i.e., trust that one party will not take advantage of the vulnerability of the other party) by offering evidence that the trustworthiness of an information source acts as an essential underlying factor for MMs' social capital. Here, we demonstrate the particular relevance of perceived trustworthiness, especially of the benevolence-based component of perceived trustworthiness in the context of MMs in NPD functions. We thereby add to the growing literature that discusses whether and how different forms of trust underpin social capital. Such a nuanced conceptualization of trust has been previously used in the context of professionals (Cook and Schilke, 2010), and in the context of trust in organizations (Tomlinson et al., 2020).

Surprisingly, solidarity in MMs' business network – firm-internal and firm-external actors – hinders MMs from promoting product ambidexterity. A reason would be the subordination of personal needs and the increased occurrence of strategic consensus (Nahapiet and Ghoshal, 1998). We thus identify a specific context that underscores previous theorizing on the risks of social capital, theorizing for which empirical evidence is limited (Adler and Kwon, 2002; Edelman et al., 2004). For instance, the study by Atuahene-Gima and Murray (2007) on top management teams theorizes that solidarity negatively relates to explorative activities, but their empirical results reveal no effect. Our findings show that solidarity may unfold differently across managerial levels (Helfat and Martin, 2015). For achieving product ambidexterity, we presume that MMs with solidarity in their network may shift their needs from their functional domain to the needs of their business network. This shift in needs may decrease MMs' motivation for sensing and seizing opportunities and reconfiguring resources for MMs' functional domain. Also, some studies on CEOs discuss the so-called 'dark side' of social capital (e.g., Griffin et al., 2021) and earlier, Edelman et al. (2004) theorized that negative aspects of

social capital might be more detrimental at the firm level. Our study provides empirical evidence that MMs' solidarity may thus be harmful at the functional level and thereby expands this line of inquiry to the middle management level.

Finally, since structural and relational social capital enhance product ambidexterity, while cognitive social capital has a negative effect, we conclude that the different facets of social capital comprise an important set of DMCs for the MM in the NPD function. By analyzing the three dimensions of social capital, we elucidate the 'set of resources rooted in relationships' (Nahapiet and Ghoshal, 1998, p. 243) in the under-researched domain of MMs' dynamic managerial capabilities.

Moreover, we reveal that MMs' *general human capital* – their specialized education – positively relates to product ambidexterity. Existing research has shown that specialized education offers MMs more profound expertise in their functional domains (Ferreira and Sah, 2012). Our results extend these findings and suggest that MMs with specialized education may also pay more attention to sensing and seizing opportunities in their functional domain than do those with general education (Ren and Guo, 2011). This result also elucidates important differences regarding the general human capital required for MMs versus top managers. Whereas at the top management level, a broader variety of knowledge gained through a more generalized education supports the assessment of opportunities and risks in strategic change (Carpenter et al., 2004; Helfat and Martin, 2015), our results suggest that MMs rather rely on their specialized education to explore and exploit opportunities.

Considering MMs' *firm-specific human capital* (i.e., firm tenure), we find no statistically significant relationship with product ambidexterity. While these results do not support the theorizing by Adner and Helfat (2003), they do align with prior work on top managers' firm tenure (Helfat and Martin, 2015), which has argued that tenure may reduce attention to opportunities needed for exploration and exploitation (Rodan and Galunic, 2004). We also do not find a statistically significant relationship between *cognition*, operationalized as MMs' alertness, and product ambidexterity. It could be that alertness enables MMs to recognize and develop opportunities but it might not enable MMs to configure resources needed for product ambidexterity (Voss and Voss, 2013).

SMEs' functional product ambidexterity. Ambidexterity research has sought to understand how MMs orchestrate explorative and exploitative activities at the functional level (Awojide et al., 2018; Burgess et al., 2015; Lin and McDonough, 2014), but has not examined how MMs' dynamic managerial capabilities may explain how product ambidexterity is achieved. Following Stettner and Lavie (2014) and Voss and Voss (2013), the simultaneous achievement of exploration and exploitation at the functional level requires capabilities to establish patterned and routinized activities. Their studies demonstrate that SMEs' firm performance benefits from achieving functional ambidexterity and call for extending research on how to implement and operate an ambidextrous strategy. Our study answers this research call by providing evidence that certain capabilities of MMs (i.e., specialized education, managerial ties, trust) allow MMs to achieve product ambidexterity. Literature on organizational ambidexterity in the context of SMEs reveals that trust is an organizational element that is necessary for both exploration and exploitation (Gibson and Birkinshaw, 2004;

Patel et al., 2013) but has not extended this theorizing towards the middle manager level in the context of functional ambidexterity. Our study fills this gap and provides that MMs' trust mobilizes product ambidexterity at the functional level. Lin and McDonough (2014) have shown that a functional unit's intellectual capital affects the unit's ambidexterity. We complement these findings by showing that, besides intellectual capital, specific capabilities of MMs (general human capital and social capital) also contribute to building functional ambidexterity.

