Digital Product Innovation within Family Firms:
A Construal Level Perspective

Abstract

Digital product innovation (DPI) is critical for the survival of firms, especially those operating in traditional industrial-age industries. While research has started to investigate digital innovation in family firms (FFs) considering them as a monolithic group, we still lack a more nuanced perspective that considers heterogeneity among FFs with respect to DPI and what drives such variance. Drawing on construal level theory to explain the risk behavior and goal time horizon of FF owner-managers, we propose and find that the presence of later family generations in control positively influences DPI in FFs, while the presence of a family CEO is detrimental to DPI. Furthermore, we propose that these relationships are moderated by the size of the top management team (TMT), finding that a larger TMT weakens the positive relationship between later generations in control and DPI. We base our analysis on a longitudinal sample of 103 FFs in the automotive, industrial engineering, and pharmaceutical sectors observed from 2013 to 2020. This first empirical study applying construal level theory to the family business literature has important implications for the FF digital innovation literature and for FF owner-managers interested in achieving DPI.

Keywords: family firms, digital innovation, generations, family CEO, top management team, TMT size, construal level theory

Introduction

The rapid evolution of information and communication technologies (ICTs) has opened up opportunities for firms in traditional industrial-age industries to develop digital product innovations (DPIs) – "new combinations of digital and physical components" (Yoo et al., 2010, p. 725) – thus enabling novel value creation pathways (George et al., 2021; Hanelt et al., 2021; Nambisan, 2017). For example, in the automotive industry, a car's connectivity is now as important as its mechanical features (Svahn et al., 2017). In the industrial machinery industry, the miniaturization of microchips has given robots once-unimaginable computing power (Teece, 2018). In the pharmaceutical industry, biosensors enable real-time tracking of a patient's health and developing tailored treatments through smart pills (Sehlstedt et al., 2016). Nevertheless, DPI is associated with higher complexity, an unprecedented level of unpredictability, and a longer payoff time compared to non-digital product innovation (Cappa et al., 2021; Nambisan et al., 2017). For instance, the immaturity of some digital technologies makes the innovation process much riskier (Ceipek et al., 2021), the reprogrammability and interoperability of digital technologies make market competition fiercer than ever (Pesch et al., 2021), and the acquisition of digital knowledge requires more time, especially for firms in traditional industrial-age industries. Moreover, managerial issues related to DPI are often more challenging than technical issues, making DPI dependent on the firm's governance and decision-making (Svahn et al., 2017; Liu et al., 2023; Li et al., 2018). In this sense, family firms (FFs), with their idiosyncratic governance structures and decision-making (Chrisman & Patel, 2012; König et al., 2013), provide a relevant context for studying DPI.

While research has begun to shed light on digital innovation in FFs (Ceipek et al., 2021; Soluk, 2022; Soluk et al., 2021b; Xie et al., 2022), it has so far neglected the potential heterogeneity among FFs, especially with respect to DPI, which is an important part of the digital transformation process (Soluk & Kammerlander, 2021). Moreover, despite the well-developed literature on FF product innovation in general (e.g., Calabrò et al., 2019; De Massis et al., 2013; Duran et al., 2016), such knowledge may not be easily transferable to DPI given its aforementioned uniqueness in terms of

risk, complexity, and time horizons. In view of the central contribution of FFs to any global economy (Family Firm Institute, 2017; De Massis et al., 2018), gaining a deeper understanding of *which are the drivers of DPI among FFs* is relevant for several reasons. First, the potential failure of FFs to achieve DPI may jeopardize their long-term survival, with serious consequences for society as a whole (KPMG, 2017; PwC, 2021). Second, the idiosyncratic decision-making and innovation behavior of FFs is mostly related to risk aversion and long-term orientation (De Massis et al., 2013). Therefore, studying DPI, with its higher risk and longer-term returns, in FFs may provide new theoretical insights into these idiosyncrasies. Third, it is increasingly important to consider FFs as a heterogeneous group to gain a more nuanced understanding of their behavior (Daspit et al., 2021).

We address this research gap by drawing on construal level theory (Trope & Liberman, 2010). The core tenet of this psychology-based theory is that each individual perceives a different psychological distance toward an object, and such a distance affects decisions about that object (Wiesenfeld et al., 2017). Based on the degree of psychological distance that different FF owner-managers perceive toward their firm, this theory allows us to explain their different goal time horizons and risk preferences (Kammerlander & Breugst, 2019), which ultimately influence their DPI-related decisions. Specifically, we focus on two sources of heterogeneity among FFs that have long attracted scholarly attention but still puzzle researchers in terms of their impact on FF innovation outcomes (e.g., Beck et al., 2011; Naldi et al., 2013; Hillebrand et al., 2020; Zybura et al., 2021): the generation in control and the presence (or absence) of a family CEO. We propose that later generation (relative to earlier generation) family members will perceive greater psychological distance toward the FF, which will induce greater risk-taking and longer-term goals, ultimately promoting DPI. Conversely, we contend that a family CEO will perceive a lower psychological distance toward the FF compared to a non-family CEO, which will negatively affect DPI. Finally, we acknowledge that decisions in FFs – such as engaging in DPI – are made jointly with the top management team (TMT) (Calabrò et al., 2021). Thus, the influence of the controlling

generation and the (family) CEO on DPI may vary with the size of the TMT. Specifically, we argue that the greater diversity of perspectives, which comes along with a larger TMT (Haleblian & Finkelstein, 1993; Certo et al., 2006), will attenuate both direct effects. We test our hypotheses on a longitudinal dataset of 103 FFs with 576 firm-year observations from the automotive, industrial engineering, and pharmaceutical sectors over the period 2013–2020. Our results support all our hypotheses, except for the proposed positive moderating effect of TMT size on the relationship between family CEO and DPI.

Our study makes the following contributions. First, by demonstrating the positive role of later generations for DPI and, conversely, the constraints imposed by a family CEO, we contribute to research on digital innovation in FFs (Ceipek et al., 2021; Soluk et al., 2021b) and FF heterogeneity (Chua et al., 2012; Daspit et al., 2021), providing insights into why some FFs are better or worse at achieving DPI. Second, we contribute to the broader FF literature by using a novel theoretical lens to challenge the often taken-for-granted assumption that FFs and their owner-managers are always long-term oriented. With this first attempt – to our knowledge – to use construal level theory as the theoretical basis for an empirical study in the family business context, we explain FF owner-managers' goal time horizon in light of the psychological distance they perceive toward the FF, ultimately contributing to the understanding of the variance in FFs' idiosyncratic decision-making (Kammerlander & Breugst, 2019). Third, we contribute to the digital innovation literature, which has so far mainly focused on the consequences of digital innovation (Yoo et al., 2010; Nambisan, 2017), by shedding light on which unique governance characteristics of FFs may be antecedents of DPI, as well as the moderating effect of TMT size. Thus, we also contribute to the debate on the importance of studying and framing digital innovation from a strategic perspective (Pesch et al., 2021; Vial, 2019).

Theoretical Framework and Hypotheses Development

Next, we review the literature on digital and product innovation in FFs. We then introduce construal level theory and explain how it allows us to explore the heterogeneity among FFs in terms of their

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DPI. Finally, we develop our hypotheses.

Digital and Product Innovation in FFs

FFs can be defined as firms that are governed and/or managed with the intention of shaping and pursuing the business vision of the controlling family members in a way that is sustainable across generations (Chua et al., 1999). Although decision-makers in FFs typically include both family and non-family members, family owners and family managers exert a particular influence on decision-making that goes beyond the simple number of shares (Berrone et al., 2010; Gu et al., 2019). They enjoy "certain control rights over the firm's assets" and a combination of soft power and authority that they use to impose their preferences and convince other decision-makers (Carney, 2005, p. 251; Kotlar & De Massis, 2013; Le Breton-Miller & Miller, 2006). Specifically, the presence of family owners and managers leads to idiosyncratic decision-making with respect to innovation (De Massis et al., 2013). For instance, research has shown that FFs of all sizes tend to limit their investments in innovation inputs (i.e., R&D) due to their willingness to preserve socioemotional wealth (Block, 2012). However, FFs convert innovation inputs into innovation outputs very efficiently, thanks to their superior resource orchestration and trusted external network (Duran et al., 2016). Moreover, when faced with the adoption of an innovative discontinuous technology, FFs may be slow to recognize the strategic importance of the technology, but once they do, they will implement it more quickly and with more stamina (König et al., 2013).

These idiosyncrasies induced by FF owner-managers might also influence decisions about DPI. However, given that the literature has extensively emphasized the difference between DPI and "traditional" product innovation in terms of product architectures, organizing logics, and innovation tools (Bunduchi et al., 2022; Lyytinen et al., 2016; Pesch et al., 2021; Wang et al., 2022), we assume that DPI in FFs requires a nuanced investigation. Specifically, DPI refers to the combination of digital and physical components to create novel products, often consisting of the enhancement of existing physical products through the incorporation of digital technologies (Yoo et al., 2010). Leveraging digital technologies for innovation is considered an imperative in the

current market, since DPIs open up new opportunities for creating, delivering, and appropriating value, which in turn enables firms to build a sustainable competitive advantage (Nambisan et al., 2017; George et al., 2021).

Despite these benefits, DPI is unique in that it is particularly risky and takes a long time to pay off, especially for firms in traditional industrial-age industries, and requires ongoing commitment from the decision-makers (Appio et al., 2021; Pesch et al., 2021). Specifically, DPI requires firms to make significant initial investments, while at the same time entailing a great deal of uncertainty (Müller et al., 2018; Xie et al., 2022). Many aspects contribute to this uncertainty. For example, digital technologies are often immature and complex to manage, and efforts to overcome these problems can be almost negated by their extremely rapid evolution (Ceipek et al., 2021; Fichman, 2004). Similarly, the complexity of DPI usually requires entering into new partnerships, which also entails risks and coordination costs (Vial, 2019). Furthermore, research highlights that organizational inertia is a threat that can easily lead to the failure of digital innovation projects (Lucas & Goh, 2009). Relatedly, engaging in DPI is also a long-term strategy for firms. Indeed, they very likely need time to acquire digital knowledge, build new partnerships, and reorganize the innovation function to overcome organizational inertia (Hanelt et al., 2021; Kohli & Melville, 2019; Svahn et al., 2017). In support of these arguments, research highlights that the benefits of engaging in digital innovation projects can be realized over an extended period of time and can impact long-term firm performance (Cappa et al., 2021; Devaraj & Kohli, 2000).

Despite providing notable insights, research on the digital transition of FFs – with the exception of a study on exploratory innovation in the context of the Internet of Things (Ceipek et al., 2021) – has lacked a specific focus on DPI and, in particular, overlooked the potential differences among FFs. This is surprising given that scholars have increasingly called for examining the heterogeneity of FFs (Chua et al., 2012; Daspit et al., 2021), which is crucial to understanding which specific characteristics enable or hinder DPI. So far, studies investigating digital transformation in FFs have identified potential barriers and enablers. For instance, family paternalistic leadership emerges as

a barrier, while the presence of non-family directors comes up as an enabler (Du et al., 2024). Moreover, some FFs respond to the challenges of digital transformation by establishing external corporate ventures (Prügl & Spitzley, 2021), while others make great efforts to sponsor their digital investments to signal and seek digital legitimacy from external stakeholders (Liu et al., 2023). In addition, prior studies paint a picture in which FFs are generally well-equipped to achieve digital business model innovation, and crises can be triggers toward these changes (Leppäaho & Ritala, 2022; Soluk et al., 2021a). For example, Soluk et al. (2021b) argue that FFs possess specific capabilities regarding the development of knowledge exploitation, risk management, and marketing, which in turn foster digital business model innovation. Similarly, FFs usually build long-term and trust-based relationships that facilitate knowledge sharing and enable superior learning mechanisms, ultimately fostering digital innovation (Ardito & Capolupo, 2023; Nieto et al., 2023; Xie et al., 2022). Finally, the idiosyncratic abilities of FFs to preserve, recombine, and develop resources promote digital innovation in general, while transgenerational control intentions hinder it (Bornhausen & Wulf, 2024).

Overall, the existing body of research has focused on digital transformation and digital business model innovation in FFs and has looked at them as a monolithic group, overlooking DPI and potential sources of heterogeneity among FFs. In the next sections, after introducing construal level theory, we examine how FFs controlled by different generations and led by a family CEO or an external CEO may differ in their DPI.

Construal Level Theory to explain FF Behavior

Drawing on psychology, construal level theory is based on the idea that each individual builds more abstract or more concrete mental representations (i.e., construals) of objects, entities, or events according to the psychological distance they perceive toward the target (Liberman & Trope, 1998). Specifically, the greater the psychological distance, the more abstract the construal is (Trope & Liberman, 2010). For example, in the entrepreneurship domain, the action of "starting a venture" can be described more abstractly as "a dream come true" or more concretely as "filing an entry into

the commercial register" (Tumasjan et al., 2013, p. 862). Prior research has identified four dimensions that psychological distance primarily refers to: time[1], space, personal involvement, and hypotheticality. In other words, people perceive more abstractly those objects or events that are distant in time and space, that happen to other people, or that seem unlikely to occur (Trope & Liberman, 2010). Studies also show that psychological distance toward a target and the resulting level of abstractness of the construal influence people's cognitions and behaviors, such as their predictions, evaluations, and the decisions related to that target (Soderberg et al., 2015).

From an innovation perspective, construal level theory is interesting because construals may be able to explain people's risk behavior and their prioritization of long-term vs. short-term goals, both of which influence innovation decisions (Tumasjan et al., 2013; Wiesenfeld et al., 2017). Specifically, more abstract construals are associated with greater risk taking and prioritization of long-term goals. In terms of risk behavior, for example, managers with more abstract construals are more likely to support radically new concepts in new product development, despite the greater risk associated with this type of innovation (Bauer et al., 2021; Liu et al., 2020). In terms of goal time horizons, higher-level construals "expand people's mental horizons and connect them to their broader and more distant goals" (Wiesenfeld et al., 2017, p. 369). For example, in his study of sustainable innovation, Mzembe (2021) finds that owners and/or managers with more abstract construals are more likely to make a large resource commitment to sustainability-oriented innovation because they prioritize the associated long-term environmental and economic impacts.

In applying construal level theory to decision-making, prior research has taken different approaches with respect to the target being construed. First, some studies focus on how individual characteristics shape construals regardless of the decision object. For instance, Steinbach et al.

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[1] In developing our hypotheses, we argue that earlier and later generations, as well as family and non-family CEOs, may perceive different psychological distances in terms of space, personal involvement, and hypotheticality. However, we make no assumptions about the time dimension. Indeed, the time dimension refers to *when* an event is happening, such as in the near future (e.g., tomorrow) or in a more distant future (e.g., next year). Since earlier and later generations, as well as family and non-family CEOs, all already control and manage the firm, their perceived temporal psychological distance can be assumed to be similar, i.e., low, since they are currently involved in the firm.

(2019) examine how managers make acquisition decisions by focusing on primary construal levels that are shaped by their personality traits, orientations, and values, thus largely ignoring the psychological distance they perceive toward the firm to be acquired. Second, other studies take an approach in which the target construed and the decision object overlap. For example, this is the case for entrepreneurs who evaluate an opportunity based on the psychological distance they perceive toward it (Duan et al., 2022). Third, other studies consider that the target construed and the decision object may differ, even though related. For example, a manager may make a decision about an idea proposed by an employee based on the psychological distance that she/he perceives toward the employee rather than the idea itself (Schreurs et al., 2020).

In this study, we follow the third approach, building on the assumption that FF decision-makers make strategic decisions – such as engaging in DPI – depending on the associated construal of the firm they control. This approach seems ideal as it is renowned that FF idiosyncrasies especially emerge from the special relationship that FF owner-managers have with their firm (e.g., Berrone et al., 2012; Zellweger et al., 2013). Accordingly, research proposing the application of construal level theory to FFs argues that it is the psychological distance toward the FF – and the construal derived – that shapes the strategic decisions of FF owner-managers (Kammerlander & Breugst, 2019). Likewise, research drawing from psychology to better understand the heterogeneous behaviors of FFs suggests that such heterogeneity is based on the unique relationship between FF owner-managers and their firms (Bee & Neubaum, 2014; Björnberg & Nicholson, 2012; Picone et al., 2021). Thus, we assume that it is the specific construal of the firm as perceived by decision-makers that influences their respective decisions. Specifically, in the following, we theorize how construal level theory can inform DPI-related decisions in FFs.