Finally, we also add to organizational ambidexterity research that demands detailed insights on the context-specific picture of achieving product ambidexterity within SMEs' functions in the manufacturing context (Lubatkin et al., 2006; Raisch and Birkinshaw, 2008). We provide further insights into how capabilities can enable ambidexterity in SMEs, as smaller firms, unlike larger firms, may not have the resources to structurally separate exploration from exploitation (Fourné et al., 2019). Thus, the implications of our results are valuable for SMEs' ambidextrous strategy implementation given that such firms face the pressure to pursue function's exploitation and exploration simultaneously (de Clercq et al., 2014; Lubatkin et al., 2006).

Limitations and Future Research Directions

This study has several shortcomings that may provide opportunities for future research. First, our study focuses solely on MMs' dynamic managerial capabilities in the functional domain of NPD. While a focus on a specific function has been recommended to provide a detailed understanding of DMCs (Schilke et al., 2018), the generalizability of our results to other functions is necessarily limited.

Second, we conceptualize MMs' dynamic managerial capabilities and empirically analyze their underpinnings separately to keep our research model parsimonious. As additional analyses, we also considered potential interaction and mediation effects to better understand how the different individual-level resources may be intertwined regarding product ambidexterity. These analyses revealed only non-significant relationships; however, other individual-level factors, such as emotions (Huy and Zott, 2019), might lead to further insights into the underpinnings of MMs' dynamic managerial capabilities. Also, it would be valuable to integrate more research from the area of social psychology to help understand which other psychological foundations underlie the formation of MMs' dynamic managerial capabilities (Helfat and Peteraf, 2015; Hodgkinson and Healey, 2011). For example, integrating identity theory and insights from the literature on passion – such as the dualistic model of passion – would likely make an important contribution to the field of DMCs (Stets and Burke, 2000; Vallerand et al., 2007).

Third, there are other micro-level mechanisms that we do not examine that may impact product ambidexterity. For instance, experimental learning approaches may mobilize product ambidexterity (Johnson et al., 2018; Lumpkin and Lichtenstein, 2005). Moreover, we focus on MMs' specialized education to capture general human capital. Other individual-level factors of general human capital could be examined that support or diminish the relationship between MMs' educational background and product ambidexterity (Kurtmollaiev et al., 2018). For instance, future research could consider MMs'

participation in specific training programs inside and outside the firm that may impact product ambidexterity (Andreu and Puetz, 2017).

Fourth and finally, our study measures product ambidexterity following Lubatkin et al. (2006) that may restrict the results to the additive modeling choice (Lavie et al., 2010). Other studies on ambidexterity follow the ‘relative exploration orientation’ by using archival data (Bhandari et al., 2020; Jancenelle, 2020). Future research could adopt this operationalization and use archival data to consider functional ambidexterity on a single continuum.

Managerial Implications

Besides its theoretical implications, our study also guides managers. Our results demonstrate that middle management has a significant impact on their functions’ success in product ambidexterity. Consequently, MMs should not be perceived as reluctant sources of inertia but as active implementers of the strategic agenda. Our study suggests that MMs with specialized education and strong structural and relational social capital stimulate their functions in such a way as to enhance product ambidexterity. Hiring such MMs for output-oriented functions seems desirable when a firm needs to foster product ambidexterity. MMs with specialized education meet their function-related requirements for specific knowledge necessary to support explorative and exploitative activities simultaneously. Also, since structural and relational social capital provide MMs with capacities that build product ambidexterity, the strength of managerial ties and the network configurations inside and outside the firm could be evaluated during recruiting assessments. Additionally, the cognitive social capital of MMs should be carefully considered. Following Helfat and Peteraf (2015), social capital requires high levels of social cognition. Since solidarity was negatively related to product ambidexterity, practicing MMs should critically reflect whether their solidarity within their business network may diminish their sensing, seizing, and reconfiguring capabilities.

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