As discussed in the previous section, engaging in DPI can be viewed as a risky and long-term decision (Appio et al., 2021; Pesch et al., 2021). According to construal level theory, firm decision-makers who perceive higher psychological distance toward their firms tend to make riskier decisions and prioritize long-term goals compared to those with lower psychological distance.

Combining these notions, decision-makers who perceive higher psychological distance (i.e., build more abstract construals) may foster DPI in their firms.

In this sense, construal level theory allows us to account for the variance among FFs and explain their heterogeneity in terms of DPI in light of their owners' and managers' different construals, thus addressing the lack of research on FF heterogeneity and digital (product) innovation. Broadly speaking, FF owner-managers may construe their family business in heterogeneous ways, depending on the psychological distance they perceive toward it. For example, they may describe their firm more concretely as "a manufacturer of our products" or "a source of income", or more abstractly as "our family tradition" or a "legacy that needs to be maintained for the future" (Kammerlander & Breugst, 2019, p. 223). Focusing on FFs controlled by family members from different generations and the presence of a family or non-family CEO, we propose that the higher (lower) psychological distance perceived by these FF owner-managers leads to more (less) DPI in FFs. In the next sections, we highlight the relevance of these two sources of heterogeneity for DPI and develop our hypotheses. Specifically, we argue how different generations and a family vs. non-family CEO perceive heterogeneous psychological distances toward the firm and, in turn, build different construals that lead to different levels of DPI.

Generation in Control and DPI

The generation in control – i.e., the generation of family members who own the majority of the equity and thus direct the FF (Gu et al., 2019; Kraiczy et al., 2015; Ling & Kellermanns, 2010) – has emerged as a prominent factor in explaining FF innovation outcomes (Beck et al., 2011; Dieleman, 2019; Hillebrand et al., 2020). Family owners belonging to earlier generations (i.e., the founder's generation and those closer to the founder) and later generations (i.e., those distant from the founder's generation) possess "distinctive knowledge endowments and patterns of emotional relationships" toward their firm (Chirico & Kellermanns, 2022, p. 3). Similarly, family owners belonging to different generations have different risk preferences and reference points when influencing innovation decisions, including DPI (Kellermanns et al., 2012; Nason et al., 2019).

Specifically, we argue that earlier and later generations in control of the FF have different construals of the firm, leading to different goal time horizons and risk preferences that ultimately affect DPI.

First, earlier and later generations in control may perceive different psychological distances toward the firm in terms of space. In the founding and earlier generational stages, FF owners often live close to the firm, and the household may even be the firm's first location (Aldrich & Cliff, 2003). Conversely, FFs in later generational stages are typically in the so-called sibling partnership or cousin consortium phase, where owners may be dispersed and live in different locations or even countries (Gersick et al., 1997). Indeed, later generations often leave home for education or work purposes and continue to live far from the FF, even if they continue to own shares (Jaskiewicz et al., 2015; Wiklund et al., 2013). For these reasons, the perceived spatial distance of later generations toward the FF will be greater compared to earlier generations.

Second, the personal involvement of family owners from different generations may vary, and thus the relative psychological distance. In the earlier stages of the firm, when earlier generations control the FF, family members tend to dedicate their lives to the business. As the firm is still growing and resources are relatively scarce, family owners are involved in all business activities, including the more operational ones (Cruz & Nordqvist, 2012; Sirmon & Hitt, 2003). On the contrary, FFs in later generational stages tend to be more professionalized, which is a prerequisite for managing the increased complexity involved (Minola et al., 2016). Therefore, these FFs will employ more external managers and thus require less day-to-day involvement of the family owners. In terms of personal involvement, emotional involvement may also change across generations. In fact, earlier generations tend to be more emotionally attached to the firm than later generations (Gomez-Mejia et al., 2007; Le Breton-Miller & Miller, 2013). For these reasons, we argue that later generations will perceive greater psychological distance toward the FF in terms of personal involvement.

Third, different generations may also perceive heterogeneous distances in the hypotheticality

dimension. When the firm is controlled by earlier generations, the family and the firm tend to be smaller, making it more likely that family members from earlier generations will join the firm at a later date. Indeed, they are needed in the FF as part of the workforce due to limited resources (Chrisman et al., 2002; Kellermanns & Eddleston, 2006) and to ensure transgenerational control (Zellweger et al., 2012), as the pool of family members who can be appointed as future owner-managers is also limited (Bennedsen et al., 2007). These considerations diminish in the case of later generation family members. In fact, as the family grows, the likelihood of becoming a FF owner-manager is lower because the pool of family members is larger, and at the same time, the pressure to join the firm is lower because resources have expanded over time (Combs et al., 2021). Accordingly, later generation family members "are also exposed to the potential succession scenario for a longer time frame, over which they will imagine a variety of potential options regarding their own identity and role in the narrative of the family firm" (Kammerlander & Breugst, 2019, p. 225). Based on these considerations, we predict that later generations may feel greater psychological distance in the hypotheticality dimension.

Overall, we argue that family members belonging to later generations will perceive greater psychological distance toward the firm in terms of space, personal involvement, and hypotheticality compared to earlier generations. According to construal level theory, this greater distance will trigger higher-level construals of the firm, which in turn will make family members of later generations more prone to risky decisions and more concerned about long-term goals (Duan et al., 2022; Wiesenfeld et al., 2017). Given that engaging in DPI can be viewed as a risky and long-term decision, as we argued in the theoretical background, later generations will influence decisions in favor of DPI more strongly than earlier generations due to their higher construal levels. More formally:

H1. *Later generations in control are positively associated with DPI in FFs.*

Family CEO and DPI

The CEO is central to firm innovation, as she/he influences the allocation of resources and the

innovation process itself in terms of guiding middle managers in innovation projects and setting up structures that promote organizational learning and knowledge management (Duran et al., 2016). Accordingly, the CEO's priorities and reference points can shape the firm's DPI, and this is particularly true for a family CEO, who typically has strong power over strategic decisions (Brumana et al., 2017; Strike et al., 2015). Specifically, we propose that a family CEO (external CEO) will perceive less (more) psychological distance toward the firm. In turn, a family CEO with a more concrete construal should inhibit DPI in the FF, whereas an external CEO with a more abstract construal should promote DPI.

First, a family CEO may perceive less psychological distance toward the firm in terms of space compared to an external CEO. Indeed, a family member appointed as CEO is expected to have a great deal of experience within the firm and to have worked there for a long time (Giner & Ruiz, 2022; Sardeshmukh & Corbett, 2011), which also makes it very likely that s/he has lived and continues to live close to the firm. Conversely, given the mobility of today's labor market, especially for top positions, an external CEO is very likely to come from a different region and be extraneous to the local context (Çolak & Korkeamäki, 2021; Custódio et al., 2019).

Second, a family CEO may perceive less distance in terms of personal involvement. Recalling the three-circle model of FFs (Tagiuri & Davis, 1996), representing the family, the ownership, and the business management, a family CEO is located at the intersection of the three circles, implying a high level of involvement and more concrete construals (Kammerlander & Breugst, 2019). Conversely, the personal involvement of an external CEO is limited to the management side of the business, thus excluding entanglement in ownership and family matters. Relatedly, a family CEO's emotional involvement will also be higher compared to an external CEO (Delgado-García et al., 2022), as her/his identification and attachment to the firm will be stronger (Fang et al., 2021; Naldi et al., 2013). Again, this closer bond of a family CEO to the firm will trigger more concrete construals.

Third, the perceived hypotheticality distance of a family CEO may be lower when measured

against the perceived distance of a non-family CEO. As discussed above, a family CEO is likely to have worked and dedicated her/his entire life to the business. It is also possible that s/he has known since childhood that s/he will likely become CEO of the FF (Ahrens et al., 2019). Moreover, the hypothesis of leaving is often not even an option in the mind of a family CEO. Indeed, research has shown that family CEOs have greater power and authority than their non-family counterparts (Miller et al., 2013; Strike et al., 2015), which also leads to their longer tenure (Brumana et al., 2017; Le Breton-Miller & Miller, 2006). This long tenure, in turn, consolidates a family CEO's power and authority, creating a self-reinforcing loop that makes dismissal highly unlikely (Chen et al., 2013; Keil et al., 2017). Conversely, an external CEO may have considered many job offers and different scenarios, of which joining the specific FF was only one and therefore less likely compared to a family member. In addition, an external CEO knows that the probability of eventually being dismissed is quite high (Gentry et al., 2021; Jenter & Kanaan, 2015). Overall, this suggests that a family CEO may perceive less psychological distance in the hypotheticality dimension.

In sum, considering the CEO as a key decision-maker for DPI, these arguments show how and why a family CEO should feel less psychological distance toward the firm and thus build more concrete construals compared to an external CEO. These types of construals will make her/him more focused on the firm's day-to-day problems and short-term goals (Wiesenfeld et al., 2017). Coupled with the more risk-averse behavior fostered by concrete construals (Duan et al., 2022), these characteristics could result in a family CEO not taking the necessary actions to engage in DPI, thus negatively affecting the firm's DPI. Accordingly, we hypothesize:

H2. *Family CEOs are negatively associated with DPI in FFs.*

The Moderating Role of TMT Size

In the previous hypotheses, we focused on the impact that FF owners and managers, i.e., the controlling family generation and family CEO, exert on DPI through their influence on decision-making. However, while the controlling family generation and the (family) CEO have a strong

influence on DPI-related decisions, these are not in their hands alone, but also involve other FF decision-makers, i.e., TMT members (Calabrò et al., 2021; Jin et al., 2017). Put differently, FF owners and managers work to enforce their own risk preferences and goal time horizons, but they also have to consider the perspectives of other TMT members, which might not be part of the family, when making DPI decisions and are likely to be influenced by them. Indeed, TMT members are key actors in shaping a firm's strategy, to the extent that the TMT composition and characteristics strongly influence organizational outcomes (Hambrick, 2007; Zimmerman, 2008). For instance, in the context of FFs, scholars have found that TMT composition directly or indirectly affects financial performance (Calabrò et al., 2021; Minichilli et al., 2010), entrepreneurial orientation (Sciascia et al., 2013), and innovation (Kammerlander et al., 2020; Kraiczy et al., 2014).

In particular, the size of the TMT is a relevant characteristic that affects decision-making. Research has argued that a larger TMT has at its disposal more capabilities and resources to address strategic issues (Haleblian & Finkelstein, 1993), but faces more difficulties in reaching consensus (Certo et al., 2006). This is because a larger TMT is also likely more heterogeneous (Amason & Sapienza, 1997; Jin et al., 2017; Rovelli et al., 2020). Indeed, various sources of heterogeneity can manifest as the size of the TMT increases, such as functional background, education, age, tenure, gender, ethnicity, and nationality (Calabrò et al., 2021; Hogg & Terry, 2000; Zimmerman, 2008). In FFs, membership in the controlling family represents another source of heterogeneity, as well as the multiple family generations that may be involved in the TMT (Ceipek et al., 2021; Kraiczy et al., 2014; Sciascia et al., 2013). Overall, a larger TMT size is likely associated with greater diversity among its members (Rovelli et al., 2020), and this will be reflected in decision-making.

Specifically, we argue that these differences potentially generate a wider range of construals among TMT members, ultimately mitigating the effect of later generations in control and family CEOs because they will confront TMT members with different risk preferences and goal time horizons. For example, in a larger TMT, there are likely to be members who perceive different spatial psychological distances toward the firm due to the potential diversity in personal

background and even nationality. Indeed, if the firm is located in their region or country of origin, the spatial psychological distance perceived by the manager may be lower. Conversely, if the TMT member works in a firm located in a foreign country or region, she/he may perceive greater spatial psychological distance. In addition, family TMT members may perceive less spatial distance toward the FF than non-family TMT members, which complement especially larger TMTs. This is because they are more likely to have lived close to the firm, especially if they belong to earlier generations (Aldrich & Cliff, 2003), or visited the location frequently during childhood and adolescence.

Furthermore, in larger TMTs, members may perceive different psychological distances in terms of personal involvement, given their different functional backgrounds, tenure, and nationality. Functional background refers to the business function in which a TMT member has accumulated experience and training, reflecting knowledge, skills, and expertise (Hambrick & Mason, 1984; Zimmerman, 2008). A manager may perceive less (more) psychological distance in terms of personal involvement if her/his expertise and education are related (unrelated) to the industry in which the firm operates because she/he is more (less) familiar with it (Falchetti et al., 2022; Gillier & Schweitzer, 2021). Tenure reflects an individual's perspectives, belief systems, networks, affiliations, and commitment to the status quo (Richard & Shelor, 2002; Zimmerman, 2008). TMT members with longer (shorter) tenure may be more (less) attached and committed to the firm. Therefore, their perceived distance in terms of personal involvement will be lower (greater) (Breugst et al., 2012). Regarding nationality, firms develop internal cultures related to the country in which they operate (Sasaki et al., 2020), and a TMT member may feel more or less personally involved in this culture depending on her/his national culture. In addition, members of the controlling family may generally feel more involved and therefore perceive less psychological distance toward the firm compared to non-family members in the TMT.

Finally, we argue that a larger TMT size is associated with a higher probability that the hypotheticality distance perceived by its members varies. Specifically, the hypotheticality distance

perceived by TMT members may differ depending on their prior experience and education. Indeed, a higher (lower) fit between their work experience and education and their role in the firm might increase (decrease) the likelihood that they will continue to work there, thus reducing (increasing) the hypotheticality distance. Finally, non-family TMT members will perceive more hypotheticality than family members in the TMT due to their greater number of job options.

Overall, this line of reasoning highlights that, in a larger TMT, it is reasonable to expect higher heterogeneity among its members, each with their own psychological distance toward the firm, hence suggesting different construals among TMT members. In other words, TMT members will have different risk behaviors and goal time horizon priorities (Duan et al., 2022; Wiesenfeld et al., 2017), not all of which will align with those of the controlling family members. Therefore, FF decision-makers must more frequently negotiate among different perspectives when making DPI-related decisions in the presence of a larger TMT (Amason & Sapienza, 1997; Ling & Kellermanns, 2010; Minichilli et al., 2010). FF owner-managers play a dominant role in such negotiations and exert considerable influence over decisions. Nevertheless, during these interactions, the other TMT members work to persuade FF owner-managers and make their own preferences prevail (Haleblian & Finkelstein, 1993; Cruz et al., 2010; Kammerlander et al., 2020; Kraiczy et al., 2015). As a result, it is likely that in the presence of a larger TMT, FF owner-managers' risk and goal time horizon preferences are mitigated when making DPI decisions because they consider the different perspectives of other FF decision-makers.

Specifically, the riskier behaviors and long-term goals of later generations that ultimately promote DPI are likely to be mitigated in the presence of a larger TMT. Indeed, the more TMT members there are, the higher the likelihood that some components will have more risk-averse and short-term perspectives that later generations must consider and accommodate. Therefore, these mitigating perspectives stemming from a larger TMT may influence their judgment and ultimately reduce their positive impact on DPI. More formally, we hypothesize:

H3. A larger TMT weakens the positive relationship between later generations in control of the

FF and DPI.

Similarly, we suggest that the variety of construals of a larger TMT may influence a family CEO's decision-making. Previously, we argued that the close psychological distance perceived by a family CEO makes her/him more risk-averse and concerned with short-term goals, thus hindering DPI. However, the members of a larger TMT are likely heterogeneous (Amason & Sapienza, 1997; Jin et al., 2017; Rovelli et al., 2020) and, therefore, diverse psychological distances are likely to coexist among them. Specifically, as argued above when developing H3, different TMT members may perceive different psychological distances in terms of: (i) space, due to their diverse countries or regions of origin and family or non-family member status; (ii) personal involvement, due to their different functional backgrounds, tenure, nationality, and family member status; (iii) hypotheticality, due to their diverse work experience, education, and family member status. In turn, given this wider array of psychological distances that are likely to coexist in a larger TMT, TMT members will have different risk preferences and goal time horizons. Although - according to construal level theory - a family CEO will be more risk averse and concerned with short-term goals, in the presence of a larger TMT, s/he is likely to interact with TMT members who are also more risk-inclined and prioritize long-term goals. Accordingly, a family CEO's judgment may be influenced by these perspectives, thereby mitigating her/his negative impact on DPI. Therefore:

H4. *A larger TMT weakens the negative relationship between the presence of a family CEO and DPI.*

Methods
Sample and Data Collection

To test the relationships proposed in our hypotheses, we constructed a unique longitudinal database of publicly traded FFs from the automotive, industrial engineering, and pharmaceutical sectors operating in North America, Europe, and Southeast Asia. Samples of publicly traded firms have been used extensively in FF research (e.g., Braun & Sharma, 2007; Gomez-Mejia et al., 2003) and, because we rely on secondary data, data availability and reliability are higher for publicly traded

firms as compared to private ones (Michiels & Molly, 2017; Tsao et al., 2009). We focus on automotive, industrial engineering, and pharmaceutical firms because they are among the industrial-age industries currently undergoing digital transformation (McKinsey & Company, 2019; Sehlstedt et al., 2016; Svahn et al., 2017), and achieving DPI is therefore an important but risky goal. Moreover, family involvement in ownership and management is common for firms in these sectors (Villalonga & Amit, 2010), as is the tendency to patent their innovative outcomes (WIPO, 2022), which allows us to use patents as a reliable proxy to measure DPI. Finally, we focus on firms operating in North America, Europe, and Southeast Asia due to access to richer data in our database.

The starting point for our data collection was the NRG Metrics database, which has been validated in both the management and finance literature (e.g., Delis et al., 2020; Miroshnychenko et al., 2021), and provides data on ownership structure, corporate governance, directors and officers (including family involvement) for over 8.000 publicly traded firms around the world[2]. It also includes information on the generation controlling the firm in case of FFs, the presence of a family CEO, and TMT size. We extracted firms in the automotive (auto parts, automobiles, and tires subsectors), industrial engineering (industrial machinery and commercial vehicles & trucks subsectors), and pharmaceutical (biotechnology and pharmaceuticals subsectors) sectors located in North America (i.e., US and Canada), Europe (i.e., the EU27 countries plus Norway and Switzerland), and Southeast Asia (i.e., India, Indonesia, Japan, Singapore, and South Korea). Next, we identified FFs. In line with the literature, we classified firms as FFs if the controlling family is involved in both ownership and management (Anderson & Reeb, 2003). Specifically, FFs had to meet two criteria: (1) the controlling family owns at least 10% of the shares (Gomez-Mejia et al., 2010; Nekhili et al., 2017); and (2) at least one family member sits on the board of directors (Tao-

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[2] NRG Metrics collects data through annual reports generally obtained from the firms and other sources, such as presentations, SEC filings, and press releases. NRG Metrics employs expert analysts to manually enter, review, and crosscheck data with senior analysts who frequently perform random audits. To ensure the quality of the data, NRG Metrics has developed proprietary software that tracks all the inconsistencies and errors in the data.

Schuchardt et al., 2022; Werner et al., 2018). Since the NRG database also identifies lone-founder firms, we were able to ensure that these firms were excluded from our sample.

For all the identified FFs, we then collected firm-level financial and accounting data from Orbis (Bureau van Dijk), which mainly served as control variables. In some cases, firms were not included in Orbis and were therefore excluded. If more than one firm with the same name was registered in Orbis, we checked the country of origin and selected the firm whose country of origin matched the NRG database. Since Orbis provides data from 2013 for most of our sample firms, our final sample consists of 103 FFs observed over the period 2013–2020 (576 firm-year observations). The final panel is unbalanced, as we include firms that were active for the entire 8-year period, firms that were founded during this period, and firms that became inactive during the observation period. This also allows us to mitigate survivorship bias (Elton et al., 1996). Finally, for each FF, we collected granted patent families (PFs) and related bibliographic information (e.g., application year, cited patents, International Patent Codes – IPC) from the Questel Orbit Intelligence FamPat database to measure our dependent variable.

Variables

Digital product innovation is our dependent variable and a patent-based measure. Patents have been used in previous studies to capture product innovation in general (e.g., Dosi et al., 2015), and DPI in particular (Pesch et al., 2021). Specifically, *DPI* is operationalized as the number of digital PFs filed by a firm in year t.[3] When a PF is granted, it is assigned to a set of IPC codes according to the technological domains to which it belongs. We classify a PF as digital if it is assigned to an IPC code belonging to the ICT domain, as defined in the relevant OECD report by Inaba and Squicciarini (2017). This variable is measured with a one-year lag with respect to the independent variables, as we assume that PFs in year t reflect the outcomes of a previous ownership and

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[3] All the PFs considered were granted to the firms. Nevertheless, we consider the filing year rather than the grant year because the former better reflects the period during which the DPI was developed. In fact, the grant year is subject to the duration of the examination process, which may take several years and may also vary by country. In addition, firms can use their patents from the year of filing.

management structure.

Generation in control refers to the generation that owns the majority of the equity and thus guides the FF (Gu et al., 2019; Kraiczy et al., 2015; Ling & Kellermanns, 2010). Of the firms in our sample, 44% are controlled by the first generation, 24% by the second generation, 15% by the third generation, and 17% by the fourth generation. *Family CEO* is a dummy variable equal to 1 if the CEO position is held by a member of the controlling family, 0 otherwise. Of the firms in our sample, 27% have a family CEO. *TMT size* is our moderating variable operationalized as the number of members of the TMT.

Control variables. To help control for potential differences across FFs, we controlled for *family ownership* operationalized as a continuous variable reflecting the percentage of ownership shares held by the family, and for the presence of a *family chairman*, a dummy variable equal to 1 if the chairman is a family member, 0 otherwise. To improve reliability, we included several control variables that may affect DPI. We controlled for *firm age*, calculated as the number of years since the firm was founded, to address the potential for higher levels of innovativeness in younger organizations (e.g., Kraiczy et al., 2015). We controlled for *firm size*, measured as the number of employees, because larger firms may have more slack resources to devote to innovation activities (e.g., Beck et al., 2011). We controlled for *R&D expenses*, which represent the firm's R&D expenditures, as it is a relevant innovation input (e.g., Bammens et al., 2022). We controlled for *leverage*, measured as total debt to total assets (e.g., Sekerci et al., 2022), because a firm's financial well-being affects innovation decisions (Nemlioglu & Mallick, 2021). *Patent stock*, which reflects the firm's prior knowledge, is calculated as the number of patents granted to the firm in the previous five years and is controlled to address concerns that firms may develop more innovations when working with a larger stock of prior knowledge (e.g., Decker & Günther, 2017). With the exception of firm age, all these variables are log-transformed. Finally, to account for possible environmental factors, we control for *industry effects* and *country effects*. For the latter, we grouped countries into three variables: North America, Europe, and Southeast Asia.

Model Specification

We used a random effects negative binomial regression model to test our hypotheses. As our independent variable is a non-negative integer count variable that is not normally distributed, the Poisson or negative binomial longitudinal econometric approach are appropriate. Because our dependent variable is overdispersed (i.e., the mean is lower than its standard deviation), we chose a negative binomial model over the Poisson model because it corrects for overdispersion (Wooldridge, 2012). In addition, we used a random effects model because it allows accounting for time-invariant variables (Wooldridge, 2012).

Findings

Table 1 presents the descriptive statistics and pairwise correlations. The correlation values are all below the 0.70 threshold, thus avoiding multicollinearity concerns (Cohen et al., 2014).

(Insert Table 1 about here)

Table 2 shows the results of the negative binomial regression. We use partial models to present the results. Model 1 includes only the control variables. Models 2 and 3 include the independent variables *generation in control* and *family CEO*, respectively. Models 4 and 5 include the interaction terms "*TMT size* x *generation in control*" and "*TMT size* x *family CEO*", respectively. Finally, Model 6 is the full model and includes all the variables. In Model 1, the coefficient of *patent stock* is positive and significant ($\beta = 0.918$, $p < 0.01$) and the coefficient of *firm size* is negative and significant ($\beta = -0.351$, $p < 0.01$), indicating that the firm's stock of prior knowledge positively affects DPI, while larger firms have more difficulties in developing DPI. This negative effect could be explained in light of the problems larger firms may face in reorganizing the innovation function for DPI, entailing higher organizational inertia and coordination costs (Lucas & Goh, 2009; Vial, 2019).

H1 predicts that FFs controlled by later generations will be associated with more DPIs. Model 2 provides empirical support for H1, as the coefficient of *generation in control* is positive and statistically significant ($\beta = 0.377$, $p < 0.05$).

H2 proposes that the presence of a family CEO has a negative effect on DPI compared to FFs where the CEO is a non-family member. In Model 3, the regression coefficient of *family CEO* is negative and statistically significant (β = -1.260, p <0.01). Thus, H2 is supported.

H3 posits that a larger TMT weakens the positive effect of later generations in control on DPI. Model 4 provides empirical support for H3, as the interaction term between *generation in control* and *TMT size* is negative and statistically significant (β = -0.132, p <0.05). To better interpret the moderating effect, we provide a graphical representation of the interaction effect in Figure 1 considering two different levels of *TMT size*, i.e., one standard deviation below the mean and one standard deviation above the mean (Hoetker, 2007). The figure shows that a larger TMT weakens the positive relationship between *generation in control* and *DPI*, providing further support for H3.

H4 predicts that a larger TMT weakens the negative effect of a family CEO on DPI. Since in Model 5 the interaction term between *family CEO* and *TMT size* is positive but not statistically significant (β = 0.329, p = 0.078), H4 is not supported, although the sign is consistent with our prediction. Finally, the full Model 6 shows similar results, namely H1, H2, and H3 are supported, while H4 is rejected.

(Insert Table 2 and Figure 1 about here)

Robustness Tests

To ensure the reliability of our main findings, we conducted a series of robustness tests reported in Table 3. First, we tested our results by using different FF definitions. Following prior research, we considered different thresholds of shares owned by the family to classify a firm as a FF, namely 5% and 20% (Chrisman & Patel, 2012; Sekerci et al., 2022). The results in Models 7 and 8 confirm our main findings: H1, H2, and H3 are supported, while H4 is not. Second, we checked our results by considering a 2-year time lag between the independent and dependent variables. Model 9 presents the results, which are again consistent with our main results. Third, we tested the robustness of our DPI measure using a different operationalization. Specifically, instead of the number of digital PFs filed by a firm in year *t*, we considered the ratio to the total number of PFs

filed by the same firm in year t (digital plus non-digital). We tested this alternative measure with 1-year lag in Model 10. To perform this test, we ran a Tobit regression model because the dependent variable is censored and limited (Long, 1997). Model 10 supports H1 and H2, while H3 loses significance. Fourth, we performed a series of likelihood-ratio tests on our main results (i.e., from Model 1 to 6). Comparing each model to its nested model, the likelihood-ratio tests show a statistically significant improvement in every case, except when comparing Model 5 to Model 3, which is consistent with H4 not being supported.

(Insert Table 3 about here)

Our arguments in the moderating hypothesis are based on the idea that diversity increases with TMT size (Amason & Sapienza, 1997; Certo et al., 2006; Jin et al., 2017; Rovelli et al., 2020). To further scrutinize this assumption, we conducted a manual search of the sample firms' websites (specifically, TMT members' profile pages) and online platforms (primarily LinkedIn) to collect additional data on TMT members. In particular, we collected data on the following characteristics of TMT members: industry experience, education field, education level, tenure, nationality, and controlling family membership. Specifically, we assessed Blau's heterogeneity index (Wiersema & Bantel, 1992), which is calculated as the inverse of the Herfindahl-Hirshman homogeneity index (e.g., Barkema & Shvyrkov, 2007; Boone et al., 2004), with respect to industry experience, education field, education level, nationality, and controlling family membership. We calculated tenure diversity as the coefficient of variation, i.e., the standard deviation divided by the mean (e.g., Wiersema & Bantel, 1992; Bengtsson et al., 2020). In a subsequent step, we normalized and summed all these diversity measures to construct a comprehensive index of *TMT diversity* (e.g., Boone et al., 2004; Talke et al., 2011). We performed several tests. First, we conducted a correlation test between our measure of *TMT size* and *TMT diversity*. We found that *TMT diversity* is positively and significantly correlated with *TMT size* ($\beta = 0.309$, $p < 0.05$). Second, we ran a linear regression between *TMT size* and *TMT diversity*, and the coefficient of *TMT size* is positive and significant ($\beta = 0.185$, $p < 0.00$). Therefore, these results support our assumption that a larger TMT is more

diverse. Finally, we tested our models with this measure of *TMT diversity* as a moderating variable instead of *TMT size*. The results support our main findings, i.e., H3 is supported while H4 is not. Since data on TMT characteristics are only available as a snapshot in time and are therefore time-invariant, based on the current TMT, we cannot base our main analyses on this more nuanced measure. However, combining the results of our robustness tests with the general acknowledgment that TMTs change only slightly over a decade (Cruz et al., 2010; Heyden et al., 2017), we are confident that our respective results are robust.

Finally, we performed some post-hoc analyses. First, one could speculate about an interaction effect between *generation in control* and *family CEO* because, despite having separate roles, it is possible that they interact and thus influence each other when making DPI-related decisions. For similar reasons, it might be worth investigating also the effect of the three-way interaction between *generation in control, family CEO*, and *TMT size*. Therefore, we tested for these potential effects in a post-hoc analysis; the results, however, showed that these effects were not significant. Second, as we also collected data on non-family firms, we performed a post-hoc analysis to compare DPI in FFs vs. non-family firms. We decided to run this test because of the idiosyncratic behavior of FFs in innovating with discontinuous technologies (König et al., 2013) – such as digital technologies – and because prior research has specifically focused on assessing digital business model innovation in FFs vs. their non-family counterparts (e.g., Soluk et al., 2021b), while overlooking DPI. We performed this post-hoc test on a sample of 436 family and non-family firms (3053 firm-year observations) and the results show that FFs are better at developing DPI than non-family firms ($\beta = 0.562$, $p < 0.01$).

Discussion, Future Research Directions, and Conclusions

Using a sample of 103 FFs in the automotive, industrial engineering, and pharmaceutical industries observed from 2013 to 2020, we find, as hypothesized based on construal level theory, that later generations in control of the FF positively influence DPI, while a family CEO hinders DPI. Finally, we find that a larger TMT weakens the positive relationship between later generations in control

and DPI (as expected), but we find no empirical support for a larger TMT weakening the relationship between family CEO and DPI.

Theoretical Implications

Our study provides three main contributions. First, we add to the literature on FF digital innovation and FF heterogeneity, extending the findings of previous studies on digital innovation in FFs that are so far limited to comparing family and non-family firms and examining digital business model innovation (Soluk et al., 2021b; Xie et al., 2022). Indeed, we offer a first attempt to account for the heterogeneity of FFs (Chua et al., 2012; Daspit et al., 2021) when examining their DPI. The family generation in control and the presence of a family CEO are two important sources of heterogeneity among FFs that have long attracted scholarly attention (e.g., Beck et al., 2011; Naldi et al., 2013), but still puzzle researchers in terms of their impact on FF innovation outcomes (e.g., Hillebrand et al., 2020; Zybura et al., 2021). To explain how different generations in control and CEO type affect DPI, we draw on construal level theory (Trope & Liberman, 2010), which has recently been highlighted as relevant for making sense of different FF owner-managers' decisions and the resulting outcomes (Kammerlander & Breugst, 2019). We believe that compared to conventional management theories in family business research (e.g., agency, stewardship, or social capital theories), construal level theory can provide a more comprehensive understanding of the heterogeneous perceptions that different FF owner-managers have of the FF and how these perceptions shape their goals, decisions, and behaviors. While all members of the controlling family might share emotional attachment and wealth at stake, construal level theory suggests that the perceptions of the FF might still differ, depending on their psychological distance. Accordingly, we strongly encourage FF scholars to draw on construal level theory in future studies. In addition, by focusing on DPI, we extend prior studies limited to analyzing digital business model innovation in FFs (e.g., Soluk et al., 2021b; Xie et al., 2022). Indeed, digital business model innovation is mainly concerned with the exploitation of digital technologies to develop new ways to create and capture value (Müller et al., 2018; Teece, 2018). In this sense, it may also refer to using new digital

channels to reach the customers or new digital systems to manage internal activities more efficiently, thus involving fewer radical changes in the actual products. Conversely, DPI entails the development of new products based on digital technologies (Yoo et al., 2010), and therefore may be more complex and require more time and resources (Lyytinen et al., 2016).

Second, we contribute to FF research in general by challenging the *a priori* assumption that FF owner-managers prioritize long-term goals when making decisions (Le Breton-Miller & Miller, 2006; Lumpkin & Brigham, 2011). Such a conversation, which is rooted in the transgenerational control intentions of FF owner-managers (Zellweger et al., 2012), has led to different conclusions with respect to FF innovation activities. While, on the positive side, long-term goals may favor innovation investments, on the negative side, transgenerational control may be jeopardized by the risk entailed in such investments (Le Breton-Miller & Miller, 2006; Miller et al., 2013). In this study, drawing from construal level theory, we argue that if FF owner-managers perceive the firm more concretely, they may also be more concerned about short-term goals. Hence, even if their overall goal is to lead the firm into the future and pass it to the next generation at some point in time, their specific decisions made in the day-to-day business might still be short-term oriented, depending on the specific construals. Accordingly, to the best of our knowledge, this is the first attempt to use construal level theory as the theoretical underpinning of an empirical study in the family business context. By arguing that the heterogeneous construals of FF owner-managers induce different risk behaviors and goal time horizons, we enrich the debate on this topic. Although we argue and find that more abstract construals are associated with higher DPI, we do not claim that more abstract construals, and thus the long-term view, are beneficial or superior in every situation. For example, there may be turbulent market or institutional conditions in which a more cautious approach to investing (i.e., more concrete construals), and thus a short-term view, may be preferable.

Third, we contribute to digital innovation research (Yoo et al., 2010, 2012; Nambisan, 2017; Nambisan et al., 2017). This literature stream has attempted to shed light on digital innovation

activities, the role of the external competitive environment, the internal organizational environment, and the outcomes of digital innovation products, services, and processes (Kohli & Melville, 2019). In contrast to prior studies that mainly focus on the *consequences* of digital innovation (e.g., Cappa et al., 2021; Hanelt et al., 2021), our study contributes to the emerging research at the intersection of digital product innovation and organizational structures (Appio et al., 2021) by considering the presence of different FF owner-managers as a potential *antecedent* of DPI. Focusing on the governance structure of (family) firms, we shed light on the impact of family involvement in ownership and management and TMT size on DPI. In doing so, we highlight the key role of the firm's governance structure for digital transformation and support prior research that advocates the need to frame digital innovation as a strategic initiative (Pesch et al., 2021; Vial, 2019). Indeed, we argue that the commitment of key decision-makers can be critical to engaging in DPI, especially for firms that may struggle with it, such as traditional industrial-age industries.

Practical Implications

Our work also has practical implications. First, we show that FFs controlled by later generations develop more DPIs. Accordingly, senior FF owner-managers may want to cede control to the next generation(s) if circumstances allow them to do so. If this is not possible, they should involve and trust the next generation(s) in decision-making, especially with respect to digital innovation. Second, we find that the effect of generation in control is mitigated by a larger TMT. Accordingly, if later generations cannot yet be involved in decision-making, we inform earlier generations of FF owner-managers that another option to better pursue DPI might be to increase the size of the TMT. Third, we find that a family CEO is detrimental to DPI. Therefore, FFs that want to excel in DPI should recognize this limitation and consider hiring an external CEO. As an alternative, they might consider appointing a non-family chief digital officer and giving her/him as much power as possible over digital innovation projects. In this way, they could overcome, or at least mitigate, the constraints imposed by the presence of a family CEO. Fourth, as we base our arguments on construal level theory, FF owner-managers and FF advisors may wish to consider the construal

perspective when designing interventions to improve strategic decision-making. Finally, the results of our post-hoc analysis should encourage FF owner-managers who may be reluctant to engage in DPI. Indeed, we show that FFs are better at DPI than their non-family counterparts, despite the higher risk involved and the difficulties that FFs may have in adopting discontinuous technologies.

Limitations and Future Research

Our work is not without limitations that also provide opportunities for future research. First, as we relied on secondary data, we could only theorize about the different psychological distances perceived by different FF owner-managers and their resulting decision-making behaviors. Although we acknowledge this limitation, many notable studies have investigated FF owner-managers' decision-making based on secondary data (e.g., Chrisman & Patel, 2012; Kotlar et al., 2018; Gomez-Mejia et al., 2007). Nevertheless, we encourage future studies to delve deeper into these psychological distances and how people build their construals using primary data, such as surveys, vignette studies, or qualitative methods (e.g., Liu et al., 2020; Tumasjan et al., 2013).

Second, our sample is limited to the automotive, industrial engineering, and pharmaceutical sectors. Although these sectors are theoretically sound for our research design as we were interested in industrial-age industries where DPI is particularly risky, and prior studies have also recognized their relevance to DPI (e.g., Svahn et al., 2017), future research could test the robustness of our findings in different industries. Similarly, although our sample is international and we focus on digitally developed countries, Chinese firms, for example, are not included in the NRG database. Therefore, it may be interesting to test whether our findings hold in other settings with different institutional contexts and different levels of digital technology development and diffusion (Autio et al., 2014; OECD, 2016; Wright et al., 2014).

Third, we rely on patent data to measure DPI. Although prior research has extensively used patent-based measures, including for DPI (e.g., Pesch et al., 2021), they may be imperfect proxies for innovation. Indeed, not all inventions are patentable and firms may prefer other mechanisms to protect the results of their innovation activities (OECD, 2009). Accordingly, future studies may

want to use other non-patent-based measures, such as those relying on survey methods.

Fourth, we encourage scholars to address questions about how construals can be actively shaped and/or whether or how they can change over time. For instance, these questions resonate with research on transgenerational entrepreneurship (Habbershon et al., 2010; Jaskiewicz et al., 2015), which seeks to understand how some FFs are able to maintain their entrepreneurial spirit across generations, as construals may be antecedents of these entrepreneurial actions. In addition, construal level theory could inform research on FF conflict and cohesion (Bettinelli et al., 2022), since each family member builds her/his construal egocentrically, but must ultimately confer and agree to make decisions.

Finally, we invite fellow researchers working in the psychological domain to consider FFs as a relevant context for applying construal level theory. Indeed, prior studies in the psychological literature have mainly focused on one psychological dimension at a time and on hypothetical decision-making tasks based on student samples (e.g., Förster et al., 2004; Fujita et al., 2006; Wakslak et al., 2006). Instead, the family business domain may provide a context in which real decisions are made, and different dimensions of psychological distance coexist and coalesce in the construals of FF owner-managers. In turn, these insights may shed light on how individuals integrate multiple competing goals and ultimately make decisions.

Conclusions

Digital innovation in FFs is particularly relevant due to the global importance of these organizations and the impact of digital technologies on all types of business activities. Our study shows that FFs can take advantage of the opportunities offered by digital technologies to develop DPIs. Specifically, drawing on construal level theory, we argue and find that FFs controlled by later generations are associated with higher DPI, while the presence of a family CEO is detrimental to DPI. We also find that TMT size plays an important role. In doing so, we hope to encourage scholars to engage with the topic of digital innovation in FFs and consider this relatively novel theoretical lens to make sense of their empirical investigations.

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Table 1. Descriptive Statistics and Pairwise Correlations

	1	2	3	4	5	6	7	8	9	10	11
1. DPI	1										
2. Generation in control	0.38*	1									
3. Family CEO	-0.14*	-0.16*	1								
4. TMT size	0.18*	0.07	-0.19*	1							
5. Family ownership	-0.15*	-0.00	0.16*	0.06	1						
6. Family chairman	-0.03	0.01	0.14*	-0.07	0.15*	1					
7. Firm age	0.15*	0.50*	-0.17*	0.17*	0.16*	-0.13*	1				
8. Firm size	0.38*	0.38*	-0.14*	0.32*	-0.13*	-0.01	0.31*	1			
9. R&D expenses	0.23*	0.32*	-0.36*	0.22*	-0.16*	-0.14*	0.28*	0.50*	1		
10. Leverage	-0.07	-0.05	-0.06	-0.16*	-0.11*	-0.09*	-0.12*	-0.18*	0.06	1	
11. Patent stock	0.43*	0.42*	-0.20*	0.42*	0.01	0.01	0.32*	0.68*	0.47*	-0.13*	1
12. Industry effects	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
13. Country effects	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Mean	2.89	2.01	0.27	2.21	40.83	0.41	73.46	8.06	7.92	0.37	3.05
S.D.	11.51	1.16	0.44	2.15	19.76	0.49	43.04	1.98	4.85	0.92	2.58

N = 576; *$p < 0.05$

Table 2. Results of the Negative Binomial Regression

Model	1	2	3	4	5	6
Generation in control (H1)		0.377*		0.804**		0.790**
		(0.164)		(0.237)		(0.241)
Family CEO (H2)			-1.260**		-2.087**	-1.798**
			(0.473)		(0.658)	(0.625)
Gen. in control x TMT size (H3)				-0.132*		-0.126*
				(0.053)		(0.056)
Family CEO x TMT size (H4)					0.329$^+$	0.194
					(0.186)	(0.189)
TMT size				0.375*	-0.122$^+$	0.304
				(0.181)	(0.073)	(0.190)
Family ownership	-0.003	0.000	-0.003	-0.002	-0.003	-0.003
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Family chairman	-0.098	-0.137	-0.238	-0.352	-0.286	-0.509
	(0.297)	(0.287)	(0.310)	(0.293)	(0.313)	(0.323)
Firm age	-0.002	-0.005	-0.003	-0.010*	-0.005	-0.011**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Firm size	-0.351**	-0.345**	-0.293*	-0.326**	-0.242$^+$	-0.244*
	(0.126)	(0.125)	(0.130)	(0.116)	(0.125)	(0.117)
R&D expenses	0.046	0.060	-0.028	0.065	-0.034	-0.020
	(0.040)	(0.040)	(0.045)	(0.040)	(0.042)	(0.040)
Leverage	-0.352	-0.455	-0.370	-0.393	-0.401	-0.449
	(0.290)	(0.346)	(0.296)	(0.333)	(0.131)	(0.357)
Patent stock	0.918**	0.800**	0.933**	0.776**	0.967**	0.819**
	(0.113)	(0.113)	(0.114)	(0.111)	(0.117)	(0.113)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.186*	-2.643*	-1.615	-3.637**	-2.174$^+$	-3.193**
	(1.087)	(1.037)	(1.125)	(1.025)	(1.143)	(1.055)
N	576	576	576	576	576	576
Wald chi2	122.76**	152.35**	125.37**	163.36**	127.73**	166.02**
Log likelihood	-484.14	-481.77	-480.29	-478.52	-477.74	-472.93

This table shows the coefficients of the regression models with the standard errors in parentheses below the coefficients.
$^+p < 0.10$; $*p < 0.05$; $**p < 0.01$

Table 3. Robustness Tests

Model	7	8	9	10
Generation in control (H1)	0.852**	0.997**	0.917**	0.009*
	(0.258)	(0.345)	(0.218)	(0.004)
Family CEO (H2)	-1.884**	-1.818**	-1.470*	-0.012*
	(0.618)	(0.644)	(0.730)	(0.005)
Gen. in control x TMT size (H3)	-0.152*	-0.165*	-0.153**	-0.000
	(0.060)	(0.066)	(0.052)	(0.001)
Family CEO x TMT size (H4)	0.250	0.239	0.039	0.002
	(0.189)	(0.196)	(0.195)	(0.002)
TMT size	0.371$^+$	0.465$^+$	0.434*	-0.002
	(0.203)	(0.228)	(0.177)	(0.003)
Family ownership	-0.005	-0.006	0.000	-0.000
	(0.009)	(0.011)	(0.008)	(0.000)
Family chairman	-0.153	-0.185	-0.748*	0.002
	(0.349)	(0.417)	(0.317)	(0.004)
Firm age	-0.009*	-0.010$^+$	-0.015**	-0.000$^+$
	(0.005)	(0.006)	(0.004)	(0.000)
Firm size	-0.330*	-0.377*	-0.049	0.001
	(0.140)	(0.178)	(0.100)	(0.002)
R&D expenses	-0.017	-0.012	-0.036	0.000
	(0.038)	(0.041)	(0.044)	(0.001)
Leverage	-0.510	-0.467	-0.559	-0.002
	(0.383)	(0.385)	(0.454)	(0.003)
Patent stock	0.935**	0.814**	0.633**	0.004**
	(0.122)	(0.150)	(0.103)	(0.002)
Industry effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Constant	-2.482*	-1.844	-5.828**	-0.026
	(1.221)	(1.639)	(1.065)	(0.019)
N	607	474	517	576
Wald chi2	144.89**	102.27**	150.21**	54.52**
Log likelihood	-470.38	-401.48	-404.25	1262.04

This table shows the coefficients of the regression models with the standard errors in parentheses below the coefficients.
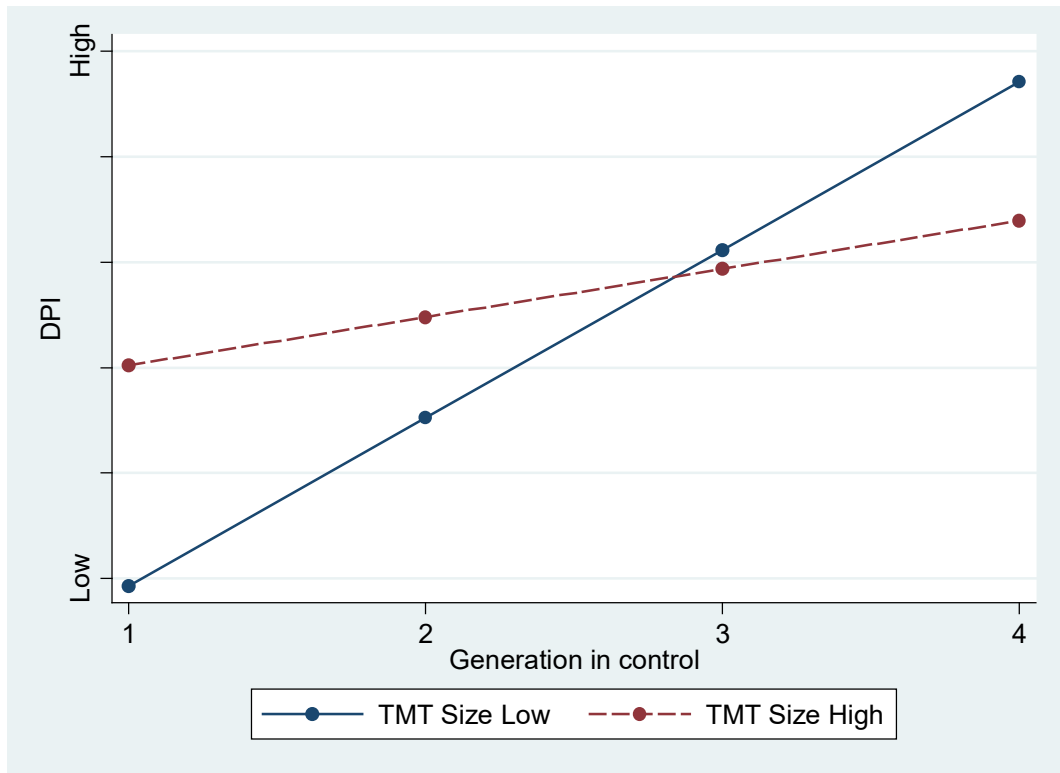$^+p < 0.10$; *$p < 0.05$; **$p < 0.01$

Figure 1. Moderating effect of TMT size on the relationship between generation in control and DPI.